FRCA primary onexamination 4

1) A 20-year-old male has sustained 15% body surface area burns in a house fire. In these circumstances, which of the following is/are true?

True / False

◉	○	Colloid is the principal agent used for fluid resuscitation in the Mount Vernon Formula ✓Correct
○	◉	Convulsions and coma may be expected with a carboxyhaemoglobin concentration of 30% ✓Correct
○	◉	Each leg represents 9% of the body surface area ✓Correct
◉	○	Hydration may be managed by oral fluids alone ✓Correct
○	◉	When given 100% oxygen the half life of carboxyhaemoglobin falls to 4 hours ✓Correct

The rule of '9s' is used to approximate the body surface area (BSA) burnt.

For adults

- The head is 9%
- Arms 9% each
- Legs 18% each (not 9%)
- Trunk 18% front and
- 18% back, and finally
- The perineum 1%.

Adults can compensate with oral fluids for up to a 15% burn but children can only compensate for a burn below 10%.

The Mount Vernon formula uses colloid at 0.5 ml per Kg x % BSA of burn every four hours for the first 12 hours following injury, then every six hours for the next 12 hours.

Carbon monoxide poisoning is common in fires within enclosed spaces. Symptoms range from a throbbing headache, nausea and vomiting with 10-30% carboxyhaemoglobin to convulsions, coma and cardiac arrest with more than 60% carboxyhaemoglobin (not 30%).

Treatment of carbon monoxide poisoning is with high inspired concentrations of oxygen. The half life of carboxyhaemoglobin is four hours but this falls to 30 minutes (not four hours) when breathing 100% oxygen.

2) Which of the following is/are true/false regarding phenothiazines?

True / False

○	◉	Act as alpha adrenergic receptor agonists ✓Correct
◉	○	Act at the chemoreceptor trigger zone ✓Correct
◉	○	Have antihistamine effects ✓Correct
◉	○	May cause hypothermia ✓Correct
◉	○	Potentiate the effects of opioids ✓Correct

Phenothiazines are a group of drugs used as sedatives and antipsychotic drugs, for example, chlorpromazine and promethazine, etc.

They have numerous other properties including

- Antiemetic
- Antimuscarinic
- Antihistamine
- Antidopaminergic and
- Alpha adrenergic receptor antagonist properties (not alpha agonist).

Some drugs may potentiate the effects of opioid analgesic drugs. They can impair central temperature regulatory mechanisms, shivering and peripheral vasoconstriction, and patients may therefore become hypothermic.

They are antagonists at dopamine receptors in the chemoreceptor trigger zone (CTZ) and therefore have antiemetic actions.

3) Do complications of blood transfusion include the following?

True / False

●	○	Alkalosis ✓Correct
●	○	Haemolytic reactions ✓Correct
●	○	Haemosiderosis ✓Correct
○	●	Hypercalcaemia ✓Correct
●	○	Thrombocytopenia ✓Correct

Complications following blood transfusions can be early or late and may be classified as follows

- Immunological
- Infective
- Metabolic and
- Volume effects.

Haemolytic reactions may be early or late, for example, ABO incompatibility.

Haemosiderosis is a complication of iron overload secondary to chronic blood transfusions.

Consumption or dilution of clotting factors and platelets and disseminated intravascular coagulation (DIC) are also recognised complications.

An alkalosis may follow the metabolism of citrate (found in stored blood) to bicarbonate, but an acidosis is uncommon.

Hypocalcaemia (not hypercalcaemia) can be seen with rapid blood transfusions which may require intravenous calcium therapy.

4) Regarding pituitary hormones, which of the following is/are true?

True / False

○	●	Act via receptors found within the cell nucleus ✓Correct
○	●	Adrenocorticotrophic hormone (ACTH), growth hormone (GH) and prolactin are glycoproteins ✓Correct
●	○	Are used in the treatment of prostate cancer ✓Correct
○	●	They are structurally similar to steroid hormones ✓Correct
●	○	They also have paracrine effects ✓Correct

The hypothalamic and some pituitary hormones are typical examples of peptide hormones.

They are chains of amino acids or peptides and are structurally dissimilar to the steroid derived hormones. Unlike the steroids, the majority of peptide hormones are lipophobic and interact with cell surface receptors. These peptides have autocrine, paracrine as well as endocrine effects.

