Physiology Multiple Choice Question Bank

Primary Exam for FANZCA - July 2001 Update (v3.02)

[1] Queensland Anaesthesia Website: http://www.qldanaesthesia.com

- All these questions are also available on the website and may be printed from the separate web pages (File->Print on your browser) or downloaded as a complete file (THIS document).
- Please ***re-format*** the file as required before you print. The MCQs are in 10 point size for easier reading. Change this to whatever you want. Also adjust the file so that individual questions don't print over 2 pages.

[2] Some Answer Comments are available on the site

Answer commentaries and/or references for some of these questions are available on the site. There is also a form where you can submit your comments about any question & this will be posted on the website for the use of all. Thanks in advance for contributing in this way.

[3] Separate Physiology & Pharmacology files

- The MCQs have been split into these 2 sections. This is the Physiology file.
- This decreases the size of the file to minimise email download problems which can be a problem with large attachments.

[4] Why .DOC files OR .RTF files?

The files can be downloaded from the site in several formats: either .DOC (MS Word format) or as .RTF files. Download the type you require. Please read the details on the site about why you may prefer the .RTF format.

[5] Marker Questions

Questions that have a lot of symbols (meaning they have been asked multiple times) are probably all 'Marker Questions' - The score from these questions are used to do a comparison between the groups sittting different papers. These questions are more likely to be on the paper you sit so it is worth your while to know these well.

[6] Thank your colleagues

This collection has been made possible by the efforts of your colleagues who have sat the exam & have written down the questions they have been able to recall. Please thank them for their efforts and please assist by sending along the questions you remember after your paper.

[7] Many questions are incomplete

In some the question wording may be misleading. In any case the examiners are prone to change some of the options at different exams. SO: The best strategy is to read around the topics suggested by the questions and not try to rote learn answers. A substantial number of these questions will definitely appear on your paper.

[8] Contribute yourself

If you find this collection useful & would like to help in improving this 'Memory Bank' of *Actual Primary MCQs***,** could you please send along to me the questions that you can remember after you sit your exam. The question codes remain the same so just use the Question Code to indicate the repeat questions.

[9] Primary Email List

This collection gets updated usually after each exam (ie at least twice per year) as I receive new questions or other collections. If you would like to receive these updates, contact me with your email address and I'll add you to the Mailing List for Primary Updates

[10] FREE

There is *no charge* for this collection. This is a group effort which I am happy to coordinate. Please copy & distribute to assist other registrars with their primary study.

[11] "***The Physiology Viva: Questions & Answers***"

This book is currently out of print: sold out!. A second edition should be available in 2002. This book was written especially for the Primary ANZCA exam. Details of availability will be posted on the website.

Thanks, Best wishes with the exam,
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Please copy & distribute this collection to your colleagues

Section 1 : Physiology

BP	Basic Physiology
FE	Fluid & Electrolyte Physiology
AB	Acid-Base Physiology
RE	Respiratory Physiology
CV	Cardiovascular Physiology
KD	Renal Physiology
GI	GIT Physiology
BL	Blood & Immunology
EM	Endocrine & Metabolic Physiology
NU	Neurophysiology
MU	Physiology of Muscle & Neuromuscular Junction
MF	Maternal, Foetal & Neonatal Physiology
CM	Clinical Measurement

Coding Letters

The coding letters (from a to k) within the square brackets [ ] after the question code indicate which paper(s) the question was on. The key is:

a = Mar 96 paper	b = Jul 96 paper
c = Mar 97 paper	d = Jul 97 paper
e = Mar 98 paper	f = Jul 98 paper
g = Mar 99 paper	h = Jul 99 paper
i = Feb 00 paper	j = Jul 00 paper
k = Apr 01 paper	

Eg: question CV01 [adgi] . . . was on the papers in Mar 96 (indicated by the 'a'),Jul 97 ('d'), Mar 99 ('g') & Feb 00 ('i')

Basic Physiology

BP01 [a] Gap junctions:
A. Maintain cellular polarity – No, tight junctions do – Renal: late Distal Tubules and Collecting ducts, Intestinal Mucosa & Choroid Plexus
B. Occur at the apices of cells – tight junctions here also (Ganong p15)
C. Have corresponding connections between cells – made of numerous CONNEXONS which line up (?correspond) between cells, direct intercellular communication of solutes with MW <10,000 (Ganong p16)
D. ?

BP02 [d] Bulk flow:
A. Is related to concentration gradient – No, this is diffusion
B. Is related to permeability coefficient – Not entirely (see below)
C. Depends on hydrostatic and oncotic pressure – Yes, in essence it is synonymous with filtration (bulk or direct flow)
D. ?

BP03 [gk] All of the following histamine effects are mediated by H2- receptors EXCEPT: (they increase intracellular cAMP)
A. Vasodilatation
B. Bronchoconstriction – H1 Receptor
C. Gastric acid secretion
D. Tachycardia

BP04 [i] The trace element that is an integral component of carbonic anhydrase, lactic dehydrogenase, and several other peptidases:
A. Magnesium
B. Manganese
C. Zinc – Carbonic anhydrase has an atom of Zn in each molecule
D. Cobalt
E. Copper

Fluid & Electrolyte Physiology

FE01 [aefkl] Effects of hypokalaemia:
A. Short PR interval – No, it increases the PR interval (Ganong, p543)
B. Ventricular extrasystoles - Correct
C. Elevated ST segments – ST depression (Ganong p543)
D. Long QRS interval – No effect on QRS duration
E. Long QT interval – QT interval remains normal, however hidden U waves may make it look prolonged if mistaken for a T wave (Ganong p15)
F. Q waves – could they mean U Waves? If so, this would be the correct answer

FE01b *Jul98 version:* Hypokalaemia:
A. Hyperpolarises membrane – Yes, decreases RMP
B. Peaked T waves – No, this occurs with hyperkalaemia
C. Prolonged QT – Nil change
D. VEBs – Yes, but (A) occurs first
E. ST elevation – ST Depression (Ganong, p543)

Alt version: Hypokalaemia:
A. Hyperpolarizes the membrane – Yes (see above)
B. Shortens the QRS – No, no change
C. Shortens the PR interval - No
D. Depresses the ST segment – Yes, but option A happens first
E. Prolongs the QT interval - No

Alt version: Hypokalemia
A. ST segment changes (*it did read "changes")* – ST Depression
B. P wave flattening – No
C. Shortened QT – No change in QT interval
D. No Q wave – No, no change

FE02 [c] For two solutions separated by a semi-permeable membrane (Solution A: saline solution AND solution B: H2O): Which of the following statements is true?
A. A hydrostatic pressure applied to A will stop osmotic pressure (?) – It won't stop 'osmotic pressure' but it could oppose the osmotic pressure…
B. There will be bulk flow from A to B
C. The fluid level in B will go up – No, H2O will flow from B to A down its concentration gradient (ie. B will go down)
D. ?

FE03 [cdh] Rapid (?ingestion/?infusion) of 2 litres of normal saline causes:
A. Increased ECF, increased ICF, decreased [Na+]
B. Increased ECF, unchanged ICF, increased [Na+] – Correct (see below)
C. Unchanged ECF, increased ICF, increased [Na+]
D. Increased ECF, unchanged ICF, unchanged [Na+] – Not quite correct – 0.9% Saline has 154mOsm/L of Na – **2 litres** of this must SURELY increase the [Na]? On closer inspection (running saline through a gas analyser, the Na is only 148mOsm/L – probably related to the strong ion theory… therefore (D) may well be the correct answer…!
(Comment: N/saline is distributed throughout the ECF only as its [Na+] restricts its distribution; pure water is distributed throughout the total body water. KB)

FE04 [dfj] Hyperkalaemia:
A. Causes a prolonged QT interval – No, it shortens the QT Interval (Brandis – Viva, p15)
B. Prolongs the QRS duration – Yes, prolongation of QRS occurs (Ganong, p543)
C. Causes ST segment elevation – No, tall tented T-Waves are an early sign
D. Potentiates digoxin toxicity – No, hypokalaemia does
E. Causes loss of P wave – Atrial activity decreases & P-waves *flatten* (not technically loss I guess) (Ganong, p543) & also Brandis p15

FE04b [m] ECG changes in hyperkalaemia include:
A. ST depression
B. T wave inversion
C. P wave flattening – Yes!! See above
D. Sinus tachycardia
E. ?

FE05 [ek] Thoracic lymph contains:
A. Clotting factors - Yes
B. Higher protein content than plasma – This can't be possible as it is derived from filtered plasma (thoracic duct 50g/l protein – large proportion from hepatic lymph (Brandis, p19-20)
C. Similar composition to ISF – thoracic duct lymph contains more protein than usual ISF (from liver)
D. Rarely contains fat – Contains fat (chylomicrons) from gut lymphatics after meals – important in fat absorption (90%)
E. ?

FE06 [efg] Gibbs-Donnan effect leads to:
A. Non-diffusible ions between 2 sides will be equal – No!
B. Diffusible ions between 2 sides will be equal – No!
C. Equal concentrations of ions on both sides
D. Equal passive diffusion
E. Osmotic gradient – yes, which will in itself, upset the Gibbs-Donnan Effect if the membrane is permeable to the solvent

FE07 [f] Decreased osmolality and hypovolaemia. Would you see:
A. Decreased urine output – probably from increased ADH secretion (from more potent hypovolaemia despite decreased osmolality) but also increased aldosterone & renin
B. Increased urine output
C. Decreased ADH secretion
D. ?

FE08 [gjk] Hartmann's solution contains:
A. Potassium 2 mmol/l – No… 5
B. Calcium 3 mmol/l – No… 2
C. Magnesium 2 mmol/l – No… 0
D. Sodium 154 mmol/l – No… 129
E. Chloride ?131 ?154 mmol/l – No… 109

Apr 2001: Hartmann's solution contains no:
A. Na^{+}
B. Ca^{++}
C. Mg^{++} – Correct, there is no Mg in Hartmann's
D. Lactate
E. ?
(*Comment: Hartmann's solution contains* Ca^{++} *but no* Mg^{++}*. The* Ca^{++} *content of Hartmanns is important as it can result in clotting in the tubing if blood is given slowly before or after it in the same line. Because of this problem the traditional nursing practice in the past was to give a 100mls of normal saline before and after each bag of blood. This clotting problem is less of a concern during anaesthesia if we fluids are given quickly. Some people use 'Plasmalyte 148' which contains* Mg^{++} *but no* Ca^{++}*. The other difference between these 2 solutions is the lower [Na+] in Hartmann's 130mmol/l compared to 140mmol/l in Plasmalyte. Some neuroanaesthetists prefer not to use Hartmanns because of this. KB 26-May-01*)

FE09 [gij] The total osmotic pressure of plasma is:
A. 25 mmHg – this is roughly plasma ONCOTIC pressure (25-28mmHg)
B. 285 mOsm/l (or ?308mOsm/l) – wrong units, we want pressure not osmoles

C. 5900 mmHg – for 280mOsm/l would give 5409mmHg (? 720kPa) for total osmotic pressure
D. 300 kPa - Nope
E. None of the above - Correct

FE10 [g] Normal saline:
A. Osmolality of 300-308 mOsm/l – Osmolality is 308mOsm/l
B. Has pH 7.35 to 7.45 – No pH is 4.0-7.0
C. ?

FE11 [g] Obligatory water loss from body: - minimal amount of fluid that has to be lost (equal to excretion of urinary solute load, sweat, faecal, insensible losses)
A. 400 mls in faeces – no approx 200ml
B. 300 mls from lung – no, approx 400ml
C. Loss from skin & lung – constitutes insensible loss (800ml), which is part of obligatory
D. ??Insensible water loss – part of obligatory loss (same as option C)
E: 500ml in Urine – Correct. This is the MINIMUM daily urine loss

Alt version: Normal amount of daily water loss in a 70kg man:
A. 300mls faeces
B. 500mls from urine – Correct, see above
C. 700mls from lungs and skin (?insensible)
D. ?
E. None of the above
"*All figures seemed slightly off from standard text*"

FE12 [h] Which ONE of the following statements about intravenous crystalloid solutions is TRUE?
A. Rapid infusion of (?one litre) Hartmann's may cause lactic acidosis – No, it is only the anion, not the acid that is being added
B. Hartmann's 300-308 mosm/kg – No, 274mOsm/l
C. Hartmann's pH 7.35-7.45 – No pH 5.0-7.0
D. N/saline osmol 300-308 mosm/kg – States approx 308mOsm (probably the closest to correct) – when you do the sums 9g of NaCl in 1000ml of H20 equals about 154mmol of Na and 154mmol of Cl
E. 0.9% sodium chloride has a pH 6.5-7.5 – No pH 4.0-7.0 (but when you run it through the gas analyser it has a pH of 6.8
F. ?One litre of Hartmann's solution contains 150 mmol of Na+ - No, 129mmol Na

FE13 [ghi] Water handling by the kidney (% reabsorption):
A. 93%
B. 94%
C. 99%
D. 99.4% - Correct, see Table 38-5 (Ganong, p685) – but on p691 they say 99.7%!
E. 99.9%
Maximum would depend on minimal urine output for solute load (eg. At best 500ml/day) & GFR (normally 180L/day). Therefore, the water reabsorption would be 179.5/180 = 99.7% - option D is probably the safest bet

FE14 [j] The ion with lowest intracellular concentration is:
A: Na^{+}
B: HCO_3^{-}
C: Ca^{2+} - Correct (10^{-7} – see notes by Buntain, back of 2nd page)
D: Mg^{2+}
E: K^{+}

FE15 [k] Total plasma osmolality can be calculated via:
A. Van Halen's equation – Good one! No, even if it *were* the Van't Hoff equation, it is used to calculate osmotic pressure
B. Starling equation – for net fluid flux due to filtration
C. P = nRT – the Van't Hoff equation (see A) with a few bits missing ie c/W

D. (multiplying 19.2mmHg/mOsm/L by body Osm) (*it worked out in the exam!) – IMPOSSIBLE – LOOK AT THE UNITS… you'll end up with pressure which sure isn't osmolality*
E. None of the above – the most likely answer

FE16 [k] Which of the following will increase plasma potassium concentration
A. Beta adrenergic receptor AGONIST – No, decreases potassium (Ganong, p699)
B. Insulin – No, decreases potassium
C. Aldosterone – No, reabsorption of Na at the expense of K and H
D. ?
E. None of the above - Correct

FE17 [k] Osmotic pressure in plasma is usually 1.6 mosmol/L more than ISF. This is because of
A Plasma Proteins – yes… which would directly account for 0.9mOsm/L as well as the rest from the Gibbs-Donnan Effect & the 'exluded volume' effect
B Plasma Oxygen Tension
C Plasma creatinine
D ?
E ?
Note: units are wrong in the question!

FE18 [k] (Responses to ?increased osmolarity)
A. ?Thirst and ADH from stimulation of osmoreceptors in posterior hypothalamus – Yes, but not in that order
B. ?Thirst via stimulation of SFO and OVLT via Angiotensin II in hypovolaemia – This *is* correct, however if the question was asking about 'responses to increased osmolarity'….
C. Baroreceptors afferents to the Posterior Pituitary – input to hypothalamus (both low pressure (volume) and high pressure baroreceptors)
D. Increased ADH levels - Yes
E. Aldosterone – only if significant hypovolaemia

Alt version(Mar 03): Increases in plasma osmolarity in a healthy young person produce:
A. Production of ADH from posterior pituitary
B. Thirst via ADH effect on paraventricular nuclei
C. ….. angiotensin?
D. ?

Alt version: In hypovolaemic shock, thirst is triggered via:
A. Angiotensin II acting on the circumventricular organs – Yes, as the word *hypovolaemia* is in the question
B. ?

FE19 [k] Sweat in patients acclimatised to hot weather (as compared to patients in a temperate climate) contains less Na^+ because:
A. Takes longer for Na^+ to be transported through sweat ducts
B. Aldosterone effect causing a reduction in Na^+ in sweat – this does have an effect but (Brandis, p22) suggests that this is 'another effect'
C. Increased intake of water causing a reduction in Na concentration
D. ?

FE20 [l] Magnesium is required for:
A. To Depolarise excitable cell membranes – reduces membrane excitability (Brandis, p17)
B. Na+-K+ ATPase – Yes, an important cofactor for all enzymes that involve phosphate transfer among others
C. Coagulation - No
D. ?
E. ?

FE21 [l] Intracellular ?osmolality is greater than interstitial ?osmolality because:
A. Proteins in plasma

B. Cells producing intracellular proteins – Correct (initially I thought they were the *same* under normal conditions but apparently they not quite…)
C. ?
D. ?
E. ?

FE22 [mno] Sweating in strenuous exercise. Sweat contains Na^{+}:
A. Less than plasma – Correct – between 30-65 mOsm/L
B. Equal to plasma
C. More than plasma
D. ?
E. ?

FE23 [o] Acute onset (4 hours) diabetes insipidus in an otherwise healthy person produces these biochemical changes (*"these numbers may not be exact"*):
A. Na 130, K 3.0, Osm 260
B. Na 130, K 4.0, Osm 300
C. Na 150, K 3.0, Osm 260
D. Na 150, K 3.5, Osm 320
E. Na 160, K 3.0, Osm 320 – Probably correct (bad question)

FE24 [o] Colligative properties:
A. Increase BP, decrease freezing point, decrease SVP - Correct
B. Other combinations: increase/ decrease…boiling point/FP/SVP
C. ?
Colligative properties of a solution depend on the number of solute particles, but not their chemical properties
Freezing Point Depression
Boiling Point Elevation
Vapour Pressure Depression – reduction of the solvent molecules ability to leave the solution (it gets weird when the solute is volatile…)

FE25 [o] 2. Organic ion necessary in Na-K ATPase
A. ?
B. ?
C. Mg^{+2} - Correct
D. PO_4
E. SO_4^{-2}

Acid-Base Physiology

AB01 [ak] ABGs: pH 7.35, pCO_2 60 mmHg, pO_2 40 mmHg.
These blood gas results are consistent with:
A. Atelectasis – No. In an awake patient the raised pCO_2 would be increasing their V_A
B. Morphine induced respiratory depression (OR: Acute morphine overdose) – given limited information is this is the most likely answer??
C. Diabetic ketoacidosis – No. If the patient had DKA, combined with the raised pCO_2 their pH would be even worse…
D. . Patient with COAD – Correct. Despite the lack of bicarbonate to work with…. From the Henderson Hasselbalch equation it equals about 32 for a chronic COAD
HOWEVER… If the patient was breathing room air, the pO_2 should be more like 75mmHg with a pCO_2 of that…! (this makes me think (B))

AB02 [ce] The ABGs of a 60yr old man who has overdosed on morphine would be:
A. paO_2 60, $paCO_2$ 55, pH 7.29, HCO_3 32, BE -1
B. paO_2 40, $paCO_2$ 60, pH 7.37, HCO_3 26, BE +5 – Most likely
C. ?

AB03 [dg] Buffering of a bicarbonate infusion:
A. 60 to 70% occurs intracellularly
B. Exchanged for Cl^- across the red cell membrane – Hamburger effect in red cells
C. Compensated for by increased respiratory rate.
D. Intracellular proteins

AB04 [degi] Phosphate buffer system is an effective buffer intracellularly and in renal tubules because:
A. Its pKa is close to the operating pH – particularly intracellular pH which is usually lower than ECF pH
B. High concentration in distal tubule
C. High concentration intracellularly
D. All of the above - Correct

AB05 [dk] Arterial gases including pH 7.46 bicarbonate 31mmol/l PCO_2 46mmHg indicate:
A. Metabolic alkalosis with respiratory compensation – correct (almost *maximally* compensated)
B. Respiratory alkalosis
C. Respiratory acidosis with compensation
D. Metabolic acidosis with respiratory compensation
E. Mixed metabolic and respiratory alkalosis
(Apr 01: AB05 changed so 2 top stems read partially compensated then bottom stem was "none of the above")

AB06 [f] Metabolic acidosis is characterised by:
A. Increased $[H^+]$ intracellularly – Correct
B. Decreased production of bicarbonate
C. ?
D. ?
E. ?

AB07 [hij] Bicarbonate system is (?the most) important buffer system because:
A. Has a pKa close to physiological pH
B. CO_2 can be exchanged in lungs and HCO_3 excreted in the kidneys – Correct
C: HCO_3^- occurs in such large amounts
D. ?
E: Can be regulated by lung & kidney – Not technically 'regulated' by them…

AB08 [j] During infusion of an acidic solution (?HCl infusion) , which contributes most to buffering?
A. Phosphate buffer
B. Bicarbonate buffer - correct

C. Intracellular buffers
D. Proteins (?intracellular proteins)
E. None of the above

AB09 [jl] In a patient with diabetic ketoacidosis, the following are true except:
A. ?
B. There is decreased $PaCO_2$
C. There is decreased concentration of H^+ intracellularly – H+ are increased
D. Renal excretion of titratable acids will be increased
E. There is increased synthesis of bicarbonate

AB10 [k] Pancreatic fistula draining 1L/day, normal volume status maintained:
A. Hyperchloraemic metabolic acidosis
B. Hypochloraemic metabolic acidosis– most likely
C. Metabolic acidosis with normal chloride
D. Hyperchloraemic metabolic alkalosis
E. Hypochloraemic metabolic alkalosis

AB11 [k] ABG's in healthy young man with pneumothorax:
A. pO_2=50, pCO_2=25 – most likely… the patient will have a shunt (therefore a depressed pO2 not offset by the 'good lung') which will increase ventilation – may cause metabolic alkalosis which would then limit this…
B. pO_2=50, pCO_2=46
C. pO_2=90, pCO_2=25 – Hmm… not quite (the pO2 is too high). Don't' forget that increasing the ventilation of good V/Q lung will not offset the drop in pO2 from a shunt – from the ODC shape
D. pO_2=90, pCO_2=46
How much of a PTX….? Geez….

Alt version: ABG of young male who develops total collapse of one lung postop:
A. pO_2 95mmHg pCO_2 50 mmHg
B. pO_2 80mmHg pCO_2 50mmHg - most likely (see above explanation) and the fact that it is 'post-op' – what KIND of operation/anaesthetic?? I suspect that this is to make us think of drugs depressing ventilation and patient receiving supplemental oxygen… who knows….
C. pO_2 90mmHg pCO_2 25mmHg
D. pO_2 60mmHg pCO_2 50mmHg

AB12 [o] ABG pH 7.48, PCO_2 24 (or 26), HCO_3 19 BE 15 is consistent with:
A. Mixed metabolic and respiratory acidosis - No
B. Acute respiratory alkalosis – No, because the bicarbonate is lower than normal suggesting a non-acute picture (?could be correct if BE was less)
C. Metabolic acidosis with compensated respiratory alkalosis – No, you can't 'over' compensate!
D. Chronic respiratory disease - No
E. Mountain climber after several weeks at altitude – No, it wouldn't look like this after several WEEKS though….(bicarbonate should be less?)
F. Hyperventilating consistent with acclimatisation to altitude – Correct – probably after a couple of days… (what about that BE though?)

AB13 [o] A 26 year old female with the following ABG's: pH 7.1, pCO_2 11, pO_2 110
A. ?
B. Metabolic acidosis with respiratory compensation – I guess so!
C. ?

Respiratory Physiology

RE01 [a] Which of the following is a normal characteristic of lung?
A. 3,000,000 alveoli – No, 300 million
B. Alveolar diameter 3 mm – No, average 0.2mm
C. External surface area: 10 m2 – seems too large
D. Alveolar surface area: 5 to 10 m2 – No, 50-100m2
E. None of the above – Correct

RE02 [agk] A young man collapses one lung. His ABGs on room air would be:
A. pO2 80, pCO2 50 mmHg
B. pO2 50, pCO2 80 mmHg
C. pO2 50, pCO2 50 mmHg
D. ?
None of these is ideal. The pCO2 should be normal or lower in a normal 'young man' who's brainstem is working normally… combination of increased VA to blow off CO2 plus the shunt causing hypoxia, further increasing ventilation (SEE BELOW)

RE02b [c] The ABGs in a healthy young 70kg male with one collapsed lung are:
A. paO2 50 mmHg, pCO2 25 mmHg
B. paO2 95 mmHg, pCO2 40 mmHg
C. paO2 60 mmHg, pCO2 45 mmHg
D. paO2 60 mmHg, pCO2 25 mmHg – Probably Correct (pO2 of 90 probably a bit too high) see Question AB11

RE03 [ag] Pulmonary vascular resistance:
A. Is minimal at FRC – Yes, this is one of the important points of FRC
B. ?Increases/?decreases with increase in lung volume
C. Increases with elevated CVP
D. ?

RE03b [j] Pulmonary vascular resistance is increased in :
A. Increase in pulmonary arterial pressure – No this has minimal effect due to recruitment & distension
B. Hypocarbia – No, this decreases HPV – therefore decreases PVR
C. Alkalosis – No, this decreases HPV – therefore decreases PVR
D. Increased left atrial pressure – No, decreases due to recruitment & distension
E. ?

RE04 [ad] The greatest increase in (?physiological) dead space would be expected with:
A. Pulmonary embolism – Correct
B. Atelectasis (or: collapse of one lung) – No, this would be an intrapulmonary *shunt*
C. Pneumothorax – No, this would be a *shunt*, but it would be minimal anyway due to HPV
D. Bronchoconstriction – No, increased shunt fraction
E. Obesity – No, decreased FRC
(see also RE08 & RE20)

RE05 [ajkl] As go from the top of the erect lung to the bottom:
A. Water vapour pressure remains constant - – Correct
B. pN2 remains constant – No, the partial pressure changes
C. pCO2 at apex is higher than at the base – No, lower (higher V/Q at apex)
D. pO2 at base is lower than at the apex – Hmm… yes this is correct also (Apex=132 , Base = 89)
E: Difference in V/Q ? – Correct, but… what is the question/answer really stating (Apex=3.3 , Base=0.6
F. Ventilation goes up as go up lung – No, decreases
G. Compliance is more at base than apex – At FRC yes, but what is the starting volume?

RE06 [agl] Distribution of ventilation & perfusion:
A. Gradient of change in ventilation is greater than that for perfusion – No, other way around
B. Ventilation increases as go up the lung – No, decreases

C. Perfusion increases as go up the lung – No, decreases
D. V:Q ratio at apex is greater than at base – Correct
E. None of the above

RE07 [a] Oxygen unloading:
A. Increases with increased paCO2 – Yes, Bohr Effect (probably due to increased H+ ions) – R shift of ODC
B. Decreases with increase in temperature – No, increases with temp
C. Decreases with increase in 2,3 DPG – No, increases
D. ?

RE08 [c] Alveolar dead space:
A. Is less than physiological dead space – Yes, by definition
B. Is decreased with mechanical ventilation – No, increased
C. Is increased with hypotension – Yes, to a point, but not just *ANY* hypotension… (See Cooper, p14) – other causes (erect posture, IPPV, age, volatile anaesthetic agents). This is because of the possibility of developing West Zone 1 areas in the lung…

RE08b [fhi] Alveolar dead space is increased with:
A. Pleural effusion – No, reduced
B. CCF – Yes, possibly from impairment of diffusion…
C. Pneumothorax – No, reduced
D. Hypotension – Not necessarily (see above question)
E. None of the above

RE09 [cdgjl] If dead space is one third of the tidal volume and arterial pCO_2 is 45 mmHg, what is the mixed expired pCO_2?
A. 20 mmHg
B. 25 mmHg
C. 30 mmHg - Correct
D. 45 mmHg
E. 60 mmHg

$$\frac{V_D}{V_T} = \frac{P_A CO_2 - P_E CO_2}{P_A CO_2}$$

(Comment: Simple application of the Bohr equation – but use the Enghoff Modification)
substitute a for A in the Enghoff Modification

RE10 [cfgjl] With constant FIO2, CO and VO2, an increase in mixed venous O2 content would be seen with:
A. Hypothermia – No. This would be true if the metabolic rate is decreased (ie. Decreased O2 requirement), but it is likely to be increased (thermoregulation)
B. Increased paCO2 - No
C. Decreased 2,3 DPG – No, the extraction is the same
D. Alkalosis – No, the extraction is the same
E. None of the above - Correct
The key word here is CONTENT

Alt wording: Without a change in body oxygen consumption or cardiac output, mixed venous oxygen tension increases with:

Alt wording (March 03): With constant FIO2 and cardiac output and no change in position of ODC, mixed venous blood oxygen tension increases with:
(see also CV47 ??same Q)

RE11 [dl] With altitude:
A. Increased 2,3 DPG – Correct, but this is actually counterproductive when you think about it
B. Increased oxygen unloading in peripheries - No
C. Increased oxygen uptake in the lungs – No
D. ?
E. ?
Alt versions:

RE11b In acclimatisation to altitude:
A. P50 is reduced, improving O2 uptake in the lungs – No, the ODC is right shifted by increase 2,3-DPG (which is offset by the alkalosis to a degree)
B. P50 is increased, improving O2 offloading in the tissues – No, overall it is decreased
C. 2,3 DPG levels are reduced, improving O2 offloading in the tissues – No, increased
D. Alkalaemia reduces the affinity for O2, increasing p50 – No, increases the affinity (reducing p50)
E. Increase in 2,3 DPG and a decrease in P50 – Yes and yes… the net effect on the ODC (by 23DPG & CO2) is to cause a net shift of the ODC to the left with acclimatisation

RE11c With acute acclimitisation to altitude:
A. Hypoventilation – No, hyperventilation
B. Decreased cardiac output – No, increased
C. Pulmonary oedema – No
D. Polycythaemia – Yes, but this is a chronic change
E. Increase in 2,3 DPG – Correct, despite being counterproductive in terms of loading of oxygen in the lungs….

RE12 [dfl] Central chemoreceptors:
A. Bathed in CSF – No, bathed in ECF which communicates freely with the CSF
B. Respond to increase in CSF pH – No, a decrease in pH (ie. Increase H+ ions) stimulates it
C. Bathed in ECF - Correct
D. In medullary respiratory centre – No, while it is indeed in the medulla it is not part of the 'respiratory centre'

RE13 [dfgkl] The peripheral chemoreceptors:
A. Have a nonlinear response to paO2 changes – Correct, dramatic rise in response to pO2 <50
B. Have an intact response at 1MAC – No, depressed
C. Respond to a fall in PaCO2 – No, but a change in PaCO2 will modify the curve (not sure about a FALL in CO2 though… certainly a raised PaCO2 does)
D. Respond to alkalaemia – Yes, response to metabolic alkalosis (not much central response)
E. Are in the carotid sinus – No, carotid & aortic bodies

(Related Q: RE36)

Alternative versions:
Peripheral chemoreceptors:
A. Respond only to ?incr-/decr-eased H^+ – No, respond to pH, pCO_2 & pO_2
B. Do not respond (or ?only respond) to O_2 – No, respond to pH, pCO_2 & pO_2
C. Stimulated by carbon monoxide - No
D. Stimulated by cyanide – Yes, by interfering with they electron transport chain and oxygen utilisation
E. Blood flow of 2 ml/gram/min – No, 2000 ml/100g/min = 20 ml/g/min
F. Aortic body innervated by vagus – Yes, the aortic bodies AND the aortic arch baroreceptors are…
G. Changes in arterial oxygen content - No, partial pressure
H.Gradually to rise in $paCO_2$

Peripheral chemoreceptors:
A. In the carotid sinus – No, carotid & aortic bodies
B. Have glomus cells – The carotid bodies do (two types, type I and II)
C. Low A-V difference – Correct (true of the carotid bodies)
D. Innervated by glossopharyngeal nerve – Not technically, the carotid sinus is innervated by the carotid sinus nerve – a branch of the glossopharyngeal nerve…but not the aortic body (vagal)
E. Blood flow of 200mls/G/min – No, 2000 ml/100g/min = 20 ml/g/min

RE13 [dfgklno] The peripheral chemoreceptors:
A. Have a nonlinear response to paO_2 changes - Yes
B. Have an intact response at 1MAC - No
C. Respond to a fall in $PaCO_2$ - No
D. Respond to alkalaemia – Yes, they must do (metabolic alkalosis compensation)

E. Are in the carotid sinus - No
F. Low metabolic rate - No
(Related Q: RE36)

Alternative versions:
Peripheral chemoreceptors:
A. Respond only to ?incr-/decr-eased H^+ - No
B. Respond only to pO_2 - No
C. Stimulated by carbon monoxide - No
D. Stimulated by cyanide - Yes
E. Blood flow of 2 ml/gram/min - No
F. Aortic body innervated by vagus – Yes
G. Changes in arterial oxygen content - No
H. Respond slowly to rise in $paCO_2$ - No

Peripheral chemoreceptors:
A. In the carotid sinus – No, baroreceptors
B. Have glomus cells – Yes
C. Low A-V difference – Yes
D. Innervated by glossopharyngeal nerve – No, the carotid sinus is (carotid sinus nerve) but the aortic body isn't (vagus)
E. Blood flow of 200mls/G/min - No

RE14 [dfhj] Surfactant:
A. Causes hysteresis (Or: Is the ONLY cause of hysteresis) – No, any elastic substance shows hysteresis
B. Is produced by type 1 pneumocytes – No, type 2 pneumocytes
C. Is commonly deficient in term neonates – Not usually
D. Acts like detergent in water – No, detergent is not 'surface active'
E. Reduces the amount of negative intrapleural pressure – No effect on intrapleural pressure…
F. Production is slow – No, synthesis is fast with a rapid turnover (West p84)
G. Increases pulmonary compliance – Yes…

RE15 [dk] In quiet breathing, exhalation is:
A. Passive due to elastic tissue alone – No, it is due to 'elastic recoil' which is more than just elastic tissue
B. Passive due to surface tension in the alveoli and elastic tissue recoil - Yes
C. Active due to intercostal contraction – No
D. ?
E. ?

RE16 [defk] The normal arterio-venous difference for CO_2 is:
A. 2ml/100ml
B. 4ml/100ml – Yes (48-52ml/100ml)
C. 6ml/100ml
D. 10ml/100ml
(Mixed venous blood contains 52 mlsCO_2/100mls blood & arterial blood contains 48 mlsCO_2/100 mls blood.)

RE17 [dfgjkl] The lung:
A. Removes/inactivates serotonin (5HT) – Yes, it TAKES UP serotonin - ?better option
B. Activates bradykinin – No, it is inactivated (up to 80%)
C. Converts angiotensin II to I – No, the other way around (by ACE) – as does the kidney (20%)
D. Inactivates aldosterone – No effect on aldosterone
E. Takes up noradrenaline – up to 30% REMOVED

Alt version: Which of the following substances is removed (?inactivated) by the lungs?
A. Serotonin – It is TAKEN UP by the lung
B. Noradrenaline – up to 30% REMOVED
C. Angiotensin I – No, it is ACTIVATED in the lung

D. Bradykinin – Bradykinin is INACTIVATED by the lung
E. All of the above

July 2000: Which of the following is inactivated in the lung:
A: Angiotensin II – NO EFFECT
B: Angiotensin I – Converted to Angiotensin II by ACE
C: Bradykinin – up to 80% INACTIVATED
D: Vasopressin – NO EFFECT
E: Noradrenaline – up to 30% REMOVED

Jul 2001 version: Metabolic functions of the lung include which one of the following?
A. Inactivates ADH – NO EFFECT
B. Converts Angiotensin II to Angiotensin I – No, other way around
C. Activates bradykinin – No, INACTIVATES it
D. Inactivate serotonin (5HT) – almost completely REMOVED
E. Activation of prostaglandins – No, removes some prostaglandins

Mar 02: Which biologically active substances are partially ?degraded by the lung?
A. Surfactant
B. Histamine
C. Angiotensin
D. Noradrenaline - Correct
E. ?all/?none of the above

RE18 [ef] Breathing oxygen :
A. Causes pain on re-expansion of collapsed alveoli – No.. – Mechanism?
B. Reduces vital capacity – Yes…
C. ?
D. ?

RE19 [efi] Contribution to the increase in CO2 carriage as blood passes from artery into vein:

	Carbamino	HCO3	Dissolved
A.	5%	90%	5% - This is the proportion of CO2 carriage in ARTERIAL blood
B.	30%	60%	10% - this is correct

C. ?
D. ?
(See also RE38)

RE20 [e] Increased physiological dead space with:
A. Age – Correct
B. Anaesthesia – Not anaesthesia alone (volatile agents and IPPV do)
C. Supine position – No, erect position
D. All of the above – No
(see RE04 & RE08)

RE20 [eo] Increased physiological dead space with:
A. Decreases with age – No, increases
B. Anaesthesia – Yes, but variable
C. Supine position – No effect
D. Calculated from Bohr equation using end-tidal CO_2 - No
E. Calculated from endtidal CO_2 and arterial CO_2 - No
F. Decreases with increase in anatomical dead space - No
G. Increases with PEEP – Probably most correct
(see RE04 & RE08)

RE20b [fi] Physiological dead space increases with:

A. Pulmonary hypertension
B. Hypotension – Yes
C. Atelectasis
D. Pleural effusion
E. None of the above

RE21 [egi] Shunt can be calculated by knowing:
A. Cardiac output
B. Arterial oxygen content
C. Mixed venous oxygen content
D. End pulm. capillary oxygen content
E. All of the above – Yes, the shunt equation

$$\frac{Q_S}{Q_T} = \frac{(C_{c'}O_2 - C_aO_2)}{(C_{c'}O_2 - C_{\bar{v}}O_2)}$$

RE22 [f] Alveolar pressure:
A. Is always negative throughout normal quiet breathing – No, impossible – if it were always negative relative to atmospheric you could never exhale…
B. Is zero (atmospheric pr) during pause between inspiration and expiration – If there is no flow, then yes
C. Is greater than 5-6 cm H2O during quiet expiration – No, not usually
D. Is less than 5-6 cms H2O during quiet inspiration – Hmm… well…. It is less that +5-6 cmH2O during quite breathing… I'm assuming the number was NEGATIVE in the real question

Also remembered as:
Alveolar pressure during quiet breathing:
A. 5 cmsH_2O negative at inhalation
B. 5 cmsH_2O positive at expiration
C. Follows intrapleural pressure closely
D. Is atmospheric between inhalation & exhalation – Yes… it has to be!

RE23 [gk] Patient with chronic airflow limitation:
A. Gradient maximal in effort independent part of flow volume loop
B. Will have increased total lung capacity – Yes, in order to have the increased elastic recoil of the lungs aid in expiration
C. Has increased static compliance – No, compliance is decreased
D. ?

RE24 [fgj] One lung anaesthesia:
A. High FIO2 will completely correct paO2 – No, not completely. There will always be some blood flow through the un-ventilated lung leading to shunt (which can't be corrected by increasing the FiO2)
B. CPAP will completely correct paO2 – No, there is a shunt present
C. Supine position will give better VQ matching – Than what position???
D. Associated with hypercarbia – Not if you're ventilating them properly. If spontaneously breathing (?possible) the pCO2 will be normal – this is POSSIBLY the answer though…

July 2000 version: With regards to hypoxia with one lung anaesthesia:
A: Oxygenation is better supine
B: Should have 10cm H_2O PEEP to lower lung
C: Is usually associated with hypercarbia, (?can be associated with hypercarbia)
Based on the previous question… (hypercarbia) seems like the most correct answer…

RE25 [fg] The partial pressure of oxygen in dry air at sea level:
A. 163 mmHg
B. 159 mmHg– Yes, 159.6 (0.21 * 760)
C. 149 mmHg
D. 100 mmHg

RE26 [g] Cause of increased minute ventilation with exercise:

A. Oscillation in paO2 & paCO2 – Possibly… although there are MANY factors implicated…
B. ?
C. ?
D. ?

RE27 [hik] Work of breathing (*as % of total VO_2*) in normal healthy adult::
A. 1% - Correct (10% of this goes into actually moving air) but the books say '<5%' so (B) *could* be a better option….
B. 5%
C. 10%
D. 20%

RE28 [i] PEEP causes:
A. Variable effect on FRC – Possibly not
B. Reduced lung compliance – No, if anything it would increase it
C. Decrease in lung water – No
D. Reduces airway resistance – Correct (Nunn p608)

Alt
RE28 [io] PEEP:
A. Has a variable effect on FRC – Probably not
B. Reduced lung compliance – No, increased
C. Reduces lung water – No
D. Reduces airway resistance – Correct (Nunn p608)

RE29 [i] At an atmospheric pressure of 247 mmHg, what is the moist inspired p02?
A. 200 mmHg
B. 2 mmHg
C. 40 mmHg – (0.21 * 200) = 42mmHg – 40 (This is mixed venous pO2!!)
D. 50 mmHg
(see also CM08)

RE30 [i] Type II pneumocytes
A. Develop from type I pneumocytes – No, the other way around
B. Are macrophages – No, alveolar macrophages are macrophages ☺
C. Are very flat and practically devoid of organelles - No
D. ?Metabolise surfactant – Well… they produce it and recycle it so this is correct

RE30b [j] Type I pneumocytes
A: Give rise to Type II pneumocytes – No, converse is true
B: Are flat & minimal organelles - Yes
C: Bind surfactant (? receptors) on their brush border – No, surfactant doesn't bind to anything
D. ?