Adrenocorticotrophic hormone (ACTH), growth hormone (GH) and prolactin are simple polypeptides or proteins, whereas thyroid stimulating hormone (TSH), luteinising hormone (LH) and follicle stimulating hormone (FSH) are glycoproteins.

Luteinising hormone releasing hormone (LHRH) analogues are a well established treatment for prostate cancer.

Peptide hormones can be synthesised using DNA techniques, for example, LH, FSH and growth hormone releasing hormone (GHRH).

5) Which of the following statements is/are true regarding intestinal carbohydrate handling?

True / False

◉	○	Brush border disaccharidase activity is required for the breakdown of sucrose ✓Correct
◉	○	Dietary starch undergoes luminal hydrolysis by pancreatic amylase prior to the release of glucose ✓Correct
○	◉	Glucose absorption is a passive process ✓Correct
◉	○	Glucose absorption shares a common carrier with galactose ✓Correct
◉	○	The absorption of glucose is sodium dependent ✓Correct

Glucose absorption from the gastrointestinal tract is an active process and is dependent on sodium transporters.

Glucose absorption also shares a common carrier with galactose.

All carbohydrates are broken down into their constituent monosaccharides or disaccharides.

Dietary starch undergoes luminal hydrolysis by pancreatic amylase prior to the release of glucose and in the case of sucrose, two glucose molecules by sucrase, which is a disaccharidase found on the brush border.

6) Do alterations in pulmonary function during a moderate asthma attack include the following?

True / False

◉	○	Decreased forced expiratory volume in 1 sec (FEV1) ✓Correct
○	◉	Decreased functional residual capacity (FRC) ✓Correct
○	◉	Increased arterial pO_2 ✓Correct
○	◉	Increased arterial pCO_2 ✓Correct
○	◉	Raised serum bicarbonate concentration ✓Correct

In mild to moderate asthma attacks the arterial pCO_2may decrease. With increasing severity the pCO_2 returns to normal and in severe asthma attacks it may be increased.

With airways obstruction the functional residual capacity increases (not decreases).

The serum bicarbonate concentration would not be raised in moderately severe asthma but it could be in a life-threatening attack for the same reasons as the arterial PCO_2 increases.

The forced expiratory volume in 1 sec (FEV1) is a good indication of airway obstruction.

Do not be confused with chronic obstructive pulmonary disease (COPD) where reduced FEV1 is normally mentioned. It measures airways obstruction and is reduced in acute asthma.

The arterial pO_2 is usually normal in a moderate attack but may decrease during a severe asthma attack.

If a pneumothorax occurs then the fall in arterial PO_2 may be greater.

7) In a clinical trial comparing a new analgesic drug with a placebo, a higher proportion of patients taking the new analgesic drug obtained superior pain relief ($p<0.05$).

Therefore, are the following true?

True / False

○	●	Amongst 100 patients treated with the drug five would be expected to have a placebo response ✓Correct
○	●	The probable error of the observations is +/- 5% ✓Correct
●	○	The result may have occurred by chance alone in less than one in 20 occasions ✓Correct
●	○	The result should be regarded as reaching conventional levels of statistical significance ✓Correct
○	●	The trial was well designed ✓Correct

It is not possible to say confidently that this drug trial was well designed without further information about the study and its conduct.

The placebo effect is often higher than 5%, with rates between 20 - 30% being common.

The result may indeed have occurred by chance alone in less than one in 20 occasions. This is the meaning of the 'p value', where a 0.05 is equal to 1/20.

Standard error is derived from the variance and 'probable error' is a fictitious term.

A p value of less than 0.05 is the conventional level of statistical significance, thus the results should be regarded as reaching conventional levels of statistical significance.

8) In the oesophagus, which of the following statements is/are true?

True / False

●	○	Spontaneous and provoked contractions may be used to indicate brainstem death ✓Correct
●	○	Stratified squamous epithelium is usually down to the level of the diaphragm ✓Correct
●	○	Striated muscle ends at the junction of the upper and middle third ✓Correct
●	○	The lower end is anchored by the phreno-oesophageal ligament ✓Correct
○	●	Typical pressures in the lower oesophagus during contractions are approximately 50 mmHg ✓Correct

The oesophagus is composed of striated muscle (upper) and smooth muscle (lower) with a mixture of the two in the middle. Thus striated muscle does end at the junction of the upper and middle third.

Stratified squamous epithelium lines the oesophagus usually down to the level of the diaphragm.

The lower end of the oesophagus is anchored by the phreno-oesophageal ligament.

Manometric measurements can show pressures as high as 500 mmHg within the oesophagus, but are more commonly approximately 100 mmHg.

The disappearance of spontaneous contractions and a low amplitude provoked contractions have been used to indicate brainstem death. It is not used in the United Kingdom criteria.

9) Which of the following statements is/are true/false regarding patent ductus arteriosus?

True / False

◉	○	Causes a wide pulse pressure. ✓Correct
○	◉	Closure of the duct may be achieved using an alprostadil infusion. ✓Correct
◉	○	Is commonly encountered in very low birthweight infants. ✓Correct
○	◉	May present with cyanosis. ✓Correct
○	◉	Should be suspected when the femoral pulses are weak or impalpable. ✓Correct

An infusion of alprostadil is used to maintain ductal patency, whereas drugs that inhibit cyclo-oxygenase will cause closure of the duct.

Patent ductus arteriosus (PDA) is frequent in very low birthweight and premature babies and causes a wide pulse pressure.

Cyanosis would occur if the shunt reverses.

Weak femoral pulses suggest aortic coarctation.

10) Which of the following statements is/are true concerning halothane?

True / False

○	◉	Increases the cardiac output ✓Correct
○	◉	Is anti-arrhythmic ✓Correct
◉	○	Is associated with hepatitis ✓Correct
○	◉	Produces an atropine resistant bradycardia ✓Correct
◉	○	Reduces portal vein blood flow ✓Correct

Halothane is a potent inhalational anaesthetic agent but is a weak analgesic.

It is negatively inotropic and produces an atropine sensitive bradycardia.

Halothane causes a reduction in portal vein blood flow, but unlike other inhalational agents, it does not cause a compensatory increase in hepatic artery blood flow, which therefore reduces hepatic oxygen delivery.

There is an increased risk of arrhythmias particularly in association with hypercapnia, which may be exacerbated by the increased sensitivity of the myocardium to catecholamines.

It is also rarely associated with a fulminant hepatitis which tends to be more prevalent in patients who have had multiple exposures to halothane.

11) Which of the following is/are true regarding carbon dioxide?

True / False

●	○	Has a boiling point of -79°C ✓Correct
○	●	Has a critical temperature of -31°C ✓Correct
●	○	Has a dissociation curve that is more linear than the oxygen dissociation curve ✓Correct
●	○	Is manufactured by heating calcium carbonate ✓Correct
●	○	Is more dense than air ✓Correct

Carbon dioxide is a gas at room temperature.

It is produced by the oxidation of carbon-containing substances or by heating calcium (or magnesium) carbonate. Its density at 298K is 1.98 kg/m^3, about 1.5 times that of air.

The carbon dioxide molecule (O=C=O) contains two double bonds and has a linear shape. It has no electrical dipole.

As it is fully oxidized, it is not very reactive and in particular not flammable.

It has a boiling point of -79°C and a critical temperature of 31.2°C (not minus 31°C). At temperatures below -78°C, carbon dioxide condenses into a white solid called dry ice.

Liquid carbon dioxide forms only at pressures above 5.1 atm; at atmospheric pressure, it passes directly between the gaseous and solid phases at in a process called sublimation.

The carbon dioxide dissociation curve is steeper and more linear than the oxygen dissociation curve.

12) In a normal pregnancy do the following changes occur in the composition of blood and haemostatic function?

True / False

●	○	A neutrophil leucocytosis ✓Correct
○	●	Fibrinolysis is inhibited ✓Correct
○	●	The concentration of factors II, V and X is increased ✓Correct
●	○	The platelet count is decreased ✓Correct
○	●	The viscosity of blood is increased ✓Correct

The haematological changes associated with a normal pregnancy are as follows

- A 30-50% increase in blood volume
- A 30-40% increase in plasma volume
- A 20-30% increase in erythrocytes and leucocytes
- A lowered platelet count
- An increase in coagulation factors I (fibrinogen), VII, VIII, IX, X, and XII thus increasing coagulability (not factors II and V)
- Fibrinolysis was previously thought to be inhibited though recent research suggests that fibrinolysis is increased and
- A reduced haematocrit and viscosity (not increased).