RE31 [j] Control (?inspiratory) of the diaphragm originates in:
A. Pneumotactic centre
B. Apneustic centre in pons
C. Dorsal medullary (?neurons of) respiratory centre – This does control inspiration – most correct
D. Ventral medullary (?neurons of) respiratory centre

RE32 [j] For a normal Hb-O_2 dissociation curve, the most correct relationship is:
A. P_aO_2 340mmHg, SaO_2 99%
B. P_aO_2 132mmHg, SaO_2 98%
C. P_aO_2 68mmHg SaO_2 ?
D. P_aO_2 60mmHg, SaO_2 91% - Correct (the 'ICU point')
E. None of the above
100mmHg -> 97.5% ; 40mmHg -> 75%

RE33 [j] Alveolar dead space ???
A. Measured by Fowler's method – No, this is for measuring *anatomical* dead space (also known as the single-breath nitrogen washout test)
B. ??

RE34 [j] Oxygen toxicity:
A: Is caused by superoxide dismutase (OR: Increased by increased SOD)
B: Causes CNS toxicity at over 100kPa
C: Is caused by absorption atelectasis – No
D: Is due to formation of superoxide radicals – Yes…
E: Prolonged ventilation at 50kPa causes pulmonary toxicity
F. Causes lipid peroxidation – Yes, as well. But (D) probably the better answer
(see also MD30)

RE35 [jk] Pulmonary stretch receptors:
A. ?
B: Are only stimulated by maintained stretch - No
C: Show (?slow) adaptation - Correct
D: Cause an immediate decrease in tidal volume - No
E. ?

RE36 [j] The peripheral chemoreceptors are located:
A. Carotid sinus – No, this is a baroreceptor
B. Carotid bodies – Correct (and in the aortic bodies)
C. The vasomotor centre – No
D. ?
(see also RE13)

RE37 [k] Mixed Venous Blood
A. Higher haematocrit than arterial – Yes, this is due to the increased osmoles in the red cells
B. SaO2 48% - No pO2 is 40mmHg, with SpO2 75%
C. Higher pH than arterial Blood – No, pH may be a little lower or normal
D. Best sampling site RA – No, probably the pulmonary artery
E. pO2 lower than coronary sinus blood – No, pO2 of Coronary sinus blood is 20mmHg
F. Coronary sinus O_2 saturation of 30% - No, 60% extraction (sats approx 40%) with pO2 of 20mmHg

RE38 [k] Carbon dioxide carriage:
a) 10% dissolved – 5%
b) 30% carbamino - 5%
c) 85% bicarbonate – 90% bicarbonate in arterial system but correct for VENOUS
d) 60% bicarbonate – 60% of the A-V difference
e) Unaffected by pO_2 – No, this will affect Hb saturations and hence influence the Haldane effect

RE39 [k] Factors that favour formation of carbamino-haemoglobin include:
A. Carbonic anhydrase – No effect on carbamino compounds – this will affect the amount of H+ that needs to be buffered (the minor part of the Haldane effect)
B. A decrease in oxygen tension – It is the OxyHb % that is important, not the *tension* per se
C. An increase in oxygen tension – No
D. A decrease in pH – No effect
E. None of the above – Correct answer

RE40 [k] CO2 diffusion limited because – is this meant to read CO (ie carbon monoxide)?
A. Combines avidly with Hb – Correct, if referring to CO (this is the reason why the pp does not rise much)
B. Partial pressure in blood increases as partial pressure in air increases – if CO, then this is incorrect
C. ?

RE41 [l] Oxygen toxicity may be seen:
A. In CNS and lungs if breath 100% at 1 ATA (?) for 24 hours
B. In CNS and lungs if breath 30% at 1 ATA (?) for 24 hours
C. In CNS if breathe 100% oxygen for 48 hours
D. ?
E. CNS toxicity seen with O2 concs far greater than 760mmHg – Correct. 3 Atm at 100% Oxygen (Nunn)

RE42 [l] Breathing 0.04% CO2 in one atmosphere for 30 minutes, you would see:
A. Periodic apnoeas (or: 'periods of apnoea')
B. Hyperpnoea
C. Signs of acidosis
D. Signs of alkalosis
E. No change – This is normal atmospheric CO2 content according to NASA
(*Comment received*: *"I suspect 0.04% CO2 is actually what we breathe, but I haven't confirmed it in Nunn's yet")*

RE43 [l] In the lung, airway resistance
A Mainly in small airways – No, mainly in segmental bronchi (generations 1-4)
B Varies with change in lung volume – Yes
C Increased by stimulation of adrenergic receptors – No, decreased (ie bronchodilation)
D Can be measured by flow rate divided by pressure difference between mouth and alveolus
E Increased by breathing helium-oxygen mixture – No, decreases
(Q42 Jul 01)

RE44 [l] The effect of decreasing airway diameter has the following effect on airway resistance:

A. 1/8
B. ¼
C. ½
D. 4 times
E. 16 times – increases 16x (for laminar flow) – if you HALVE the diameter…

RE45 [mno] Gas composition of air?

	PO_2	PCO_2	PN_2	P other gases
A.	20.98	O.4	?	
B.	20.98	0.4	?	
C.	21	0.04	?	
D.	20.98	0.04	78.58	0.42
E.	20.98	0.04	78.2	0.98 – Most correct, except it adds up to more than 100%!!

Also: "*A question on fraction of gases in normal air ie Oxygen 20.98, Carbon dioxide 0.04 Nitrogen 78.08 and other gases ?- with very little difference between the percentages*."

RE46 [mn]. What happens to lung function in COAD
A. Decreased static compliance – No, increased (but decreased dynamic compliance)
B. Increased TLC – Yes, grossly increased
C. Decreased airway resistance – No, grossly increased
D. Increased FEV1 – No, often decreased
E. ??

RE47 [o] The amount of oxygen dissolved in plasma is
A. 0.03ml O_2/100ml at PaO_2 100mmhg – No, 0.3 (same units)
B. 6ml O_2/100ml breathing 100% O_2 at 3 atmospheres - Correct
C. 6ml O_2/100ml breathing room air at 3 atmospheres
D. 0.3ml O_2/l breathing room air at 1 atmosphere – No, 3 (same units)
E. 6 mlO2/100mls breathing 100% O_2
ie. NOT Hb bound…

RE48 [o] Closing capacity
A. Increases with anaesthesia – No
B. 10% vital capacity – No, changes with age
C. Decreases with age – No, increases

RE49 [o] Measurement of Functional residual Capacity (FRC):
A. Helium dilution does not measure unventilated spaces on chest - Correct
B. Body plethysomography inaccurate if high FIO2 used – No…
C. Helium used to decrease airflow viscosity
D. ?
E. ?

RE50 [o] The absolute humidity of air saturated at 37C:
A. 760 mmHg
B. 47 mmHg
C. 100%
D. 44mg/m^3
E. 17mg/m^3
NONE of these is correct!! The correct answer is 44g/m^3 OR 44mg/L
I hope it is not like this on the exam… if it is… go with (D)

Cardiovascular Physiology

CV01 [adgil] In a normal cardiac cycle:
A. RA systole precedes LA systole – Yes, but a noticeable difference?
B. RV ejection precedes LV ejection in expiration – No, they should occur together
C. RV contraction precedes LV contraction in inspiration – No, they should occur together
D. Pulmonary valve closes after aortic in inspiration – Yes, this constitutes normal physiological 'splitting'
E. Pulmonary valve closes before aortic in expiration – No, also closes afterwards, but so close it's not noticable

Alt version:
In a normal cardiac cycle (same as CV01 but we remembered the options as)
A. RA ejection precedes LA ejection – Correct. Systole is R>L also
B. RV contraction starts before LV contraction – No, LV then RV
C. LV ejection starts before RV ejection - No
D. Pulmonary valve closes before aortic valve – No, afterwards
E. Aortic valve closes after pulmonary valve in ?expiration – No, always closes BEFORE, just the split is smaller

Alt version 2:
With respect to the cardiac cycle:
A. Right ventricle starts ejecting before left ventricle - Correct
B. Pulmonary valve closes before aortic valve – No, afterwards
C. Right & left atrial systole occur simultaneously – No, RA first
D. Peak aortic blood flow coincides with jugular venous c wave - No
E. Right ventricular ejection precedes left ventricular ejection – Correct - this is the same as (A) – but more vague…
(The above version is reported as accurate for the July 01 paper - It was Q14 on the Physiol paper) – Yeah… great…

CV02 [ahk] Normal jugular venous pressure c waves occur:
A. Just prior to atrial systole
B. Just after atrial systole
C. During ventricular systole – Most correct, at the beginning of ventricular systole, during isovolumetric contraction for the atria, and delayed a little before reaching the jugular vein
D. During expiration
E. ?

CV02b [cdfl] The 'c' wave in the JVP corresponds most closely with:
A. Peak aortic flow – Correct. During mid-systole. Don't forget there is a delay as the wave travels up the vein
B. Isovolumetric contraction – This would be correct if we were talking about atrial pressures
C. Isovolumetric relaxation – No, too late
D. Closure of aortic valve – No, too late
E. Closure of mitral valve – No, too early
However… if the word '*corresponds'* is referring to the *production* of the wave rather than it's *delayed temporal relationship with the rest of the cardiac cycle* I'd go with (B) for sure…

CV03 [ag] In a normal heart at rest the LV end-<u>systolic</u> volume is:
A. 10 to 30 ml
B. 50 to 70 mls – Correct
C. 120 to 150 ml
D. ?80 - 100 ml

CV03b [cjk] Left ventricular end-<u>diastolic</u> volume is:
A. 10-30 mls
B. 30-50 mls
C. 50-70 mls

D. 70-100 mls
E. 100-130 mls – Correct
(Jul 00 & Apr 01 versions recalled as RV EDV)

CV04 [adfl] In moderate exercise, the LV end-systolic volume is:
A. 10 mls
B. 30 mls – No, whilst the end-systolic pressure-volume line (on a LV P-V Loop diagram) would be steeper, it is not the only change that occurs during moderate exercise to affect this
C. 70 mls – Probably the most correct (due to the increased slope of the end-systolic pressure-volume line AND the increased preload) – this would mean that the LVEDV would be higher though… which makes sense
D. 120 mls
E. 140 mls

CV05 [aij] Effect of tilting table from flat to head up include:
A. Decreased activation of RAS
B. Changes to skin blood flow occur immediately – Correct, but immediately?? Carotid Sinus Baroreceptors sense the drop in BP (from decreased CO from decreased VR secondary to blood pooling) and cause vasoconstriction & venoconstriction… watch the wording…
C. ?
D. ?
E. None of the above

CV06 [a] The best site to measure mixed venous pO_2 is:
A. SVC
B. RA
C. Pulmonary artery – Correct
D. Pulmonary vein
E. ?

CV07 [adfhk] Changes with raised intracerebral pressure (ICP):
A. BP increase, HR decrease, RR decrease – Correct
B. BP increase, HR increase, RR decrease
C. BP decrease, HR increase, RR increase
D. BP increase, HR decrease, RR increase
E. No change in BP or HR

CV08 [adek] With increased heart rate: (OR: "With moderate tachycardia:"☺
A. Myocardial oxygen demand increases – Not with 'moderate tachycardia'
B. Ratio of systole to diastole increases – Correct, both decrease but systole decreases less
C. Vascular filling is unchanged – It depends if it is an *isolated* tachycardia or part of a physiological process… (see E)
D.Prolonged AP – No, it shortens with an increase in heart rate
E.Decrease in diastolic filling – It depends if it is an *isolated* tachycardia or part of a physiological process…
F. Decrease in coronary perfusion – Not normally…
G. None of the above

CV09 [a] In exercising muscle, the major increase in blood flow is due to:
A. Sympathetic vasodilatation
B. Metabolic vasodilatation – Correct
C. Muscle pumping
D. ?

CV10 [a] Which circulation has predominant metabolic control?
A. Renal
B. Liver
C. Lung
D. Splanchnic– Correct

CV10b [mn] Local metabolic control is most important in determining flow to:
A. Skin
B. Lung
C. Skeletal muscle – Correct?
D. Kidney
E. Liver
(Alt wording: Which tissues autoregulate blood flow prominently:)

CV11 [a] Myocardial ischaemia in shock is due mainly to:
A. Decreased coronary artery pressure
B. Increased myocardial O2 demand
C. Decreased myocardial O2 supply – Correct
D. ?

CV12 [cgh] The atrial component of ventricular filling
A. 5%
B. 10%
C. 30% – Correct
D. 50%
E. 80%

CV13 [c] Skin perfusion decreases:
A. With standing – Correct
B. ?
C. ?
D. ?

CV14 [cfgi] In a 70 kg man 2 metres tall with right atrial pressure of 2 mmHg & aortic root pressure 100 mmHg, the pressure in the dorsum of the foot is:
A. 0 mmHg
B. 2 mmHg
C. 5 mmHg
D. 30 mmHg – Probably most correct (if walking)
E. >50 mmHg – No, this would only be correct (approx 80mmHg) if we're talking incompetent vein valves (if walking – if standing than this is probably the most correct)

CV15 [ck] When moving from a supine to an erect position:
A. Mean arterial pressure increases – No, slightly lower initially then normal
B. Skin perfusion immediately decreases – While it does decrease rapidly… nothing is *really* immediate
C. Decreased renin-angiotensin II – No, increased
D. Cardiac output increases – No, decreases
E. Increased ADH secretion – Yes, but slower response than (F)?
F. TPR increases – Correct

CV15b [e] Changes from supine to standing causes:
A. Hypotension – Correct, which is sensed and corrected rapidly
B. Adrenal gland activation
C. ?
D. ?
E.
(See also CV05)

CV16 [ch] The lowest intrinsic discharge activity resides in the:
A. SA node
B. AV node
C. Bundle branches

D. Purkinje fibres – Their intrinsic rate is 15-40 bpm but ventricular fibres are probably slower
E. Ventricular fibres – Correct

March 2003 version: Slowest conduction (velocity) occurs in:
A. Atrium
B. AV Node – Correct (0.05m/s)
C. Bundle of His
D. Purkinje Fibres
E. Ventricular muscle – No, fast (1m/s)

CV17 [cfk] The hepatic artery : portal vein blood flow ratio is:
A. 1 : 10
B. 3 : 1
C. 2 : 1
D. 1 : 6
E. 1 : 3 – Correct

CV18 [cel] CSF production & absorption:

{Diagram of CSF pression versus flow with lines}
[Diagram on website]

A. Unit for x-axis is mmCSF – Yes… provided the crossover point is around 11
B. A is shifted to A1 when paCO2 is 50mmHg – No, only determined by pressure (and some drugs…)
C. ?
D. B is shifted to B1 with hypothermia to 33°C – No, only determined by pressure (and some drugs…)
E. B is shifted to B1 with metabolic acidosis – No, only determined by pressure (and some drugs…)

CV19 [d] Which ONE of the following causes vasodilatation:
A. TXA2
B. Serotonin (5HT)
C. Endothelin
D. Neuropeptide Y – No, it augments the vasoconstrictor effects of NA
E. Angiotensin II
F. VIP – Yes, it relaxes smooth muscle (vasodilatation, bronchodilatation, sphincters & decreases gastric acid secretions)

CV19b [i] Which of the following is not a vasodilator?
A. cGRP
B. VIP – Yes, it relaxes smooth muscle (vasodilatation, bronchodilatation, sphincters & decreases gastric acid secretions) – there is increasing evidence that it augments the postsynaptic effects of ACh
C. Neuropeptide Y – Correct, No, it augments the vasoconstrictor effects of NA
D. Bradykinin – Yes, potent vasodilator
E. Acetylcholine – Yes, via cholinergic SYMPATHETIC nerves ending on skeletal muscle

CV20 [d] Which ONE of the following causes vasoconstriction:
A. Serotonin
B. Prostacyclin
C. Neuropeptide Y – Yes, by acting on Y1 receptors at the vascular neuroeffector junction
D. Substance P – No, vasodilatation & swelling when injected SC – It's one of the neurokinins (the others designated neurokinins A & B), acting on neurokinin 1 receptors (influencing emotions, augmenting CVS stress response, found in slow pain afferents in spinal cord, etc.)
E. Alkalaemia
F. cGRP – No, vasodilatation when injected SC
G. Oxytocin – No, High doses of oxytocin produce a direct relaxant effect on vascular smooth muscles that manifests as a decrease in systolic and diastolic blood pressure and the appearance of flushing

CV20b [g] Which ONE of the following is true?
A. Neuropeptide Y secreted by vagus – No, it's associated with NA secreting nerves
B. CGRP present in afferent nerves – Yes, for example taste afferents to the hypothalamus
C. ?

CV20c [i] Each of the following cause vasoconstriction except:
A. Lying down – Not by itself…
B. Bradykinin – No, Bradykinin (a nanopeptide) is a potent VASODILATOR (as are all the kinins) – responsible for some of the effects of ACEi drugs
C. Carotid occlusion – Yes, (baroreceptor activation)
D. Hypovolaemia – Yes, high & low pressure baroreceptor (carotid sinus - RA & great veins) activation
E. Valsalva manoeuvre – Yes, during phase 2 (baroreceptor mediated) – also limits BP drop

CV21 [dk] In running 100 metres, the increased oxygen requirements of tissues is met by:
A. Increased cardiac output – Most correct answer…
B. Increased 2,3DPG – No, these changes take days
C. Increased erythropoietin – No, this in response to chronic hypoxia
D. Rise in CO_2 partial pressure, activating peripheral chemoreceptors – No the main benefit is right shift of the ODC
E. Increased oxygen tension – Yes & No… The right shift of the ODC allows more unloading of oxygen (% desaturation) whilst maintaining a higher pO2 which aids the 'oxygen cascade'
F. Increased arterial CO_2 partial pressure, leads to vasodilatation – No, it doesn't change much at all

CV22 [dfghjk] Which one of the following (does/does not) cause (an increased/ a decreased) heart rate?
A. Bainbridge reflex – INCREASES heart rate (in response to atrial stretch & increased blood volume)
B. Carotid chemoreflex – INCREASES heart rate (in response to low pO2 or pH)
C. Bezold-Jarisch reflex – DECREASES heart rate (in response to direct noxious stimuli to ventricular mechanoreceptors)
D. Hering-Breuer reflex – This has nothing to do with the heart (it is to do with pulmonary stretch receptors)
E. Cushing reflex – INCREASES heart rate initially (in response to cerebral ischaemia from increased ICP) then BRADYCARDIA from baroreceptor stimuli
F. Pulmonary chemoreflex – DECREASES heart rate by stimulation of lung vessels -> Tachypnoea -> Apnoea -> bradycardia

CV23 [dfl] Pressure difference when lying supine is greatest between:
C. Anterior tibial artery and vein – Correct (MAP to venous pressure)
B. Pulmonary artery and vein – No (27 to 5)
A. Femoral vein and right atrium – No (6 to 2)
D. Renal afferent arteriole & renal vein – No (30 to 15)
E. ?

CV24 [de] Femoral vein pressure decreased most in standing person by:
A. Taking a step forward – No, this would increase the pressure forcing blood centrally
B. Systemic arteriolar constriction – Yes, this would decrease the flow from capillaries to the veins
C. Systemic arteriolar vasodilatation – No, this would increase peripheral blood flow
D. Apnoea – Is this voluntary breath-holding or are they going to collapse!!??
E. ?

CV25 [dil] The highest oxygen extraction is found in the:
A. Carotid body
B. Heart – Correct 114mlO2/L (AV difference)
C. Kidney
D. Brain
(See also CV46)

CV25b [o] In order of oxygen extraction from highest to lowest:
A. Heart > Brain > Kidney - Correct
B. Kidney > Brain > Heart

C. Kidney > Heart > Brain
D. Brain > Kidney > Heart
E. Heart > Kidney > Brain
(Comment received: "5 options, only 1 had kidney last")

CV26 [dj] In the initial phase of the Valsalva manoeuvre:
A. Heart rate increases – No, initially there is a HR decrease (baroreceptor mediated) followed by an increase
B. Cardiac output increases – Yes, briefly, due to blood lung -> left heart - but what exactly do they mean by 'initial phase' – use proper nomenclature please ANZCA! :)
C. Venous return increases – No, decreases due to the increased ITP, therefore decreased VR
D. Blood Pressure increases transiently – Probably the most correct
E. Peripheral vascular resistance increases

CV26b [dfhl] Valsalva manoeuvre during the increased intrathoracic phase:
A. Right ventricular filling reduced in diastole – No, it increases briefly at the beginning, before the decreased VR has its effect
B. Blood pressure initially decreases – No, initially rises (by the same amount as the ITP increase)
C. Vasoconstriction during phase II – Correct (a baroreceptor mediated response – as is the increase in HR)
D. ?
E. ?

July 2001 (Q25) version: During increased intrathoracic pressure of a Valsalva manoeuvre
A. Diastolic filling of the rights ventricle is decreased – Yes, it is increased *very briefly* at the beginning though
B. Arterial baroreceptor activation produces bradycardia – Yes, but only after the pressure has been removed
C. Increased venous pressure augments cardiac output – No, assuming that we're talking about veins in general and not the brief increase in CVP at the beginning of straining
D. Total peripheral resistance is decreased – No, it is increased during phase 2 (also a baroreceptor response)
E. Arterial blood pressure initially decreases – No, initially increases

CV27 [d] The LAST part of the heart to depolarise is:
A. Base of the left ventricle – No, see point B.
B. Base of the right ventricle – Probably this one, just because there is only 1 right bundle branch…
C. The apex of the epicardium – No, the 'apex' is at the bottom…
D. The endocardium of the right ventricle – No, it is thinner so this is probably not correct
(see also CV40)

CV28 [defhijl] The fastest conduction velocity is found in:
A. SA node
B. Atrial muscle
C. AV-node
D. Bundle of His – Well… yes… but not the 'most correct'… gotta love MCQs
E. Ventricular conduction system/Purkinje system – Correct, large cells 70-80um (4m/s velocity)
F. Ventricular muscle
G. Left bundle branches – Well… yes… but not the 'most correct'
H. Right bundle branches – and again…

Mar 02 version: Which part of heart has fastest conduction?
A. AV node
B. His bundle
C. Purkinje fibres - Correct
D. SA node
E. ??

CV29 - DELETED - Same as CV08

CV30 [dfjkl] Isovolumetric contraction is closest to:
A. c wave - Correct
B. a wave – No, this is atrial contraction
C. v wave – No, this is due to the atrium filling during systole while the AV valve is still closed
D. x descent – No, this is due to ventricular ejection as the base of the heart descends.
E. y descent – No, this is due to atrial emptying during ventricular diastole
(see also CV51)

CV31 [di] The Fick principle states that:
A. Oxygen uptake as gas is equal to the arterio-venous oxygen difference in flow through the lungs
B. Arterio-venous oxygen difference in the brain multiplied by flow equals oxygen uptake - Correct
C. ?
D. ?
E. None of the above

CV32 [d] With a mixed venous oxygen content of 110ml/l and an arterial oxygen content of 150ml/l and oxygen uptake of 280ml/min cardiac output is
A. 5 litres/min
B. 6 litres/min
C. 7 litres/min - Correct
D. 8 litres/min
E. 9 litres/min
Simple use of the FICK EQUATION
Q= VO2/(CaO2-CvO2)
= 280/(150-110)
= 7 l/min

$$Flow = \frac{Uptake}{a - v}$$

$$Q = \frac{V_x}{a_x - v_x}$$

CV33 [d] Blood flow per unit mass:
(no other details) – SEE BELOW

CV33b [efjl] Blood flow at rest is most for (if in ml/min/100g):
A. Brain – 54 (15%)
B. Liver – 58 (30%)
C. Kidney – 420 (25%)
D. Heart – 84 (5%)
E. Skin – 13 (5%)
F. Skeletal muscle – 2.7 (up to 30x this when exercising) (5% at rest)
(*Alt version*: Percent of cardiac output is most for:)
(Jul01 - %CO version) -> LIVER

CV34 [e] Oxygen consumption (in mls/100g/min) is highest for
A. Muscle – 0.2 (resting)
B. Brain – 3.3
C. Kidney – 6.0
D. Liver – 2.0
E. Heart– 9.7

Comment: Need to check this in the previous question I've said it's 2.7 ml/100g/min at rest

CV34b [k] Oxygen consumption at rest is most for (if in ml/min/100g):
A. Brain – 3.3
B. Heart – 9.7
C. Liver – 2.0
D. Kidney – 6.0
E. Skeletal muscle – 0.2
F. Skin – 0.3
(Comment: no units given ie whether per 100g or total)

CV34c [k] During strong (?severe) exercise, oxygen consumption is greatest in:
A. Brain
B. Heart
C. Skeletal muscle – Most correct
D. Liver
E. Kidney
F. Skin
(*Comment: On Apr 2001 paper there were 2 questions on oxygen consumption, one at rest [CV34b] and one during exercise [CV34b]. Neither question specified whether absolute consumption or ml/100g/min which is a significant oversight. Options were the same for both. KB 26-May-01*)

CV35 [efh] The effects on plasma volume of 500 ml blood loss are neutralized within:
A. 1-2 hours
B. 8-10 hours
C. 24 hours – Probably this option
D. 1 week
E. 1 month
(Also remembered as: After 500ml blood donation in a healthy male, plasma volume will return to normal within:)

Mar 02: Following a 500ml loss of plasma, the volume is compensated by:
A. 8 - 12 hours
B. 24 – 48 hours – Probably this one
C. 3 weeks
D. ?
E. ?

CV36 [e] Venoconstriction occurs EXCEPT during:
A. Lying down - Possibly
B. Valsalva manoeuvre – Yes, vaso & veno-constriction
C. Carotid sinus compression – No, this stimulates the CS into thinking there is high BP… therefore vasodilatation & venodilatation will occur
D. ?
E. ?

CV37 [fghl] Coronary blood flow is:
A. Dominant in left coronary artery in 60% of people – No, 20% have left dominant
B. Better supply to subendocardium in systole – No, quite the opposite!
C. Better supply to subendocardium in diastole - Correct
D. Better supply to left ventricle in systole – No, obviously
E. Left > right during systole
F. Supply to subepicardium > in LV than RV during systole

Also remembered as: Blood flow in the left (?ventricle/?coronary artery) during systole
A. In less in subendocardium - Correct
B. Is less in the middle muscle layers (or: middle layer of ventricular wall)
C. Greater in right ventricle than left ventricle
D. ?
E. ?

CV38 [f] Adenosine receptor:
A. Blocks AV conduction – Correct, adenosine acts on the A1 receptor to decrease AV conduction
B. ?IP3
C. ?
D. ? (see also CD14)

CV39 [gh] Compensatory mechanisms in a patient with coarctation of the (descending) thoracic aorta:

A. Lower sympathetic tone in the lower half of the body
B. Decreased total peripheral resistance
C. Increased BP in upper body - Yes
D. ?

Jul99 version: Coarctation of the aorta:
A. Cardiac output is 1.5 times normal – Who knows….
B. Systemic vascular resistance is higher in the lower limbs as cvompared to the upper limbs - Possibly
C. Blood flow in all tissues will be normal – Yes, autoregulation should see to that
D. Arterial baroreceptors are inactive – No
E. Blood pressure the same at arm and leg – No… although it depends on WHERE the coarctation is and which arm we're talking about…

CV40 [g] During a cardiac cycle, the first part of the ventricles to contract is:
A. Apex of left ventricle
B. Base of left ventricle
C. Septum – Probably correct
D. Epicardium at base of left ventricle
E. ?Right ventricle ?

CV41 [g] Beta adrenergic receptors:
A. Described by ?Lundqvist/?Lofgren in ?1936/?1943 – Ahlqvist suggested this receptor theory in 1948
B. At least 3 subtypes are now known - Correct
C. ?
D. ?
(*Comment: Option A refers to Ahlqvist who first suggested the presence of alpha & beta adrenergic receptors. -KB)*

CV42 [gjk] When the aortic valve closes, the pressure in the right ventricle is:
A. 0 mmHg
B. 15 mmHg – This is Mean PAP, the rest are either too small (0) or too large for the pulmonary circuit
C. 30 mmHg
D. 50 mmHg
E. 120 mmHg
Difficult… when the aortic valve closes the pulmonary valve is still open, but only for a split second. The number should be close to mean pulmonary arterial pressure of 15mmHg or so

CV43 [fk] The velocity of blood flow is greatest in:
A. Capillaries – No, linear velocity is the slowest here
B. Pulmonary vein during diastole – Probably the most correct
C. Small arteries – No, this is where it starts to drop off
D. Inferior vena cava – No, as some of the flow is missing from the SVC
Difficult question: Linear velocity is dependant not only on flow but vessel diameter…

CV44 [fi] In a 70kg trained athlete at rest:
A. Cardiac output 7 lpm – At rest, maybe less
B. Left ventricular end-systolic volume 60mls
C. Stroke volume 70mls – No, generally have higher SV & lower HR at rest
D. Oxygen consumption 350mls/min – No, should be normal value around 250ml/min
E. a-v O2 extraction 5mlsO_2/100mls blood – Yes, should be no different at rest to normal individual

***CV44** [fi] In a 70kg trained athlete at rest: I answered this as if it read 'during exercise' by mistake!….*
A. Cardiac output 7 lpm – No, can be up to 35 l/min
B. Left ventricular end-systolic volume 60mls
C. Stroke volume 70mls – No, usually greater than the mean resting SV
D. Oxygen consumption 350mls/min – No, can be much greater than this…(3000ml/min in a fit person and 6000ml/min in an elite athlete)

E. a-v O2 extraction 5mlsO_2/100mls blood – No, it is much higher than this… (the reason that the increase in VO2 is much more than the increase in Q – therefore the a-v difference must be more) VO2=Q(CaO2-CvO2)

CV45 [g] Physiological consequences of aortic cross-clamping:
A. ?
B-E. ?
I'd say pick (C)

CV46 [g] During exercise, oxygen extraction is greatest in:
A. Brain
B. Heart – 9.7ml/min/100g
C. Skeletal muscle
D. ? (see also CV25)

CV47 [go] If CO constant & ODC unchanged& O2 consumption constant, Mixed venous oxygen tension decreased with:
A. Cyanide toxicity – No, it's increased
B. Anaemia – Yes, normally ODC likely to be right shifted therefore the 'tension' unchanged but the question states that the ODC is UNCHANGED….
C. Decreased temperature – No… because ODC UNCHANGED (stated in question) therefore there will be less oxygen utilisation in the tissues (decreased MR).
D. Increased CO_2 – No, ODC likely to be right shifted

CV48 [hl] Afferents from the Carotid ?sinus ?body:
A. Use glycine as a neurotransmitter – No, glutamate
B. Synapse in the C1 area of the brainstem – No, A2 area
C. Travel via sympathetic nerves – No, they travel via the glossopharygeal nerve (CN-IX)
D. ?
E. ?

July 2001 version (Q24 on this paper): Arterial baroreceptor afferents
A. Reach spinal cord via sympathetic nerves – No, they travel via the glossopharygeal nerve (CN-IX)
B. Utilise glycine as a neurotransmitter – No, glutamate
C. Primary synapse in C1 area of the medulla – No, A2
D. Activate GABA inhibitory interneurons – Correct
E. Excite autonomic efferents in the anterolateral horn

CV49 [jl] Which ONE of the following is true:
A. Right atrial systole and left atrial systole occur at same time – Correct.
B. Pulmonary valve closes before aortic in inspiration – No, normally always closes later
C. c wave of atrial pressure trace occurs at time of peak aortic pressure – No, corresponds with isovolumetric contraction
D. RV ejection precedes LV ejection – No, they occur simultaneously
E. ?

CV50 [j] In an average, healthy 70kg male with standing erect with mean arterial BP of 100mmHg:
A: Cerebral venous pressure is approximately 10mmHg – No it is almost zero (or negative)
B: Mean arterial pressure at head level is 70mmHg – No, closer to 80mmHg
C: Venous pressure in foot is approximately ?70/?100mmHg – No, it will be more like 130mmHg for a 1.7m tall male with incompetent veins
D. Cerebral perfusion pressure 70mmHg – Yes, assuming an ICP of 10mmHg and JVP of 0mmHg (=80-10)
(See also CV14)

CV51 [jl] During isovolumetric contraction of the ventricles:
A. Aortic blood flow is reversed – No, blood flow still occurs in the forward direction, helped by arterial compliance
B. Coronary blood flow increases
C. The pulmonary valve is not yet shut – No, it has been shut and still is shut…

D. Aortic pressure is falling – Correct, it is not until the end of this phase (when the aortic valve opens) does it rise
E. When both ventricles reach the same pressure their respective outflow valves open – No, the pressure differential that is important is between the L & R ventricles and the aorta & pulmonary a. respectively.
(Q13 on Jul 01)

CV51b [m] Isovolumetric contraction is associated with:
A. Immediate increase in heart rate due to cardiac sympathetics
(OR: Baroreceptor reflex decrease in heart rate)
B. Cardiac output increased/unchanged
C. Increased systolic BP and decreased diastolic BP
D. Does no work – Probably correct… no external work being done really…
E. Decrease stroke volume

CV52 [k] Cerebral blood flow is increased by:
A. Decrease in CSF pressure of 5 mmHg – Not necessarily… if ICP was less than venous already it would make no difference
B An increase in MAP of … - Yes… an increase in MAP will increase the CBF if OUTSIDE the autoregulatory range…
C. Significantly increased by an increase of pCO_2 of 5mmHg – Yes, it will increase by 4% for every mmHg change (therefore increase by 20%)
D. Plasma glucose > 10 mmol/l – No difference
E. Increased regional (?OR global) neural activity (OR: Increased metabolic requirements) – If global, then yes…
(Alt version: A significant increase in global cerebral blood flow is most likely to be caused by:)

CV53 [k] Baroreceptors located in all EXCEPT:
A. Carotid sinus – Yes
B. Carotid body – No, chemoreceptor
C. Right atrium – Yes
D. Aortic arch – Yes
E. Large veins – Yes
(*Comment: The carotid body is a chemoreceptor. Many people get the roles of the carotid body & carotid sinus mixed up. Having both options here probably alerts you to the correct answer - KB*)

CV54 [kl] The volume of blood is greatest in:
A. Systemic Capillaries – 5%
B. Large veins – 67% (veins and venules)
C. Small arteries – 11% (aorta, arteries and arterioles)
D. The liver – part of the others…
E. ?The lung – 12%

CV55 [k] Hydrostatic pressure increases in: (capillary hydrostatic pressure?)
A. Arteriolar constriction – No, decreases
B. Venous constriction – Yes, increases capillary pressure
C. Capillary dilatation – No, simple application of the 'Law of LaPlace'
D. ?

CV56 [l] Configuration of an ECG recording:
A. 25 mm / sec, 0.5 mV /cm
B. 25 mm/sec, 1mV /cm - Yes
C. 50mm/sec 0.5 mV /cm
D. 50mm/sec 1mv / cm
E. none
Alt version: On a standard ecg
A. Speed 50mm/s 50mm/mv
B. Speed 50mm/s 25mm/mv

C. Speed 25mm/s 25mm/mv
D. Speed 25mm/s 50mm/mv
E. None of the above – Correct (speed 25mm/s & 10mm/mV)

CV57 [l] During exercise in an untrained person, increased cardiac output is mainly due to:
A. Increased heart rate – Not alone
B. Increased stroke volume – Not alone
C. Increased venous return – Yes… an increased 'tendency' for venous return
D. ?
E. ?

CV58 [m] Long term control of tissue blood flow includes:
A. Adenosine – No, short term
B. Nitric oxide – No, short term
C. Change in tissue vascularity – Correct (long term – see Ganong p612)
D. Oxygen tension at the precapillary sphincter – No, short term
E. "*something else also short term*"

CV59 [o] Peak left ventricular (LV) volume corresponds with (or correlates best with):
A. a wave
B. v wave
C. c wave – Yes, isovolumetric contraction
D. x descent
E. y descent

CV60 [o] Cardiac muscle is different from skeletal muscle because:
A. Fast Na Channels
B. Slow Ca Channels – Correct (see Ganong p74)
C. Presence of actin and myosin – No, they both have this…
D. Lower RMP
E. ?

CV61 [op] Widened pulse pressure in all except:
A. More rapid ventricular ejection – This does widen pulse pressure
B. Increased aortic compliance – Correct – this decreases PP. Opposite occurs with age (ie. Less compliant -> increase PP)
C. Increased diastolic pressure
D. ?
Alt version: All increase pulse pressure except
A. Increased TPR
B. Increased Stroke Volume
C. Increased LV dP/dT
D. Increased Diastolic pressure
E. Increased aortic compliance – Correct – this decreases PP. Opposite occurs with age (ie. Less compliant -> increase PP)

CV62 [p] Adrenaline in VF arrest
A. Increases contractility
B. 'Coarsens' fine VF
C. improves coronary perfusion – Correct?
(Comments received Jul03: "Couple of other options that were plain wrong. Maybe I missed something but I assumed it was mainly to contract the peripheral circulation and allow circulating blood to stay in the coronary and cerebral circulation. I didn't think it was to increase contractility (the ventricle is not pumping blood out and circulation is due to CPR . ??)

CV63 [p] In a young woman who loses 20% of her blood volume:

A. Decreased diastolic BP – Slight decrease may be possible due to inadequate maximal vasoconstriction to cope with that volume loss
B. Increased serum ADH – Yes, definitely
C. Increased pulmonary vascular resistance – No, PVR increases as LAP decreases, but LAP unlikely to drop signicantly
D. Decreased cerebral blood flow – No, unless there are other compounding factors
E. Increased urinary sodium concentration – No, the effects of aldosterone, which in this person, should be well established (via RAS)... In that case the urine Na concentration will be lower (and the urinary K & H will be higher - potassium diuresis & drop in urinary pH)...

The problem is that option (E) makes no mention of WHAT urine the 'increased Na concentration' is compared to... Is it referring to the urine produced with maximal ADH & no aldosterone, or the urine in the absence of ADH...??
I'd say they're trying to make us think it is the former (the later is just TOO obvious).