13) Which of the following is/are true concerning the pH electrode?

- **True / False**

◉	○	A semi-permeable membrane reduces protein contamination. ✓Correct
○	◉	Only the reference electrode needs to be kept at 37°C. ✓Correct
○	◉	Produces a non-linear output of 60 millivolts per unit pH. ✓Correct
◉	○	The glass measuring electrode is made of silver/silver chloride. ✓Correct
○	◉	The reference electrode contains a saturated potassium hydroxide solution. ✓Correct

- The measurement of the pH is performed using a glass pH electrode which responds to hydrogen ions (H+ ions) rather than oxygen or carbon dioxide.
- The glass electrode (measuring electrode) is a bulb made of pH sensitive glass holding a silver/silver chloride electrode in a buffer solution. The potential difference across the glass bulb depends on the pH difference between the inside and outside.
- The reference electrode (mercury/mercury chloride) is in contact with a potassium chloride solution (not hydroxide) via a membrane. This semi-permeable membrane reduces protein contamination from the sample.
- The blood sample (urine or cerebrospinal fluid) and the buffer are separated by the H^+ ion sensitive glass. The buffer maintains a constant pH within the glass, but a gradient exists between the sample and the buffer solution, which gives a potential difference.
- Thus one electrode is in contact with the buffer the other is in contact with the sample. The two electrodes create a circuit and the potential difference can be measured and displayed on a meter.
- Both the glass and reference electrodes (not just the reference electrode) are maintained at 37°C.
- It produces a linear electrical output (not non-linear) of about 60 millivolts per unit pH.

14) Do hormones synthesised by the kidney include the following?

True / False

◉	○	1,25 dihydroxycholecalciferol ✓Correct
○	◉	Aldosterone ✓Correct
○	◉	Angiotensin I ✓Correct
○	◉	Angiotensin II ✓Correct
◉	○	Erythropoietin ✓Correct

- The kidney is responsible for the manufacture of renin which acts on the circulating peptide angiotensinogen to convert it to angiotensin I which is then further cleaved in the lungs to angiotensin II. This acts on the adrenal cortex to release aldosterone.
- The kidney also manufactures 1,25 dihydroxyvitamin D hence hypocalcaemia occurs in chronic renal failure and the kidney is also responsible for the synthesis of erythropoietin.

15) May the following occur in uncomplicated haemolytic jaundice?

True / False

○	◉	Bilirubinuria ✓Correct
○	◉	High conjugated serum bilirubin ✓Correct
○	◉	High serum alkaline phosphatase ✓Correct
◉	○	Reticulocytosis ✓Correct
◉	○	Urobilinuria ✓Correct

Uncomplicated haemolysis with hyperbilirubinaemia would be associated with excess urobilinogen due to the high unconjugated bilirubin.

Elevated liver function tests would not be characteristic and indeed elevated alkaline phosphatase would suggest obstruction.
Due to the haemolysis, increased reticulocytes with jaundice would feature.

16) With respect to local anaesthetic agents which of the following statements is/are true?

True / False

◉	○	Consist of hydrophilic and hydrophobic units ✓Correct
○	◉	Levobupivacaine is an R enantiomer ✓Correct
◉	○	Peak plasma levels are seen after intercostal block ✓Correct
◉	○	Rapidity of onset is related to pKa ✓Correct
○	◉	They lower the threshold potential ✓Correct

Local anaesthetics consist of (usually) a hydrophilic tertiary amine group connected to an unsaturated aromatic ring by a hydrocarbon chain. The bond between the two classifies local anaesthetics into esters and amides.
Levobupivacaine, ropivacaine and mepivacaine are chiral drugs with R and S enantiomers
Levobupivacaine is the S enantiomer.
Local anaesthetics do not alter resting transmembrane or threshold potentials.
Failure of sodium ion permeability to increase slows depolarisation such that threshold is never reached.
Intercostal>caudal>epidural>brachial plexus>sciatic for absorption of LAs into the blood stream.

17) Are the following factors taken into account in the APACHE II scoring system?