Renal Physiology

KD01 [ak] Renal blood flow is dependent on:
A. Juxtaglomerular apparatus – Altered by but not DEPENDANT on
B. [Na^+] at macula densa – Altered by but not DEPENDANT on
C. Afferent vasodilatation – Altered by but not DEPENDANT on
D. Arterial pressure – Yes… if there is NO PRESSURE…
E. Efferent vasoconstriction – Altered by but not DEPENDANT on

Factors (not) affecting ?renal blood flow/GFR:
A. Sympathetic nervous system – Yes, NA causes contraction of mesangial cells and decreases area available for filtration in the glomerulus
B. Sodium flow past macula densa – Yes, Renin secretion inversely proportional to transport of Na and Cl across this portion (macula densa) just before the start of the DCT
C. Afferent arteriolar vasodilatation – Yes, increases GFR
D. Arterial pressure – No, only at extremes of pressure (outside autoregulatory range) – between 80-180mmHg
E. Efferent arteriolar vasoconstriction – Yes, increases GFR (probably the least important if the question was regarding RBF)
(Similar Q: see KD18)

KD01b [d] Renal blood flow:
A. Is 600-650ml/min per kidney – Correct (which equals about 1250ml/min for BOTH kidneys – ie. 25% of cardiac output)
B. Is directly measured by infusing PAH – No, indirectly measured (0.9x RPF -> PAH clearance – then need to take into consideration Hct to get RBF)
C. Is increased by sympathetic tone – Strange answer…

KD01c [f] Renal blood flow:
A. Greater per unit mass than cerebral blood flow – Correct (Brain 54ml/min/100g)
B. Is greater in the medulla compared to the cortex – No, less (Cortex 450ml/min/100g, Outer Medulla 20ml, Inner Medulla 3ml)
C. Is closely related to tubular sodium reabsorption – Not closely
D. Only sympathetically mediated – No, autoregulated, Angintensin II, prostaglandins, etc etc
E. Some noradrenergic endings on JG complex and tubules - Yes, by Renin exretion & Na resorption respectively – but does this have immediate impact on renal blood flow?
F. Parasympathetic via hypogastric plexus – No, vagal origin via aorticorenal plexus

KD02 [a] Which has the greatest renal clearance?
A. PAH - Yes, used to measure renal plasma flow (ie. Assumes that the renal vein has no PAH)
B. Glucose – No, 100% reabsorbed
C. Urea – No, 53% reabsorbed
D. Water - No
E. Inulin – No, only a measure of GFR (since amount excreted per unit time = GFR + Tx (net amt transferred))

KD03 [chk] The ascending limb of the Loop of Henle is: (thick)
A. Impermeable to Na^+ - No, active transport… (Na-K-2Cl-ATPase)
B. Involved in active transport of K^+ into the lumen – No, passive diffusion and actively pumped out
C. Involved in active transport of Cl- out of lumen – Yes (Na-K-2Cl-channel) – secondary active transport…
D. Involved in active transport of Na^+ into lumen – No, out of lumen (Na-K-2Cl cotransporter) - which is SECONDARY active transport
E. Hypotonic at the top – No, the tubuler fluid is hypotonic BEYOND the top of the LOH as Na and Cl pumped out…
F. ?None of the above ?Actively transports water – No, passive

KD04 [dfi] Regarding glucose handling in the kidney
A. Reuptake is passive – No, secondary active transport (SGLUT-2 on the lumen, GLUT-2 basally)

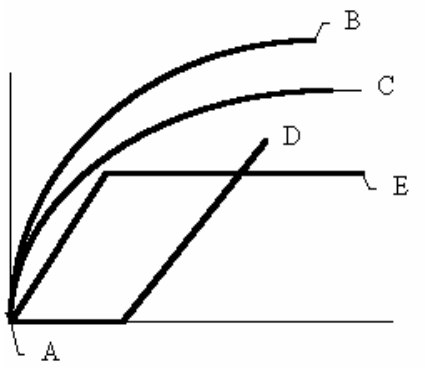
B. Tm is the same for all nephrons – No, one of the reasons for 'splay'
C. D-glucose more rapidly absorbed than L-glucose – Yes
D. Reabsorption is inversely proportional to lipid solubility – No…

KD05 [d] Water filtration by the kidney:
A. Is 180 l/hr – No, GFR is 180 L/Day
B. Is 125 ml/min – Correct
C. Up to 90% is reabsorbed – No, up to 99.7% reabsorbed (maximal ADH)
D. Most drugs have MW less than 600 and are freely filtered – No, depends on lots of factors

KD06 [efghj] A substance is freely filtered and actively secreted. Which of the following represent the changes in concentration of the substance along the nephron?
{A graph of clearance vs plasma concentration with various labelled curves labelled A, B, C, D}
see Ganong figure 38-13 (p688)
?? None of the above

Alt version: Substance that is freely filtered and then reabsorbed by a saturable transport mechanism:
(Graph of Excretion rate (y axis) vs Plasma concentration (x axis) with 4 curves labelled A to D and with E: None of the above.) see Ganong figure 38-10 (p687) Answer will be graph D from the one pictured below…
Probably (D)

Also remembered as:
A substance is freely filtered then resorbed up to its transport maximum in the kidney. Which curve represents the ?excretion/resorption curve?
Probably (D) (if resorption curve)



A. Curve A-B
B. Curve A-C
C. Curve A-D
D. Curve A-E– If x-axis is 'plasma level' and y-axis is amt resorbed (Tx)
E. None of the above

Several comments received re July 2000 paper:
"*KD06 Reworded: The excretion of a substance that is freely filtered and secreted up to its maximum threshold is represented by:*
Note: Please draw new curve (A-F) consisting of a line of high gradient which then sharply changes into a line of lesser gradient (but not zero)."
AND
"*Which one is filtered and actively secreted at kidney*
4 graphs a-b,a-c, a-d, a-e and none of above
correct answer corresponds to Ganong graph of PAH clearance a-d I think" -> NO
AND

"*For a substance filtered and secreted by a saturable transport mechanism the correct curve is: four curves including a straight line, logarithmic washin curve, straight line then flat, straight line then abrupt change to less steep straight line.*"

KD07 [e] ?Secretion/?absorption of urea takes place in:
A. Proximal convoluted tubule – Urea reabsorption takes place in the proximal tubule by ?facilitated diffusion, mediated by urea transporters (also occurs in inner medullary collecting duct – under influence of vasopressin)
B. Distal convoluted tubule – No, water not urea is removed
C. ?
D. ?

KD08 [f] Glomerular capillary permeability is:
A. Less than in ordinary capillaries – No, much greater K_f (50x that of skeletal muscle)
B. 50 times more than skeletal muscle capillaries - Correct
C. ?
D. ?

KD09 [g] Which ONE of the following is not involved in the regulation of glomerular filtration rate (GFR)?
A. Juxtaglomerular apparatus – Yes, if low pressure at JG cells -> increase renin
B. Arterial pressure – No, autoregulation maintains GFR (unless outside extremes) – BUT there is the pressure diuresis concept…
C. Efferent arteriolar tone – Yes, constriction -> decreases GFR
D. Na content in distal tubule – Yes, effects renin secretion (sensed by macula densa)
E. Afferent arteriolar tone – Yes, dilation -> increases GFR
(Similar Q: KD14)

KD10 [fl] With regard to glomerular filtration:
A. Autoregulation maintains flow – Yes, within the range 80-180mmHg – but NOT PRECISELY (pressure diuresis concept)
B. ?Afferent arteriole driving force - ????
C. Is equal for cationic & anionic molecules – No, Cations enter Bowman's Capsule more than anions due to negatively charged basement membrane, etc
D. All cross if ?>/?< 8 nm in diameter – They never ALL cross (anions maximal fractional clearance – smallest molecule size – is only 0.55)
Jul 2001 version:
The permeability of glomerular capillaries:
A. Equals that of other capillaries – No, greater than most
B. Is much less than that of other capillaries – No, greater than most
C. Is equal for cationic and anionic molecules of equal size – No, see above
D. Approaches 100% for neutral molecules of 8mm diameter – No, is zero above 8nm for neutral molecules)
E. Is about 50 times as great as that of a skeletal muscle capillary - Correct
(Q 18 on the Jul 01 paper)

KD11 [g] Kidney:
A. Maximum urine osmolality of 1200 mOsm/l – Correct, but Ganong suggests 1400mOsm/l (500ml to excrete daily solute load of 700mOsm)
B. ?
C. ?

KD12 [hi] Significant tubular reabsorption occurs with:
A. Phosphate – Yes, proximal tubule Na/Pi co transporter
B. Creatinine
C. Urea
D. Sulphate
E. All of the above

KD13 - deleted - same Q as EM26

KD14 [ik] Increased GFR caused by
A. Increased cardiac output – Possibly, but autoregulation would limit the effect (but it is NOT FULLY autoregulated – press diuresis concept)
B. Afferent arteriolar vasoconstriction – No, decreases P_{GC}
C. Efferent arteriolar vasodilatation - No, decreases P_{GC}
D. Increased chloride delivery to the macula densa – No, this *decreases* GFR

Apr 2001 version: Which of the following is involved in the regulation of glomerular filtration rate (GFR)?
A. Juxtaglomerular apparatus
B. Afferent arteriolar tone
C. Efferent arteriolar tone
D. Chloride transport at the macula densa
E. All of the above – Correct (see above questions)

KD15 [j] The formula for GFR is:
A. GFR = Kf (HP_G - HP_B + OP_G - OP_B)
B. GFR = Kf (HP_G - HP_B - OP_G + OP_B) - Correct
C. GFR = Kf (HP_G + HP_B - OP_G + OP_B)
D. GFR = Kf (HP_G + HP_B - OP_G - OP_B)
E. GFR = Kf (HP_G - HP_B - OP_G - OP_B)
(Comment: HP is hydrostatic pressure, OP is oncotic pressure, G is glomerulus, B is Bowman's capsule)

KD16 [jl] The effect of PTH on the kidney is to:
A. Increase Ca excretion and increase phosphate excretion
B. Increase Ca excretion and decrease phosphate excretion
C. Decrease Ca excretion and increase phosphate excretion - Correct
D. Decrease Ca excretion and decrease phosphate excretion
E. None of the above
It increases Ca reabsorption and decreases phosphate reabsorption (ie EXCRETION) – but it has nothing to do with SECRETION (just in case they put that in a version of this!)

KD17 [j] Water handling by kidney (% reabsorption)
A. 93%
B. 94%
C. 99%
D. 99.4% - under maximal ADH (see Question in Fluids & Electrolyte section)
E. 99.9%

KD18 [j] Resistance to renal blood flow is chiefly determined by:
A. Renal artery
B. Afferent & efferent arterioles – Correct
C. Interlobular & arcuate arteries
D. Peritubular capillaries
E. ?
(see also KD01)

KD19 [j] Tubuloglomerular feedback (ie: tubular->glomerulus feedback – don't confuse with glomerulotubular balance):
A. Increased solute delivery to macula densa causes decreased GFR – Correct, it is an inverse relationship (Sensor: Macula Densa – Effector: Afferent Arteriole)
B. ?
C. ?
(see also the more complete KD23 which may be the same Q as this one – NO, not the same question – see note in blue…)

KD20 [k] For renal clearance of a substance to exceed Inulin,

A. Increase in GFR – no, this would increase inulin clearance by the same amount
B. Must be secreted by either the proximal or distal tubules - Correct
C. Must have a lower molecular weight than Inulin – No, not directly relevant

Alt version: If a substance (x) is cleared by the kidney at a rate greater than inulin, it must be:
A. Freely filtered – No, this would equal GFR = C_{IN}
B. Actively secreted - Correct
C. ?
D. Actively reabsorbed – No, this would mean it's U_XV would be less than GFR alone (ie. T_X negative)
E. ?

Alt version: If a substance is found in the urine at a HIGHER concentration than inulin, then – depends on plasma concentration surely?? (Answers below assuming same initial concentration in plasma….
A. It must be filtered more – no, can't filter more than the GFR
B. It is secreted into the lumen – yes….
C. ?
D. There is less reabsorption in the ?DCT – Inulin is not reabsorbed therefore, you can't absorb less than nothing!

KD21 [k] Water excretion by the kidney is due to:
A Osmosis – Yes, most likely
B. Active transport into the lumen – No…
C. Passive secretion in the collecting tubules – No..
D. Solvent drag – No, this refers to the drag of solutes by the solvent (eg some Na in late proximal tubule)
E. Facilitated diffusion – No, water *reabsorption* under the influence of ADH is facilitated diffusion
F. Paracellular movement – No, not main route of movement
(*Comment: "bulk flow" or "filtration" were not choices*)

KD22 [kl] Angiotensin II causes:
A. Increases proximal tubular reabsorption of Na & H_2O & increases secretion of K^+ – Correct (the effect on K is a distal tubule event)
B. Increases distal tubular reabsorption of Na & H_2O & decreases secretion of K^+
C. Decreases distal tubular reabsorption of Na & H_2O
D. Increases excretion of Na & H_2O – No, aims to increase BP and decrease GFR

KD23 [l] Glomerulotubular balance
A Involves afferent arteriole feedback loop - No
B Involves efferent arteriole feedback loop - No
C Juxtaglomerular complex - No
D Ability to increase tubular absorption in response to an increase in filtered load – Yes, PERCENTAGE of solute reabsorbed in PCT is constant (particularly prominent with Na)
E None of the above
(Q41 on Jul 01 paper)
Unlikely that humoral factors play a role at all

KD24 [l] Kidneys produce:
A. Erythropoietin - Yes
B. ADH - No, supraoptic and paraventricular nuclei of the hypothalamus
C. Angiotensin II – No, produced in the liver
D. ANP - Atrium
E. Cholecalciferol – Made in the skin, 25-hydroxy in the liver, 1-hydroxy in the kidney

KD25 [l] Renal nerve sympathetic stimulation
A. Causes increased sodium reabsorption from the PCT – Yes, directly affects tubular reabsorption as well as effect on RBF & GFR
B. Inhibits renin release – No, directly stimulates renin secretion from circulating catecholamines and NA from the renal sympathetic nerves & indirectly stimulates renin secretion by macula densa because of decreased Na & Cl mass presented to the tubule here from the decreased GFR

C. Increased GFR - No decreased GFR by constriction of mesangial cells by NA
D. ?
E. ?

KD26 [l] Water reabsorption by the kidney:
A. 90% in proximal tubule – No, 60-70%
B. 60% in distal tubule – No, 5% (plus approx 15% in loop of Henle)
C. By active transport – No, facilitated diffusion and osmosis
D. ?
E. ?

KD27 [l] Glomerular filtration rate (GFR):
A. Is independent of the size of the capillary bed – No, it *is* dependant on capillary SA and permeability (Kf) (GFR = K_f [P_{GC} – (P_T + π_{GC})]
B. Depends only on the hydrostatic and osmotic pressure differences across the capillary – Depends on the membrane too
C. Is determined by the same forces governing filtration across all other capillaries - Correct
D. Depends only on the permeability of the capillary – No, not only
E. Requires active transport – No, passive

KD28 [mo] Pressure diuresis:
A. Due to decreased reabsorption of Na+ & water in peritubular capillaries - Most likely… ?
B. Regulated by macula densa
C. Increase ADH
D. Increase angiotensin
E. Control by JGA

KD29 [mno] What is the minimum amount of urine required to excrete 600mOsm
A. 100ml
B. 500ml – Correct (if you're assuming that the maximum concentration is 1200mOsm/L)
C. 1 litre
D. 2 litre
E. 4 litre

KD30 [mn] Increase in GFR occurs with
A. Increased sympathetic stimulation
B. Decreased renal blood flow
C. Hypoproteinaemia – Correct (Starling's Forces) but would be offset by TGF with time
D. Ureteric obstruction
E. None of the above

KD31 [m] Filtration fraction measured as inulin clearance/ PAH clearance
A. ?
B. ?

KD31b [o] Regarding renal clearance:
A. Inulin clearance measures renal blood flow – No, it is a measure of GFR
B. Creatine clearance correlates with GFR – No, creatinine not creatine
C. Filtration fraction measured as inulin clearance/ PAH clearance – Correct – a fraction of filtered plasma (GFR) divided by total plasma flow
D. ?
(Comment: "option B was creatine & NOT creatinine!")

KD32 [o] Regarding urea:
A. Urea is formed from …ornithine – No, from Arginine to Ornithine & Urea
B. 10% is reabsorbed by kidney – No, more like 60%
C. ?

KD33 [o] The clearance (or 'renal regulation') of which ONE of the following is NOT regulated by a hormone:
A. Sodium – Yes, aldosterone
B. Potassium – Yes, aldosterone
C. Calcium – Yes, PTH
D. Phosphate – Yes, PTH
E. Sulphate – Nope..

KD34 [o] Biggest contribution to urine concentration by:
A. Na^+ absorption in thick ascending limb - Correct
B. Passive diffusion of urea in collecting ducts – No…
C. Chloride absorption in distal convoluted tubule – No…

GIT Physiology

GI01 [cdf] Oesophagus at rest is:
A. Open at the top
B. Open at the bottom
C. Open at the top and the bottom
D. Closed at the top and the bottom – Yes, but relaxes on swallowing
E. Contracted throughout its length

GI02 [cj] Na^+ absorption in small bowel
A. Occurs by active transport – Secondary active transport (luminal membranes freely permeable with Na/K-ATPase on basilateral membrane)
B. Occurs with H^+ – No, di & tri-peptides are transported with H+
C. Decreases with glucose (OR: Is facilitated by glucose) – No, glucose absorption requires the presence of Na (SGLT-1 & SGLT-2 cotransporters in small intestine) & CONVERSELY presence of glucose enhances Na resorption
B: Is by active transport at the brush border membrane – No, active part is the basolateral membrane
C: ? passive across basilateral membrane (?diffusion) – No, actively pumped out
D. Occurs with Cl^- through tight junctions – No…

GI03 [dfh] After a fatty meal, most of the fat would be:
A. Absorbed in the portal circulation & transported to the liver – Some is, but not most
B. Absorbed in the portal vein & transported in the hepatic artery – No…
C. Absorbed into chylomicrons in the lymphatics - Yes
D. Absorbed as triglycerides into the portal vein & bypass the liver – No, small FFA (unesterified) can travel through the portal vein TO the liver

GI03b [g] Fat digestion:
A. Bile salts are the most efficient emulsifiers
B. Gastric lipase is the most important – Not important (except in pancreatic insufficiency), lingual lipase is and is active in the stomach (can digest 30% of dietary triglyceride)
C. Pancreatic lipase in the duodenum is the most important - Yes
D. Digestion takes place in micelles – Digestion has occurred -> then form micelles
E. Micelles attach to enterocyte receptor – Possible, but no evidence as yet…

GI04 [fl] Vitamin B12 deficiency:
A. Due to decreased ingestion – Possible, but usually VERY rare (vegans)…
B. Due to decreased absorption by ileum – Possible (surgery/disease)
C. Causes a deficiency in haemoglobin – Not always
D. Causes a decrease in decrease in red cell production – Not always, megaloblastic anaemia occurs by actual NUMBER or red cells may be normal OR decreased
E. ?
I'd go with (E) if it were 'All of the above'

GI05 [fh] Iron absorption:
A. Passive – No, active and controlled (metal transporter on luminal side and active transport out of basolateral membrane)
B. Binds to apoferritin in small intestine lumen – No, some Fe2+ is oxidised to Fe3+ and binds to apoferritin in the enterocyte cytoplasm (forming ferritin)
C. Decreased with increased pH – Most correct…
D. Requires acidic gastric pH – No, most is absorbed from the small gut

GI06 [fj] Findings in iron deficiency:
A. Increased apoferritin synthesis – No, this is DECREASED to allow more Fe2+ to enter the blood
B. Decreased transferrin saturation - Yes
C. Transferrin synthesis is reduced – No, increased
D. Increased amounts of ferritin – No, this is in iron overload
E. Haemosiderin is produced – No, this is just large intralysosomal aggregates of ferritin

GI07 [gi] The major route of iron excretion is:
A. Excretion of transferrin in the gut – No, and even if this were true, transferrin is a protein…
B. Shedding of intestinal mucosal cells - Yes
C. Increased renal excretion – No effect
D. ?

GI08 [gk] Gastric acid secretion is decreased by:
A. Vagal inhibition - Yes
B. Luminal peptides & amino acids (OR: "Ingestion of protein") – No, luminal factors such as this (and distension) cause release of gastrin and therefore acid
C. Noradrenaline - No
D. M1 cholinergic antagonist same efficacy at reducing gastric acid secretion - ????
E. Distension of bowel wall – No, increases gastrin secretion
(Also remembered as "*Intestinal secretion is inhibited by:*)

GI09 [hik] Release of which ONE of the following increases the pH of duodenal contents?
A. Secretin – Yes, increases the secretion of bicarbonate by the duct cells of pancreas and bile ducts
B. Gastrin – No, increases H+ therefore decreases pH
C. Intrinsic factor – No effect on pH
D. Cholecystokinin – Yes, but INDIRECTLY by augmenting the effect of secretin
E. Gastrin releasing peptide – No, this is the transmitter secreted by the vagus which innervate the G Cells, and thus increase gastrin secretion
F. Pepsin – No effect on pH

GI10 [hl] Speed of delivery of nutrients from stomach to small intestine:
A. CHO>fat>protein
B. CHO>protein>fat – Transit time fastest for CHO, then protein, then fat
C. Protein>CHO>fat
D. ?
E. Fat>protein>CHO

GI11 [j] Gastric emptying is slowest after consuming:
A. High protein meal - No
B. High fat meal – Yes…
C. Alcohol – No, some people eat fatty meals to slow the release of alcohol to the duodenum
D. ??Metoclopamide/???calcium – No, metoclopramide stimulates gastric emptying
E. Carbohydrates - No

GI12 [k] Chyme in duodenum is alkaline due to
A. Secretin – Yes, it causes the secretion of HCO3 by pancreatic and biliary duct cells
B. ?

GI13 [l] In the small intestine, glucose is absorbed
A. Passively - No
B. In combination with Sodium – Yes, energy is the Na gradient maintained by basolater Na/K-ATPase
C. By facillitated difussion – No, secondary active transport (with Na via SGLT co-transporter)
D. By cotransport with Chloride - No
E. Actively by insulin dependent uptake – No, independent of insulin
(Q 49 Jul 01)

GI14 [l] After ingestion of a meal:
A. Digestion of fat and carbohydrate begins in the mouth while protein digestion begins in the stomach – Correct (salivary lipase & amylase and acid & pepsins in the stomach)
B. Carbohydrate in the mouth and protein in the stomach – Yes, but not complete answer…?
C. Protein in mouth and fats and carbohydrate in stomach – No…
D. Most fluid and electrolytes are absorbed in the large bowel – No, 7500ml in small bowel 1300ml in colon
E. Composition of the food has no effect on transit time through the bowel – No, see GI11

(?F. Drugs have no effect on gastric motility) - Incorrect

GI15 [l] Calcium uptake in the intestine:
A. Is passive – No, active transport
B. Requires a carrier protein on the mucosal side - Yes
C. Is by facilitated diffusion – No, active transport, facilitated by 1,25-cholecalciferol (induces synthesis of 2 forms of Ca binding proteins and several Ca-H-ATPase transporters)
D. Is less than 10% than dietary intake – No, 30-80% of dietry Ca is absorbed
E. Is facilitated by phosphate – No, it is inhibited by phosphates (as they form insoluble salts in the intestine)

GI16 [o] Bacteria in the intestines:
A. Reduced by the continuous movement of contents through GIT
B. Small intestine is sterile – No…
C. Bacteria in small intestine and large intestine – same in number but different species – No…
D. Required for the absorption?/ breakdown of?
E. Reduced in small intestine due to gastric acid & fast motility – Correct apparently…

GI17 [o] Functions of the liver include ALL EXCEPT:
A. ?
B. ?

Blood & Immunology

BL01 [a] Which of the following decrease platelet aggregation & cause vasodilatation?
A. PGE2
B. PGF2alpha
C. TBXA2 – No, causes vasoconstriction and platelet aggregation
D. PGD2
E. PGI2 – Yes, opposite effects of Thromboxane A2

BL01b Which is associated with inhibition of platelet aggregation?
A. Prostaglandin I – Yes, has the opposite effects of Thromboxane A2…
B. Prostaglandin E
C. Prostaglandin F
D. ?

BL02 [ahk] Which ONE of the following causes bronchodilatation?
A. PGE2 – Corect (think Aspirin sensitive asthma)
B. PGF2 alpha
C. TBXA2
D. LTB4 – Bronchconstriction via CysLT1 receptor
E. LTD4

BL03 [dk] In a patient receiving 24 units of blood over 2 hours, the complication most likely to be seen would be:
A. Hypercalcaemia – No, if anything the Ca may be a little lower
B. Increased oxygen uptake in the lungs – Possibly (if stored with ACD and not CDPA due to low 2,3-DPG levels)
C. Coagulopathy – Ca low enough to interfere with clotting is incompatible with life but lack of clotting factors…
D. Hypokalaemia – No, [K] is increased in stored blood (presumably due to decreased Na-K-ATPase activity)

BL03b [df] Problems of massive transfusion most commonly include:
A. Metabolic alkalosis – No, if anything it would be an acidosis (but citrate would buffer it a little?)
B. Hyperkalaemia – Probably the most likely, due to increased [K] in storage blood
C. Coagulopathy due to hypocalcaemia – No, levels low enough for this are incompatible with life
D. ?

BL03c [hk] The effect which is LEAST likely to occur shortly after transfusion of 25U of whole blood
A. Hypocalcaemia – Possible with that much blood (over what time frame?)
B. Dilutional coagulopathy – Possible, usually due to thrombocytopaenia before coagulation factor deficiency
C. Metabolic alkalosis – No, more likely acidosis
D. Increased affinity of Hb for O_2 – Possible (due to decreased 2,3-DPG)
E. Hyperkalaemia – Not usually but possible if rapid transfusion (reactivated Na-K-ATPase, dilution effect & slow transfusion)

BL04 [d] Which immunoglobulin (?MW 69,000) would exist as a monomer in tears, saliva & mucus (?secretions)?
A. IgA – Yes, for external secretions (exists as a monomer, dimer or trimer)
B. IgG
C. IgM
D. IgE
E. IgD

BL05 [dl] Erythropoietin is a glycoprotein which:
A. Stimulates red and white cell production – No, immature erythroid cells only
B. Is broken down in the kidney – No, liver
C. Has a half life of days – No, hours
D. Levels inversely proportional to haematocrit – No, probably related to pO2

BL05b [g] Erythropoietin:
A. Red cell maturation 24 to 72 hours – No, 2-3 days
B. Inactivated by Kupffer cells – No, produced by the kidney and Kupffer Cells
C. Metabolised in liver - Yes
D. Half-life is 5 ?mins/hours – Yes, if the answer is 'hours'

BL06 [d] Phagocytic cells:
A. Capture bacteria in the blood – I guess this is the most correct option!
B. ?

BL07 [dhik] Antithrombin III affects (?inactivates) which coagulation factor?
A. XIIa (?XIa) – Yes.
B. Xa – Yes.
C. IIa – Yes
D. IXa - Yes
E. All of the above - Correct
Inactivates activated factors II, IX, X, XI & XII, facilitated by heparin

BL08 [e] Vitamin K (?neutralizes):
A. Factor 5
B. Heparin
C. Antithrombin 3
D. Plasminogen
None of the above

BL09 [efgl] Desmopressin:
A. Increases factor 8 levels/activity – Yes, by increasing release of von Willibrand's factor which increases factor VIII activity and optimal function of platelets
B. Anti-heparin effect – No, but heparin can cause a decrease in DDAVPs ADH effect
C. Has pressor activity – Yes, but almost none…
D. ?

BL10 [e] Post-translational modification occurs with:
A. Factor V
B. Von Willebrand factor
C. Factor XII
D. Protein C - Correct

BL11 [efhj] Post-translational modification:
A. Removal of introns – No, this is post-tranSCRIPTIONal modification
B. Modification of amino acid residues in proteins – Yes, by combination reactions (hydroxylation, carboxylation, glycosylation, phosphorylation of aa residues – which essently splices the protein)
C. Self-splicing – No, not possible to 'self-splice'
D. tRNA involved – No, tRNA is involved with translation (think 'different language' ie 'translate' RNA -> Protein) only

BL12 [e] Haemoglobin breakdown:
A. Fe is excreted by the kidney – No, iron is reused or stored (Fe loss is mainly from GI epithelia shedding)
B. Haem is broken down to biliverdin – Yes, but it is rapidly converted to bilirubin in the tissues…
C. Haem is converted to bilirubin and transported to liver bound to albumin – Yes, this is correct too
D. ?

BL13 [f] Platelet activation will NOT occur without:
A. Ca+2 – Correct - The platelets require influx o Ca to release the contents of their granules…
B. Vessel wall damage – No. Platelet aggregation can occur with exposure to collagen… or IN VITRO
C. Von Willebrand factor – No, whilst this does cause platelet aggregation, it can occur without it (collagen & laminin)

D. Fibrinogen
E. ?Serotonin ?Factor VIII

BL14 [gil] Glycoprotein CD4 is expressed on:
A. Cytotoxic T cells – No, they have CD8
B. Suppressor T cells
C. Helper T cells – Yes…
D. Plasma cells

BL15 [gh] Immunoglobulin G (IgG) has:
A. 4 heavy chains – No, it exists as a monomer
B. 4 light chains – No, it exists as a monomer
C. 2 heavy & 2 light chains - Yes
D. Variable heavy & light chains – Yes, in a way but only a portion of each is variable
E. None of the above

Jul99 version: Immunoglobulin (?antigen specificity is determined by:)
A. Variable heavy & light chain – Yes, both heavy and light chains have a variable region (tip of Fab region) which enable antigen specificity
B. Constant heavy & variable light chain
C. Constant light & variable heavy chains
D. Constant both chains

BL16 [h] Platelet activation requires:
A. Vessel wall damage – No, they can be activated in vitro without vessels…
B. Ca^{++}- Yes
C. Cyclooxygenase – Possbily….?
D. vonWillebrand factor – Yes, but not ONLY this (also collagen & laminin from damaged vessels)
E. Prostaglandins

BL17 [hk] Cytokines are:
A. Low molecular weight proteins - Correct
B. Enzymes
C. Autacoids
D. Immunoglobulins
E. Interleukins – Sort of… Interleukins are cytokines once their function is known in humans they are named IL-x…

BL18 [hmo] Which of the following statements about FFP is NOT true?
A. Must be group specific – False, it IS group specific usually but doesn't HAVE to be…
B. Does not need to be cross matched - True, it doesn't need crossmatching
C. Contains all clotting factors except for platelets – True, there are no platelets
D. Contains clotting factors except deficient in factors V and VIII – False, it DOES contain them
E. Is not useful in treating ?protein C deficiency/ coagulopathy – False, it contains Protein C
F. Does not contain albumin – False, it does….
G. Does not contain anticoagulant – False, it does contain SOME citrate
H. Contains an anti-thrombotic protein – True, it does (Proteins C & S etc)

BL19 [io] Complement activation requires
A. Antigen antibody complex – Yes, but it's not 'required'
B. Opsonisation of bacteria – Yes, but it's not 'required'
C. Helper T cells - No
D. Previous exposure to antigen - No
E. Plasma proteins – Correct (ie. The complement proteins!)

BL20 [j] Tissue Bound Macrophages:
A: Derived from megakaryocytes – No, platelets are derived from these
B: Not found in the lung & liver – Incorrect, pulmonary alveolar macrophages and Kupffer Cells are examples

C: Stimulated by lymphokines – Yes from T lymphocytes
D: Digest bacteria using lymphokines
E: ?
Also recalled as: Fixed macrophages in lungs & liver:
A. Originate in the bone marrow and migrate to their site of action as megakaryocytes – No, as monocytes
B. Kill bacteria in phagosomes by lymphokines – No, are stimulated by lymphokines
C. Are activated by cytokines secreted by activated T cells – Yes, lymphokines
D. Part of humoral immunity – No, cellular immunity

BL21 [j] HLA antigens are found on:
A. All leucocytes
B. B cells
C. T cells
D. All nucleated cells – Yes, class I antigens on all nucleated cells, class II only on APCs & activated T-Cells

BL22 [k] For a T cell to react to (?recognise) a foreign antigen:
A. Opsonisation
B. The antigen presenting cell presents antigen - Correct
C. Needs T helper cells
D. Prior exposure to Antigen required

Alt version: Antigen binding to T lymphocytes requires
A. Previous exposure
B. Presentation of antigen by "Antigen presenting cells" - Correct
C. Active T helper cells
D.
E. None of the above

BL23 [k] Thrombin inhibits
A. factor Xa – No, via activated Protein C it converts Va & VIIIa to their inactive forms
B. tPA – No, indirectly inhibits the t-PA inhibitor, thereby activating it
C. protein C – No, it activates protein C
D. platelets – No effect on platelets
E. none of the above - Correct

BL24 [k] Lymphocytes
A. Don't remain in the lymph system – No, most are in the lymphoid system (only 2% in blood stream)
B. Are formed in the bone marrow in adults – No, most are formed from lymph nodes, thymus, spleen from precursor cells that originated from the bone marrow
C. Formed from neonatal precursor cells – Yes, from bone marrow lymphocyte precursor cells which are then processed in the thymus or bursal equivalent to become T or B lymphocytes
D. Produced by tissues derived from foetal bone marrow - No
E. ?

BL25 [l] Rejection of an allograft is due to:
A. Non specific immunity
B. Supressor T cells
C. Helper T cells
D. Cytotoxic T cells - Correct
E. HLA cytotoxic reaction

BL26 [l] Haemoglobin contains:
A. One protoporphorin ring and 4 ferrous ions
B. Four protoporphorin ring and one ferrous ion
C. Four protoporphorin rings and four ferrous ions – Yes, one Fe2+ per protoporphyrin ring for each subunit – ie. 1 globin and 1 heme (4 subunits per Hb molecule)
D. One protoporphorin ring and one ferrous ion – No, this would be the correct if the question was 'each subunit of Hb'

E. None of the above

BL27 [p] Blood viscosity:
A. Is independent of the white cell count – Not normally but it can be
B. Falls as haematocrit rises – No, increases
C. Is independent of vessel diameter – No it is, axial streaming, etc
D. Falls as flow rate rises - Correct
E. Is independent of fibrinogen concentration - No

Endocrine & Metabolic Physiology

EM01 [ach] Effects of a 24 hour fast:
A. Glycogenolysis (?gluconeogenesis) – Yes, glycogen stores (liver 0.1kg & muscle 0.4kg) will last a day (Ganong, p290)
B. Protein catabolism – only prolonged fasting
C. Acidosis – only prolonged fasting
D. Ketone production from protein – only prolonged fasting
E. All of the above – if the question was >24 hours and A = gluconeogenesis then this would be the correct option

Alt version: After 24 hours without food or water a healthy young adult will:
A. Deplete glycogen rapidly – No, it should only last about 24 hours (and the question states 'after')
B. Develop a metabolic acidosis
C. Demonstrate ketone body formation in the liver – Correct – lipid metabolism, production of Acetyl-CoA in the absence of adequate carbohydrates…
D. Have decreased protein content of body

EM02 [a] Which hormone causes increased BSL, increased protein anabolism & increased plasma FFA?
A. Cortisol – Increases BSL (hepatic glycogenolysis & gluconeogenesis) and increases FFA (by producing a protein which increases the action of cAMP), but increases protein CATABOLISM
B. Parathyroid hormone – no effects on CHO, protein & fat metabolism
C. Growth hormone – Yes, increases hepatic glucose output, protein anabolic hormone, and increases FFA in blood (by producing a protein which enhances catecholamine's ability to activate cAMP) – (Ganong, p297 &387)
D. Insulin – No, it decreases FFA (by decreasing hormone sensitive lipase activity)

EM03 [a] Which hormone causes increased BSL, increased protein catabolism & increased plasma FFA?
A. Cortisol – Correct (see above)
B. Parathyroid hormone
C. Growth hormone
D. Insulin

EM04 [a] Which of the following are associated with adrenocortical hypofunction?
A. Aseptic necrosis of bone
B. Osteoporosis
C. Redistribution of body fat
D. Decreased muscle bulk
E. Delayed closure of epiphyses
Who knows? (obviously an examiner does)!

EM05 [adel] The hypothalamus inhibits the release of:
A. TSH
B. ACTH
C. FSH
D. GH – Correct (somatostatin)
E. Oxytocin

EM06 [cjl] Secretion of renin is stimulated by:
A. Increased left atrial pressure – No this secretes naturetic peptide
B. Increased angiotensin II – No, this stimulates angiotensinogen production, but has a negative effect on renin production
C. Decreased right atrial pressure – Probably, a low pressure baroceptor response?
July 2000 version: Which decreases renin release:
A. PG – No, this stimulates renin secretion
B. Angiotensin II – Correct, negative feedback by A2 on renin release
C. Vasopressin – Correct, this inhibits renin secretion
D. Baroceptor stimulation – No, this would increase renin secretion

E. ANP

EM06 [cjlo] Secretion of renin is stimulated by:
A. Increased left atrial pressure – No
B. Increased angiotensin II – No, negative feedback
C. Decreased right atrial pressure – Yes if this sufficient to activate renal sympathetic nerves
D. ??erythropoietin – No

EM07 [ck] Regarding hyperglycaemia: Which of the following is untrue? It causes:
A. Increased H^+
B. Increased Na^+ (?K^+)
C. Increased urine output
D. Increased ECF (or blood volume)
E. Increased glucagon – No, decreased

EM08 [dgik] Mechanism of action of ADH:
A. Insertion of water channels (pores) into basolateral membrane – No, apical membrane
B. Increase in GFR – No, nil effect on afferent/efferent arterioles or GFR - (may have indirect effect when ADH from hypotension)
C. Insertion of water channels into luminal (apical) membrane – V2 receptors -> Adenalyl cyclase -> cAMP acting on vesicles containing Aquaporin-2 Channels (removed when cAMP levels fall)
C. Increased Na^+ uptake in DCT
D. Removal of water pores from apical membrane – No, this occurs when cAMP levels fall

Alt version: ADH and the cortical collecting ducts
A. Inserts water channels into the apical membrane – Correct
B. Inserts water channels into the basolateral membrane - Incorrect
C. Increases paracellular flow – No, the water flows down its osmotic gradient, THROUGH the cells, not between them

EM09 [d] How many hours after a meal is Basal Metabolic Rate (BMR) measured?
A. 1 hour
B. 2 hours
C. 6 hours
D. 12 hours – Usually about 12 hours post prandial
E. 18 hours (Note: Another response gave 4, 8, 12, 15 & 20 hrs as the options)

EM10 [di] Which ONE of the following is a water soluble vitamin?
A. Vitamin A
B. Vitamin B – Correct (also other B vitamins & vitamin C)
C. Vitamin D
D. Vitamin E
E. Vitamin K

EM11 [dhk] Insulin (? OR: Insulin receptor):
A. Receptor site intracellular – No, extracellular (2 alpha subunits), and the 2 beta subunits are intracellular
B. Inactivates tyrosine kinase – Insulin binds to receptor, triggering the tyrosine kinase activity of the beta subunits
C. Activates membrane glucose transport – probably most correct (it acts by fusing vesicles containing glucose transporters to the membrane)
D. Acts via activation of transport protein to increase glucose transport into cells – Doesn't strictly 'activate' the channel protein…

EM11b [mn] How does insulin act?
A. Voltage gated ion channels
B. Tyrosine kinase membrane receptor - Correct

C. Nuclear receptor
D. G protein
E. ?

EM12 [dl] Heat production at rest is mostly due to:
A. Skeletal muscle activity – Not really the 'most' correct
B. Na,K ATPase pump – Yes, accounts for about 30% of basal activity, most is actually for ATP synthesis
C. Dynamic action of food
D. ?

EM12b [i] Decreased heat production under general anaesthesia is due to:
A. Decreased skeletal muscle tone – Correct (as the question mentions 'decreased production' and 'GA')
B. Decreased anterior pituitary function
C. Vasodilatation
D. Starvation
E. Decreased Na^+/K^+ ATPase activity
Mar 2002 version:
Heat loss in anaesthesia due to
A. Loss Na/K ATPase (?)
B. Loss of skeletal muscle tone
C. Vasodilatation – Correct (the question has 'heat loss' in it)
D. Respiratory tract
E. ?