True / False

◉	○	Alveolar-arterial oxygen gradient ✓Correct
◉	○	Immunocompromised status ✓Correct
○	◉	Platelet count ✓Correct
◉	○	Rectal temperature ✓Correct
○	◉	Serum urea ✓Correct

The APACHE II score is a form of physiological scoring system which devises a score by taking the following three factors into consideration:

(i) Acute physiological score

(ii) Age of the patient and

(iii) Previous health condition.

The acute physiological score takes into account the following factors

- Rectal temperature (°C)
- Mean blood pressure
- Heart rate
- Respiratory rate
- Alveolar-arterial oxygen gradient if FiO_2>0.5 or PaO_2 if FiO_2 <0.5
- Arterial pH
- Serum Na+

- Serum K+
- Serum creatinine
- Haematocrit in %
- Leucocyte count and
- The Glasgow coma scale.

The age points are graded from less than 44 to more than 75 years with less than 44 years scoring '0' points and more than 75 scoring '6' points.

One of the factors in previous health condition (chronic health points) includes immunocompromised status.

There are also scores for post-operative admission, non-operative admission and emergency operation.

Increasing APACHE II score is associated with an increasing risk of hospital death.

18) Which of the following is/are true rgarding central parenteral nutrition (TPN)?

True / False

●	○	Can induce derangement of liver function tests ✓Correct
○	●	Is a hypo-osmolar solution ✓Correct
●	○	Is associated with metabolic disturbances in about 5% patients ✓Correct
○	●	Typically contains 14-16g nitrogen as D-amino acids ✓Correct
●	○	Typically contains about 250g glucose ✓Correct

TPN is hyperosmolar.

Consequently it is advocated that it is given centrally to reduce the risk of thrombophlebitis.

It contains 14-16g of L-amino acids (not D).

19) May the following physiological changes occur during a laparoscopic procedure in a fit patient?

True / False

●	○	A reduction in cardiac output secondary to direct pressure on the inferior vena cava and pelvic veins ✓Correct
○	●	Alteration in the left ventricular function ✓Correct
●	○	Increase in the systemic vascular resistance by a combination of mechanical pressure on the aorta and splanchnic vessels, and release of catecholamines ✓Correct
○	●	Reduction in the renal blood flow and glomerular filtration rate (GRF) due to decreased vasopressin levels ✓Correct
●	○	Release of inflammatory mediators as a direct result of afferent neuronal stimulation from the peritoneum ✓Correct

Peritoneal insufflation with or without Trendelenburg position may result in an increase in systemic vascular resistance (and therefore rise in mean arterial blood pressure) by mechanical compression of the aorta and splanchnic vessels and the release of catecholamines, prostaglandins, renin and vasopressin.

Direct pressure on the inferior vena cava and pelvic veins leads to decreased venous return and therefore a fall in cardiac output (this effect may to some extent be compensated for by blood entering the central vascular space from the inferior vena cava and splanchnic bed).

Increased renal vascular resistance, decreased cardiac output and elevated vasopressin levels all lead to a fall in renal blood flow and GFR.

Left ventricular function is unaltered in fit patients.

The metabolic response to laparoscopic surgery (mediated by neuroendocrine stimulation and release of inflammatory mediators) may be caused by afferent neuronal stimulation from the peritoneum.

20) Which of the following is/are true regarding evidence based medicine?

True / False

◉	○	Combines clinical expertise and external evidence ✓Correct
○	◉	Is a method for rationing resources in a health care system ✓Correct
○	◉	Is restricted to randomised placebo-controlled trials ✓Correct
◉	○	May involve a health economics assessment ✓Correct
◉	○	Relies on objective measurements of disease outcomes ✓Correct

"Evidence based medicine is the conscientious, explicit and judicious use of current best evidence in making decisions about care of individual patients. This means integrating individual clinical expertise with the best available external evidence". (BMJ 1996; 812: 71-2)

Clinical expertise involves proficiency and judgement gained by clinicians with time and the compassionate application of knowledge to individuals.

Current best evidence comes from many sources including randomised controlled trials, meta-analysis, national expert guidelines (for example, hypertension and asthma), patient-orientated studies, health economic assessment.