EM13 [dgj] Angiotensinogen secretion is increased by:
A. ACTH - Probably, glucocorticoids increase angiotensinogen secretion (Ganong, p439)
B. Beta-endorphin
C. Growth hormone
D. Antidiuretic hormone
E. Prolactin

EM14 [dl] The energy value of 1g of carbohydrate is:
A. 3 kcal
B. 4 kcal – 4.1kcal/g liberated from carbohydrate
C. 5 kcal
D. 7 kcal
E. 9 kcal

EM15 [el] Oxytocin causes:
A. Decrease in systolic blood pressure - Yes, most correct of the options…
B. Water intoxication – Not necessarily
C. Increase in cardiac output – Yes, but not directly (vasodilatation, reflex tachycardia and therefore increased CO)
D. Increase in systolic blood pressure – Not usually
E. All of the above
(see MD01)

EM16 [eg] ADH secretion:
A. Plasma osmolality at osmoreceptors in posterior hypothalamus – Yes, very sensitive (1-2% change) – location ??posterior (could be wrong)
B. Decreased ECF volume – Yes, hypovolaemia is not as sensitive, but is very potent cause of ADH secretion
C. ?

EM17 [e] The active section of the G-Protein is:
(No other details)

EM18 [fhk] G protein coupled receptors. All true EXCEPT:
A. Seven transmembrane components – yes
B. Hydrophobic links
C. Extracellular portion for phosphorylation – No, they are intracellular
D. G protein has intrinsic GTPase activity – Yes, the alpha-subunit has GTPase activity
E. The receptor is a heterotrimeric protein – No, the G protein is – the receptor is coupled to it…
(See also MD13 in Pharm MCQs)

Jul 99 version: G proteins include:
A. Multiple external phosphorylation sites
B. Alpha subunit has GTPase activity – true
C.
(Comment: *also remembered as ATPase activity. The intrinsic GTPase activity resides in the alpha sub-unit. The G protein is the heterotrimer not the GPCR*)

EM19 [f] Regarding the interthreshold range in temperature control:
A. Is constantly altered by feedback from temperature sensors in the periphery – Nope…
B. Is lowered by general anaesthetic agents – No the range is INCREASED by anaesthesia
C. ?
D.

EM19b [f] The set-point of temperature of an adult is normally 37.1C. This:
A. Is fixed in individuals – No, variation (SD2 – 95%) – 36.3-37.1 – and changes with diseases/drugs etc
B. ?
C. Parallels rectal temperature – Not if they are hypo/hyperthermic (no correlation with 'set point')
D. Decreases with exercise – No, unchanged
E. Decreases with anaesthesia – No, the set-point is unaltered but the interthreshold range in increased…

EM20 [fi] Decrease in set temperature in anaesthesia due to:
A. Decreased Na^+-K^+ ATPase activity
B. Decreased skeletal muscle activity
C. Vasodilatation
D. Starvation
?None of the above… if the question is SET temperature… (don't confuse set temperature with interthreshold range…)

EM21 [fgk] Endothelins:
A. Produced by damaged vascular endothelium - Correct
B. Vasoactive - Correct
C. Found in brain & intestine – Correct
D. ?
Ganong p576-577

EM22 [f] Growth hormone: See Q EM02
A. Increased lipolysis - Yes
B. Increased blood glucose - Yes
C. ?Source of energy?
D. ?
E. ?

EM23 [gj] A low respiratory quotient in a septic patient is due to:
A. Increased lactic acid
B. Fat metabolism – Correct, sepsis -> increased fat metabolism -> decreased RQ
C. Increased ventilation – No, this increases CO2 'output' and therefore increases RQ
D. Fever

E. Hypoxaemia

Jul 2000 version: Respiratory exchange ratio increased in septic patient because
A. Increased $C0_2$ output – No, this increases CO2 'output' and therefore increases RQ
B. Increased 0_2 uptake
C. Increased fat utilisation – Correct, sepsis -> increased fat metabolism -> **decreased** RQ
D. ?
(? respiratory *quotient*)

EM23b [o] Respiratory exchange ratio:
A. Always equals respiratory quotient – West says they're the same! Pfft…
B. Increases in strenuous exercise – Yes, may be as hight as 2
C. Decreases after payment of oxygen debt - Correct
D. ?

EM24 [i] Lactate
A. The way products of glucose enter the citric acid cycle – No, Pyruvate -> Acetyl-CoA enters TCA
B. Formation used to regenerate NADP – No, pyruvate -> lactate generates NAD+ from NADH (NADH isn't converted by oxidative phosphorylation *anaerobically* – not possible!)
C. ?

Alt version: Normal blood lactate level is 2 mmol/l. Where does this come from
A. Even in resting individuals there is some anaerobic metabolism – Lactate produced under normal conditions comes from overflow from glycolysis, not anaerobic metabolism -> it's then metabolised in the liver to glucose or TCA (Cori Cycle)
B. Lactate is the substrate that is produced to enter the citric acid cycle – No, Acetyl-CoA (from Pyruvate)

EM25 [j] Phosphorylase:
A. Is found in all human cells - no
B. Present in liver & muscle – Correct (and kidneys)
C. ?
D. *Something about glucagon & the liver* – (liver only) similar to below…
E. *Something about cAMP/adrenergic transmission – (in muscle & ?liver)* B2 receptor->adenylyl cyclase->cAMP->Protein Kinase A->Phosphorylase a->glycogenolysis

EM25 [jmno] Phosphorylase:
A. Is found in all human cells - No
B. Present in liver & muscle – Yes (and kidneys)
C. Increased activity by adrenaline – Correct – Beta-2 receptors on the liver
D. In liver increases glycogen production and reduce breakdown of glycogen - No
E. "*Something about cAMP/adrenergic transmission"*

The following MCQ fragment has also been submitted which looks like this question:
During starvation:
A. Glucagon causes increased phosphorylase activity in liver/muscle
B. Adrenaline causes increased phosphorylase activity in liver/muscle - Correct
C. ?

EM26 [hikl] Creatine phosphate:
A. Is a source of creatinine for protein synthesis.- it is not used for protein synthesis (most is excreted renally)
B. Is a source of cyclic AMP for second messenger systems – No, cAMP formed from ATP by adenylyl cyclase
C. Is a high energy phosphate source for muscle contraction. – Yes, but not directly (phosphorylcreatine), in muscle used as source of energy to replenish ATP (probably the most correct answer though)

D. Is a source of urea for loop of Henle gradient – No, urea is from NH4+ which is a byproduct of deamination of amino acids in the liver
E. Energy source for ADP production. – No, used for ATP production in muscle
(Q 54 Jul 01)
Previously versions which are considered to be the above question remembered differently :
Creatine phosphate is important in:
A. Readily usable phosphate for muscle upon intensive exercise – Yes, but not directly (see below)
B. Synthesis of urea – No (see above)
C. Supply of ATP – the primary process in muscle is that it supplies energy to replenish ATP, muscle doesn't take the energy directly from the Creatine-phosphate (Ganong, p286)
D. ?

?Creatinine ?Creatine
A. ?Phosphorylcreatine is synthesised in the liver – No, muscle
B. ?Phosphorylcreatine is excreted in the urine – No, needs to be converted to Creatinine
C. ?During exercise phosphorylcreatine reacts with ADP – Yes, it reacts with ADP to form ATP
D. ?
E. Rate of creatinine (?excretion/production) remains constant throughout life - No

EM27 [k] Metabolic rate is increased least with:
A. Exercise
B. Specific dynamic action of food
C. Hot climate
D. Cold climate
E. Increased CNS activity – Provided no significant impact on SNS

EM28 [k] Glucocorticoids
A. Increases RBC – Correct, increases erythrocyte count (Goodman & Gillman 10th Ed, p1661)
B. Increases lymphocytes – No, decreases (as well as eosinophils, monocytes, basophils)
C. ?
They also increase neutrophils

EM29 [l] ADH secretion is decreased by:
A. Morphine
B. Nicotine
C. Nausea (?and vomiting) – No, increases ADH (Stress Response)
D. Hypoxia (or: ACTH)
E. Alcohol – Correct (Ganong, p237)

EM30 [o] Calcitriol: Main actions on calcium by
A. Increased absorption of Ca^{++} and PO4 from gut – No, only Ca
B. Negative feedback on PTH - Correct
C. Increased absorption of vit D from gut – No, increased
D. ?

Neurophysiology

NU01 [al] The Nernst equation represents the potential at which:
A. Electrical neutrality exists
B. Concentration of ions on each side of membrane equal – No, this is why there is a Nernst potential in the first place
C. Potential at which there is no net movement of ions – possibly this answer (provided that there is a concentration difference and the ion is diffusible)
D. (?Balance of chemical & electrical forces?)
E. Both sides are equiosmolar

NU02 [g] Shivering that is ?mediated by the hypothalamus:
A. . . ? . . muscle spindle to increase tone – Correct. Increased Aγ contraction/tone
B. . . ? . . via red nucleus
C. . . ? . . rhythmic stimulation of anterior horn cells - No
D. Activation of shivering centre in brainstem
(see NU04)

NU03 [h] Transection of a motor nerve leads to:
A. ?Muscle fibre hypertrophy – No, atrophy
B. ?Increased/decreased RMP
C. ?Increased/decreased receptors
D. Increased spontaneous muscle activity – Yes, fasciculations

NU04 [j] The mechanism for shivering is via:
A. Anterior horn motor neurones set up oscillating signals to muscle. - ?via increased Aγ contraction/tone
B - E. ??

NU05 [j] The setpoint in temperature regulation control the body's response to changes in temperature. Location of sensory receptor which regulates the setpoint?
A. Anterior hypothalamus
B. Posterior hypothalamus - Correct
C. Spinal cord
D. Skin
E. Great veins

Alternative version:
The efferent limb of thermoregulation comes from
A. ?
B. ?
C. Anterior hypothalamus - Yes
D. Posterior hypothalamus - Yes
E. ?

NU06 [k] Chemoreceptor trigger zone:
A.Both D2 and 5-HT3 receptors – Yes
B. ?(something about motion sickness)
C. Stimuli from blood and CSF – No, circumventricular
D. ?
E. ?

NU07 [mn] ("*Question about Pain" ?details*)
A. Substance P acts on pain receptors – Yes, peripherally
B. Any peripheral stimuli can activate pain receptors – Yes, especially if neuralgia (I'd go with (A) given these options…)
C. Dull and sharp pain travel via the same fibres – No
D. ?
E. A delta & C fibres act on the same receptor – No

NU08 [m] Cerebrospinal fluid (CSF):
A. Production is 150 ml / day – No, 600ml/day
B. Volume is 50 ml – No, 150ml
C. Produced by choroidal blood vessels and ependymal cells - Correct
D. ?
E. ?

NU09 [o] Which ONE of the following is characteristic of type A nerve fibres:
A. Nociception
B. Slower conduction than C fibres
C. Myelinated – Yes, both A & B (C is unmyelinated)
D. Substance P
E. Sensory only

Physiology of Muscle & Neuromuscular Junction

MU01 [a] Characteristics of muscle action potential:
A. RMP -90 mV – Yes, although is this really answering the question (ie. Action potential)?
B. APD 2 to 4 msec – Yes, lasts for 2-4ms
C. ERP 1 to 3 msec – Yes (absolute refractory period) – Ganong, p65
D. Conduction velocity 0.25 to 0.5 m/sec – No, velocity is approx 5m/s
E. All of the above

MU02 [ad] During muscle contraction:
A. Myosin heads hydrolyse ATP – No, not alone… When actin & myosin bind (forming actinomyosin), then they hydrolise ATP and the myosin head swings. If the heads alone hydrolysed ATP, then they would do so under resting conditions!
B. Z-lines move together - Yes
C. Myosin cross-links & swivels 90 degrees – No, myosin doesn't 'cross-link' and the heads (when bound) swivel more than 90 degrees anyway
D. Interaction between actin & tropomyosin occur – No, tropomyosin is removed from the binding sites by the action of Troponin C binding with Ca++
E. Calcium passively passes into SR in relaxation – No, actively pumped into SR by Ca-Mg-ATPase pump, but then diffuses into the terminal cisterns

MU03 [a] Muscle spindle functions:
A. Increased gamma efferent tone smooths contraction - Correct
B. Increased alpha efferent tone smooths contraction
C. ?
D. ?

MU04 [d] To prevent clonus (oscillation) of the muscle spindle:
A. Increase in alpha-efferent discharge - Correct
B. Increase in gamma-efferent discharge
C. There is a delay in the circuit
D. Increased tone
E. All of the above
(Also remembered as: 'Clonus is more likely if:')

MU05 [dk] In skeletal muscle:
A. Relaxation is due to passive Ca^{++} uptake by sarcoplasmic reticulum – No, it is an ACTIVE process
B. Contraction is due to Ca^{++} release from T tubules – No, T tubules are only responsible for allowing rapid propagation of the AP deep within the myofibril
C. Contraction is due to Ca^{++} binding to tropomyosin – No, it binds to troponin C which releases tropomyosin from the myosin head binding sites…
D. Z lines move together in contraction - Yes
(See also MU09 & its variations as it seems there are 2 or more questions and the options seem to be a little jumbled)

MU06 [d] In smooth muscle:
A. Spontaneous pacemaker potentials are generated – Yes
B. An action potential is required for contraction – No, not REQUIRED
C. Ca^{++} is released from sarcoplasmic reticulum – Yes, but not the main source (mostly extracellular)
D. Multiple spiking action potentials occur with increased membrane potential – Yes

MU07 [efkl] Contraction in smooth muscle is different from skeletal muscle:
A. Source of Ca^{++} is different – Yes, most Ca++ comes from the ECF
B. Force is greater in ?smooth muscle ?skeletal muscle
C. Unable to produce same force of contraction – No, can be just as powerful if not more… think of labour!
D. Unable to maintain same duration of contraction – No, can have quite prolonged duration, despite no stimulus even…
E. Has prolonged latency – Yes, but A) *more* correct *sigh*

F. Sarcomere of skeletal muscle is > smooth muscle – Smooth Muscles don't have sarcomeres

MU08 [el] Force developed during isotonic contraction is:
A. Dependent on the load condition – Probably… I'm assuming this means at what length the muscle was at when it was loaded…
B. Independent of the load condition
C. Independent of muscle fibre length
D. ?

MU09 [f] Muscle :
A. The A band is dark because it contains thick actin filaments – No, thick MYOSIN filaments
B. Myosin filaments are attached to the Z line – No, actin is
C. Sarcomere is the area between 2 adjacent M lines – No, between 2 Z-Lines
D. ?

MU09b [hij] Isotonic contraction of a skeletal muscle fibre is not associated with a change in (? distance between):
A. Sarcomere length – No, there IS a change in sarcomere length
B. A bands – Correct, they don't change (this is essentially the myosin (thick) filament length within each sarcomere)
C. I bands – No, I bands span the Z line and consist of the NON-overlapping portions of actin. They shorten during contraction
D. Z-lines move closer together – No, they DO move closer together
E. M-lines move closer together – No, they DO move closer together (it is the Middle of the A band – ie myosin)

MU09c [k] During Isotonic contraction of a skeletal muscle fibre:
A. Calcium enters from the T tubular system near the myofibrils – Yes & No… the T system enables the rapid transmission of the AP to all myofibrils deep within the fibre (it is continuous with the sarcolemma – the muscle fibre cell membrane). It DOES let Ca into the cell which in turn activates the ryanodine receptor, which enables Ca influx from the SR…
B. ?
C. ?
D. Z-lines move closer together - Correct
E.

MU10 [fgk] Tetany does NOT occur in cardiac muscle because:
A. Long absolute refractory period – Correct (ends halfway through phase 3)
B. Acts as a syncytium – It does, but this is not the answer
C. Pacemaker signal can overcome any tetany - No
D. ?
E. ?

MU11 [g] Sarcomere:
A. From I line to I line – No, Z-Line to Z-Line
B. Actin filament attached to M line – No, this is where myosin filaments change their head polarity
C. ?
D. Z line crosses across myofibrils & from muscle fiber to muscle fiber – No, they within myofibrils only…
E. Smooth muscle cells are larger than skeletal muscle cells – No, skeletal muscle cells are large and multinucleated

MU12 [fghlo] The soleus muscle:
A. High glycogen stores – No, less than most muscles (as a %)
B. Few mitochondria – No, many mitochondria & plenty of myoglobin..
C. Large nerve fibre – Well it is an Aα fibre… … but they are SMALLER than slow twitch (see answer E)
D. Long duration of contraction – Correct, it is a slow twitch, therefore it can 'sustain contraction' for longer
E. Large muscle fibre (OR: Large muscle diameter) – No, the 'fibres' are SMALLER with slow twitch (size principle p76 Ganong)

F. High capacity for glycolysis – No, low levels of glycolytic enzymes
(Note: The soleus muscle has fatigue resistant (red) muscle fibres - and, in contrast, the gastrocnemius tends to have white muscle fibres - KB May 03)

MU13 [g] Skeletal muscle action potential:
A. Na & K conductance begin to increase at same time - Correct
B. Units of conductance are mA/cm3 – No, Ohm^{-1} (or *sieman* or *mho*!)
C. ?

MU14 [i] An increase in force of a skeletal muscle contraction is initially achieved by:
A. Recruitment of nerve fibres – Not quite correct
B. Recruitment of muscle fibres – Not quite correct
C. Recruitment of motor units – Correct (see Ganong p72)
D. Increased intracellular calcium – This has an effect (the Treppe phenomenon) but it is probably not the initial mechanism…
E. None of the above
Alt version:
A. Increased calcium release in contracting myocytes
B. Recruitment of myofibres
C. Recruitment of motor units – Correct
D. Increasing force of skeletal muscle contraction is due to

MU15 [i] In a large nerve fibre, the typical action potential duration is:
A. 0.03 millisecs
B. 0.3 millisecs
C. 3 millisecs – Correct (Ganong)
D. 30 millisecs
E. 300 millisecs

MU16 [j] The muscular contractions in skeletal muscle working at what level of efficiency?
A. 10%
B. 15%
C. 35%
D. 50% - Most correct… see below
E. 75%
Efficiency (work done/energy expended) ranges from 0% (isometric) to 50% (isotonic) – POORLY WORDED

MU17 [j] Annulospiral endings are involved in:
A. afferent to receptors measuring tension – really are afferents FROM the receptors (but they do measure tension, not length per se, despite that their function is to maintain muscle length…)
B. afferent to receptors measuring length
C. supply to intrafusal & extrafusal fibres – No Ia annulospiral endings are afferents to only the intrafusal fibres
D. ?

MU18 [k] Denervated muscle extrajunctional receptors differ from the motor end plate receptors…
A Have 1 alpha subunit – No, they have 2 alpha-1 subunits
B Open for shorter time – No, open for a longer time but lower conductance
C Not produced in the end plate - Correct
D. ?
E None of the above

MU19 [mno] *("question about energy source for muscles"*)
A. ?
B. ?
C. Skeletal muscle uses creatine, cardiac and smooth use ATP – No…
D. Skeletal and cardiac muscle uses creatine and smooth muscle uses ATP – No… not strictly (?the most

correct option)
E. All muscles utilise creatine - No

Alt version: An immediate available energy source in muscle is:
A. ATP in all 3 muscles – Correct. Phosphorylcreatine is converted to ATP in muscle
B. ATP in smooth, phosphorylcreatine in skeletal and cardiac muscle
C,D,E. (*"combinations of the above"*)

Maternal, Foetal & Neonatal Physiology

MF01 [a] The hyperventilation of pregnancy is due to:
A. Progesterone - Correct
B. Decreased resistance
C. ? D. ?

MF02 [a] Normal maternal ABG at term:
A. pH 7.36, pCO2 36 mmHg
B. pH 7.42, pCO2 36 mmHg
C. pH 7.44, pCO2 30 mmHg – Correct for CO2… but the pH probably would be 'more' normal after 9 months!…
D. ?
E. pH ? pCO2 ?

MF03 [cl] Closure of the ductus arteriosus occurs due to:
A. Prostaglandins – No, they maintain ductus patency (hence giving indomethacin to close the ductus)
B. Oxygen
C. Aortic pressure exceeds pulmonary artery pressure
D. Vascular smooth muscle contraction in the presence of oxygen - Correct
E. ?

MF04 [cfk] With regard to the foetal circulation:
A. ? Goes into the left atrium
B. Ductus venosus drains into the IVC directly - Correct
C. Oxygen saturation is 40% in umbilical vein – No, more like 80%
D. ?

Apr 2001: With regard to the foetal circulation:
A. Blood from SVC goes into the left atrium via the Ductus arteriosis – No..
B. Ductus venosus drains into the IVC directly - Correct
C. Oxygen saturation is 40% in umbilical vein – No, 80%
D. ?

Mar 02: In the foetal circulation:
A. Umbilical vein straight into IVC – Not directly
B. SVC blood to LA via foramen ovale – No, blood from the IVC (well oxygenated) follows this route
C. Only has foetal haemoglobin – No, but a very large % is
D. ?
E. ?
(see also MF09)

MF05 [di] Brown fat:
A. Produces ATP and Heat – No, it produces heat by NOT producing ATP (short circuited electron transport chain)
B. Insulates the great vessels of the neck
C. Is autonomically mediated – Correct (sympathetics)
D. Extramitochondrial uncoupling of oxidative phosphorylation – No, within the mitochondria

MF06 [d] Highest O2 saturation in the foetal circulation is in:
A. Thoracic IVC – Correct (67%)
B. Right atrium – Not really, blood mixed
C. Ascending aorta – No, some blood from the right atrium will have mixed with it
D. Pulmonary vein – No
E. Ductus arteriosus – No, this blood has come from the SVC -> RV -> Ductus
Highest is the ductus venosus

MF06b [o] With regard to fetal circulation:
A. Fetal umbilical vein has higher PO2 than maternal vein - No
B. Fetal umbilical vein has higher PO2 than fetal umbilical artery - Yes
C. ?

MF07 [e] Which of the following is immediately due to onset of ventilation in the newly born?
A. Increased left atrial pressure - No
B. Closure of ductus venosus - No
C. Decreased RV pressure – Yes
D. ?

MF07b [f] Which effect is due to spontaneous ventilation in neonate? (Or: The first breath in a neonate has a predominant role in:)
A. Decreasing RV outflow pressure – Yes
B. Closure of ductus venosus
C. Closure of foramen ovale
D. Increased systemic vascular resistance
E. Increased LV pressure

MF08 [gi] FRC in the neonate:
A. 1 ml/kg
B. 15 ml/kg
C. 30 ml/kg – Yes
D. 70 ml/kg

MF09 [g] Foetal circulation:
A. Inferior vena cava blood has high pO2 because of ductus venosus – Yes
B. Inferior vena cava blood enters the head via ductus arteriosus – No
C. ?

MF10 [h] The reason for increased aortic pressure after birth:
A. Removal of placental circulation – Yes
B. Duct closure – No
C. Increased pulmonary flow – No
D. ?

MF11 [i] Tidal volume of a neonate:
A. 1 ml/kg
B. 3 mls/kg
C. 7 mls/kg – Yes
D. 15 mls/kg
E. 30 mls/kg

MF11b [j] Tidal volume in a 2.3kg neonate:
A. ?
B. 10ml
C. 15ml – Yes
D. 30ml
E. ?

MF11c [j] The FVC of a neonate weighing 2.3 kg is:
A. 100 ml
B. 150 ml – Yes (67ml/kg – same as adult values)
C. 200 ml
D. 250 ml
E. 300 ml

MF12 The neonate has
A. Less plasma cholinesterase – Yes
B. Higher volume of distribution for neuromuscular blockers – Yes, greater TBW and greater % ECF
C. Higher levels of alpha-1 acid glycoprotein – No, lower
D. High levels of cytochrome P450 enzymes – No, lower

MF13 [j] Maternal-fetal ABO incompatibility is less common than Rhesus incompatibility because:
A. Fetal antibodies to ABO are less developed
B. Maternal ABO antibodies do not cross the placenta - Correct
C. Maternal ABO antigens do not cross the placenta
D. Fetal ABO antigens are less immunogenic
Alternative recalled options:
B: Maternal Ab's rarely cross placenta - Correct
C: Foetal RBC's rarely enter circulation
D: Foetus have immature ? Ab's/Ag's
E: Foetus have absent ?Ab's/Ag's

MF14 [k] With regard to the neonate
A. Static compliance is greater than adult values
B. Dynamic compliance is greater than adult values
C. Specific compliance is the same as adult values - Correct
D. Dynamic compliance is the same as adult values
E. Static compliance is the same as adult values.

Alt version: Comparing the neonate to adult lung
A Dynamic compliance of the lung is less in the neonate
B Static compliance of the chest wall is more in the neonate
C Specific static compliance is about the same - Correct
D. ?
E. ?

MF15 [l] (. .??. . paO2 in maternal uterine blood. . .) but foetus can maintain adequate O_2 because:
A. Large placental surface area
B. Double Haldane effect
C. Foetal haemoglobin - Correct
D. ?
E. ?

MF16 [m] ("*Given a normal set of maternal blood gases at term, asked to comment on results"*)
A. Metabolic alkalosis, abnormal - something wrong going on
B. ?
C. Abnormal ABGs, expect lower bicarb (in gas is about 22)
D. Metabolic alkalosis, normal for pregnant/term mother – Correct ☺
E. ?

MF17 [m] Foetal haemoglobin:
A. All is in the form of HbF – No, not all of it
B. HbO2 dissociation curve is shifted to the left – Correct, due to the decreased affinity for 2,3-DPG of HbF
C. ?
D. ?
E. ?

MF18 [o] The thermoneutral zone is:
A-E. ("Various definitions")

Clinical Measurement

CM01 [ack] As ambient temperature increases, heat loss increases by:
A. Radiation
B. Convection
C. Conduction
D. Evaporation – Most likely, but depends on relative humidity
E. None of the above (Also remembered as: "In hot climates, most heat is lost by:")
Alt wording: "As ambient temperature increases above body temperature, the greatest % heat is lost by:")

CM02 [af] All are ways of measuring O_2 in a gas mixture EXCEPT:
A. Paramagnetic analyser - Yes
B. Clark electrode - Yes
C. Infrared absorption – No
D. Mass spectroscopy – Yes
E. None of the above

CM03 [aefhk] With regard to oxygen:
A. The only gas that can reignite a glowing splint – No, Nitrous oxide can do the same (it supports combustion)
B. Causes pulmonary (?oxygen toxicity/?hypertension) at less than 100 kPa – No
C. Some CNS toxicity occurs at 100 kPa (? or: < 100kPa) – No
D. Medical grade is 95% pure – No, medical grade is 99.5% pure (according to BOC gases)
E. Produced commercially by hydrolysis of water – No, it is produced by liquefaction of atmospheric air and separation of the oxygen by fractionation. Very little is produced by hydrolysis of water
F. May result in the reduction of alveolar lung volume if given at an FIO2 of 1.0 – Yes, absorption atelectasis

CM04 [cdhl] A naked 70kg man in a theatre at 20C will lose most heat by:
A. Conduction to air molecules next to the patient – Probably, given the flow rates of some of the airconditioners….
B. Conduction to the table
C. Radiation to OT equipment and walls – Most correct
D. Convection
E. None of the above

CM05 [ci] A pulse oximetry reading is underestimated by:
A. Methaemoglobinaemia – Correct (reading approaches 85% as the Red & Infrared absorption levels are the same for MetHb – hence the R value approaches 1)
B. Carboxyhaemoglobinaemia
C. Foetal haemoglobin
D. Sickle cell anaemia
Also remembered as:
[i] Normal two-wavelength pulse oximetry will underestimate oxygen saturation in the presence of:
A. Methaemoglobinaemia – Correct (reading approaches 85% as the Red & Infrared absorption levels are the same for MetHb – hence the R value approaches 1)
B. Carboxyhaemoglobinaemia
C. Hyperbilirubinaemia
D. Haemoglobin F
E. Haemoglobin S

CM06 [c] With respect to one mole each of CO_2 and N_2O, which is untrue?
A. Same weight - Correct
B. Same density – Almost correct (see D)
C. Same viscosity - No
D. Same volume at STP – This is almost correct… (the universal gas equation – but this is for an IDEAL gas)
(Note: Both have MW of 44, so one mole of each will weigh 44G)

CM07 [dh] Remains constant with adiabatic expansion of a gas (which is not possible in reality):

A. Density – No, it will decrease
B. Pressure – No, it decreases
C. Volume – No. This is given in the question – adiabatic EXPANSION – although it can technically be done with vacuums without a volume change
D. Temperature – No, it decreases (but HEAT is constant)
E. None of the above – Correct

- When a gas expands, it does work (opposite of work done on it) -W so the work done on it is negative and therefore the internal energy decreases therefore temperature decreases.
- When a gas expands adiabatically, no heat is supplied to it so energy to do work is taken from its internal energy. Ie. HEAT is the same
- A perfectly adiabatic expansion is not actually possible. But a change is almost adiabatic when the gas is in a container which has bad conducting walls. Example of an adiabatic expansion is the escape of air when a tyre bursts.

CM08 [dh] At an altitude of 5,500m (barometric pressure 380mmHg), assuming a normal pCO2 of 40mmHg, pAO2 will be:
A. 20mmHg – Correct, and arterial pO2 will be even lower…
B. 30mmHg
C. 40mmHg
D. 50mmHg
E. 60mmHg
(see also RE29)
PAO2= (FIO2 * (Pb – Pwater)) – PCO2 / 0.8
= (0.21*(380-47) – (40 / 0.8)
= 69.93 – 50 = 19.93mmHg

CM09 [d] According to the Hagen-Pouseille Law:
A. Flow varies inversely with resistance – Correct, provided that the flow is laminar
B. Viscosity varies inversely with length
C. ?

CM10 [d] Turbulence is more likely with:
A. Small tube diameter – No, less likely
B. High density fluid - Yes
C. ?Increased/decreased length of tube – No, length of the tube is irrelevent
D. ?Increased/decreased viscosity – If you decrease viscosity, turbulence is more likely
E. None of the above
$R=\rho dv/\eta$

CM11 [dfh] Pneumotachograph
A. Can be used to measure peak airflow – Correct, if designed for those flow rates…
B. Measures velocity and not flow (??accurate in turbulent & laminar flow)
C. Is accurate at all flow rates
D. Variable orifice flowmeter
E. Can be used to measure volume – Correct, need to integrate flow over time… ? (A) more correct
F. Unaffected by temperature

CM12 [fhi] Cardiac output measurement is most accurate with which method?
A. Direct Fick – Probably…
B. Radionuclide angiocardiography – Who knows…
C. Gated pooling – Could be…
D. LV angiogram – No… obviouisly
E. Transthoracic echocardiography – No, there are much more accurate methods
F. Thermodilution
(See also CM16)

Mar 02 version: Cardiac Output is best measured by:
A. Direct Fick
B. Gated radionuclear
C. Echocardiography
D. ?
E. ?

CM13 [f] Impedance:
A. Increases as the frequency of an AC current increases across a capacitor – No, decreases
B. Decreases as the frequency of an AC current increases across an inductor – No, increases
C. Is constant across a resistor – Correct
D. All of the above
E. None of the above

CM13b *Also remembered as:*
As the frequency of an alternating current increases:
A. Impedance increases in a resistor – No, no change
B. Impedance increases in a capacitor – No
C. Impedance increases in an inductor - Correct
D. All of the above
E. None of the above

CM13c [g] Impedance as AC frequency increases:
A. In a resistor - no change - Correct
B. In a capacitance - increases
C. In an inductor - decreases
D. All of the above
E. None of the above

CM14 [f] Oxygen manufacture:
A. Hydrolysis of water – Not for medical use but it *can* be!
B. ?? 95% pure – No
C. ?
By fractional distillation of air… and is 99.5% pure according to BOC gases (www.boc.com.au)

CM15 [f] According to Fick's law, diffusion is related:
A. Directly to thickness
B. Inversely to concentration gradient
C. Inversely to surface area
D. Inversely thickness - Correct

CM16 [gi] Stroke volume is most accurately measured with:
A. Thermodilution – Possibly, but doesn't take into account stroke volume that may not exit through the aortic valve…
B. Thoracic bioimpedance
C. Doppler
D. Electromagneto-. . ? . .
E. Echocardiography – Probably, and loss of volume through incompetent mitral valves may be evident…?

CM17 [gk] When indocyanine green is used to measure hepatic blood flow, levels are taken from:
A. Hepatic vein & portal vein
B. Hepatic artery & portal vein
C. Radial artery & ?hepatic vein – Most correct
D. Hepatic artery & hepatic vein
E. Radial artery & right atrium

CM18 [fj] Specific heat capacity of which of the following is the highest?
A. Stored whole blood – No, 85% of (D) (3.5 kJ/kg/K)
B. Red blood cells – No, 85% of (D) (3.5 kJ/kg/K)
C. Muscle tissue – No, 85% of (D) (3.5 kJ/kg/K)
D. Water – Correct (4.2 kJ/kg/K)
E. Air
July 00 version: The specific heat capacity is greatest in:
A. Packed red blood cells – No, 85% of (D) (3.5 kJ/kg/K)
B. Whole blood – No, 85% of (D) (3.5 kJ/kg/K)
C. Water – Correct (4.2 kJ/kg/K)
D. Saline?

CM19 [h] [Graph]
Is this:
A. Washin curve
B. Washout curve
C. $y = 10 + 2x^2$
D. $y = 10 + 0.2\ (1/x^2)$
E. Linear regression

CM20 [hk] Solubility of gases in blood (?at 37C):
A. $O_2 > CO_2 > N_2$ – No
B. $N_2O > CO_2$ – No
C. $CO_2 > N_2 > O_2$ – No
D. . . (etc)
E. $N_20 < O_2$) – No

Apr 2001 version: Regarding the solubility of gases in PLASMA
A Nitrous oxide is less soluble than carbon dioxide – Correct (see below)
B Carbon dioxide is less soluble than oxygen – No
C Carbon dioxide is less soluble than Nitrogen – No
D Nitrous oxide is less soluble than oxygen – No
E Nitrous oxide is less soluble than Nitrogen – No
F Oxygen is less soluble than Nitrogen – No
Nunn 209: relative to O_2
in water, CO_2 (24) > N_2O (16) > NO (1.7) > O_2 (1) > CO (0.75) > N_2 (0.5) > He (0.4)
Therefore Solubility = $CO_2 > N_2O > O_2 > N_2$

Interestingly though $\lambda_{B:G}$ = 0.03 - 0.45 - 0.003 - 0.015 (for CO_2 - N_2O - O_2 - N_2 respectively)

CM21 Renumbered as a version of CM05

CM22 [j] In a patient with pulmonary obstruction addition of helium to the inspired mixture:
A. Density is not altered – No, it is decreased
B. Flammability of mixture is increased – No, it is either no different or decreased… (still need a FUEL source)
C. Viscosity is minimally altered - Correct
D. Rotameter would not need to be recalibrated – Possibly, but it would depend on where in the circuit the helium is added…
E. Decreased O_2 transfer – No
F. Solubility of oxygen is decreased – No change

CM23 [j] For washout curve described by ?? $y = y_0 \cdot e^{-k\,T/\tau}$
A. After 2 time constants 13.5% remains – Correct
B. 50% of substance remaining after 1 time constant
C. After 6 times constants y = e
D. After 2 half lives 90% has been removed

$$C_{(t)} = C_{(0)}.e^{-k_{el}.t} = C_{(0)}.e^{-\frac{\ln 2.t}{t_{1/2}}} = C_{(0)}.e^{-\frac{t}{\tau}}$$

$$C_{(2\tau)} = C_{(0)}.e^{-\frac{2\tau}{\tau}} = C_{(0)}.e^{-2} = C_{(0)} \times 0.135$$

E. After 1 half life 37% remains

CM24 [j] Hagen-Poiseuille relationship:
A. ?? laminar flow – Correct, It's to do with laminar flow "The pressure loss caused by the laminar internal flow of a fluid through a tube is directly proportional to the flow's velocity" This is the method by which LFE (laminar flow elements) can accurately measure flow rates of a gas through a tube
B. ?? turbulent flow
C. ?

CM25 [k] Pulmonary artery catheter can be used for:
A. PCWP > LAP
B. Aplying Fick's principle, can be used to measure cardiac output
C. ?
D. ?
E. ?

CM26 [l] An apparatus whereby an external voltage is applied to a silver/silver chloride anode and a platinum cathode would be best used to measure
A. Oxygen content
B. Oxygen partial pressure – Yes, this is a Clarke electrode (the anode electrolyte is actually KCl… but it does produce AgCl during the reaction)
C. Carbon dioxide content
D. Carbon dioxide partial pressure
E. pH – No, this is with a glass (Ag/AgCl) electrode & a calomel (Hg_2/Hg_2Cl_2) electrode
(Q50 Jul 01)

CM27 [l] For laminar flow:
A. Decreased by increased pressure – No, increased
B. Influenced by viscosity – Yes, increasing viscosity decreases flow rate
C. Influenced by density – No, this is for turbulent flow
D. Proprtional to length to 4th power – No, it's proportional to the radius to the 4th power
E. ?

$$Q = \frac{\Delta P.\pi.r^4}{8.\eta.l}$$

CM28 [l] Carbon dioxide dissolved in blood follows which law?
A. Charles law – No, "at a constant pressure, the volume of a sample of gas is directly proportional to the temperature of the gas."
B. Avogadro's law – No, "the volume of a gas at a given temperature and pressure, is directly proportional to the quantity of gas. Thus, V is proportional to n, the number of moles of the gas"
C. Henry's law – Yes – "at equilibrium, at a given temperature, the amount of gas dissolved in a given volume of liquid is directly proportional to the partial pressure of that gas in the gas phase (this only holds for gases that do not react chemically with the solvent)."
D. Dalton's law – No, "Each gas in a mixture of gases exerts a pressure proportionate to the percentage of the gas and independent of the presence of the other gases present"
E. Boyles law – No, "This law states that the volume of a sample of gas is, at a constant temperature, inversely proportional to the pressure of that gas"

CM29 [l] Electroencephalogram (EEG):
A. Reticular activating system
B. Limbic system
C. Thalamus
D. Cortex – Correct (largest ionic fluxes, and closest to detectors)
E. ?

☺☺ To contribute, send your questions to: **kbrandis@bigpond.net.au** ☺☺☺☺☺☺☺☺☺☺☺☺☺☺☺☺☺☺

MCQ-25(7/01)
During increased intrathoracic pressure of a valsalva manoeuvre

a. diastolic filling of the rights ventricle is decreased
b. arterial baroreceptor activation produces bradycardia
c. increased venous pressure augments cardiac output
d. total peripheral resistance is decreased
e. arterial blood pressure initially decreases

MCQ-24(7/01)
Guanethidine
a. acts primarily at?/on? the CNS
b. produces anti-hypertensive effect primarily by presynaptically inhibiting release of noradrenaline
c. highly lipid soluble
d. mental depression is a troublesome side effect
e. orthostatic hypotension is not a prominent side effect

MCQ-25 (7/01)
Concerning the effects of various volatile agents on cerebral blood flow under conditions of 1 MAC and normocarbia
a. Halothane produces greater increase than enflurane - Correct
b. Isoflurane produces greater increase than enflurane
c. Any change produced depends upon cerebral metabolic rate
d. Change in CBF is due to change in cardiac output
e. Sorry forgot to write down "e"

CM30 [no] Which ONE of the following does NOT utilise change in electrical resistance (wording?)
A.. "*something about wire*"
B. Strain gauge - A device for determining the amount of strain (change in dimensions) when a stress is applied – it is a resistor whose resistance changes as a function of the 'deformation'
C. Katharometer - an instrument used for the analysis of gases by measurement of thermal conductivity
D. Bourdon gauge - A pressure gage consisting of a tube bent into an arc which straightens out under internal pressure actuating a pointer on a scale.
E. Thermocouple - a kind of thermometer consisting of two wires of different metals that are joined at one end; a potential difference (voltage) is generated between the other two ends which changes as the temperature of the joined end is altered…

CM31 [o] Surface tension:
A. ? (*No other details*)