Evidence based medicine is not 'cook-book' medicine, a method for cost cutting and does not solely rely on randomised controlled trials.

21) Are the following true about a normal (Gaussian) distribution?

True / False

◉	○	68% of observations lie between the mean 1 standard deviation ✓Correct
◉	○	95% of observations lie between the mean 2 standard deviation ✓Correct
◉	○	Data from a normal distribution are suitable for parametric testswithout prior transformation. ✓Correct
◉	○	The 95% confidence interval may be calculated as the mean ±1.96 times the standard error of the mean for population >30 ✓Correct
◉	○	The mean, median and mode coincide ✓Correct

The mean and median of a normal distribution are equal.

The probability that a normally distributed random variable, x, with mean, σ, and standard deviation, μ, lies between (σ - 1.96μ)and (σ + 1.96σ) is 0.95.

The probability that a normally distributed random variable, x, with mean, σ, and standard deviation, μ, lies between (σ-μ) and (σ+μ) is 0.68. 95% of the distribution of sample means lies within 1.96 standard deviations of the population mean.

A parametric test is a hypothesis test that makes certain distributional assumptions about the data that they are Gaussian.

22) There is an increased tendency to thrombosis in which of the following?

True / False

◉	○	**A** Behcet's disease ✓Correct
◉	○	**B** Kawasaki's disease ✓Correct
◉	○	**C** Paroxysmal nocturnal haemoglobinuria ✓Correct
◉	○	**D** Homocystinuria ✓Correct
◉	○	**E** Metastatic malignancy ✓Correct

Other acquired causes include

- Congestive cardiac failure (CCF)
- Trauma
- Surgery
- Myeloproliferative disorders
- Oral contraceptives.

Other inherited causes are

- Antithrombin III / protein C / protein S deficiency
- Factor V Leiden
- Dysplasminogenaemia
- Dysfibrinogenaemia
- Heparin cofactor II deficiency.

23) In a normal adult woman weighing 75 kg which of the following is/are true regarding the extracellular fluid (ECF)?

True / False

○	◉	Contains no protein ✓Correct
○	◉	Forms a greater proportion of the total body weight in an obese than in a lean woman ✓Correct
◉	○	Has a sodium concentration of 135-145 mmol/l ✓Correct
◉	○	Has a total volume of 12-15 litres ✓Correct
○	◉	Is isotonic throughout the body ✓Correct

Total body water is approx 37.5 litres (0.5 x 75), of which 1/3 is ECF (13 l) and 2/3 (22 l) intracellular fluid. In the obese, ECF is relatively contracted. Normal sodium concentration is approximately 135-145 mmol/l. ECF is composed of intravascular fluid and extravascular fluid. Both contain plasma proteins.

24) Are the following true of chromosomes?

True / False

◉	○	23 chromosomes are found in germinal cells ✓Correct
◉	○	In females only one X chromosome is activated ✓Correct

●	○	Klinefelter's syndrome result from an extra X chromosome in male ✓Correct
●	○	The Barr body is due to inactivated X chromosome ✓Correct
○	●	There are 23 pairs of autosomal chromosome traits ✓Correct

There are 22 pairs of autosomal chromosomes and one pair of sex chromosomes.

Due to meiosis, only 23 chromosomes are found in the germinal cell.

Females have two X chromosomes but only one is activated and the other stays dormant as the Barr body.

In Klinefelter's syndrome, the male cell has an extra X chromosome.

25) May a difficult intubation be associated with the following?

True / False

○	●	A thyromental distance greater than 7 cm ✓Correct
●	○	An absent atlanto-occipital gap ✓Correct
○	●	An increased atlanto-occipital gap ✓Correct
●	○	Macroglossia ✓Correct
●	○	Micrognathia ✓Correct

Anatomical features identified during patient examination and radiological investigations provide useful information during the preoperative assessment of the airway. The ability to predict which patients may prove difficult to intubate is an important skill.

The anatomical variations that are associated with difficult intubations include

- A reduced interdental gap
- Protruding upper incisor teeth
- Micrognathia (mandibular hypoplasia)
- Macroglossia (large tongue)
- A thyromental distance less than 6.5 cm
- A high arched palate
- A reduced or absent atlanto-occipital gap (not an increased gap).

The atlanto-occipital gap is assessed using a lateral cervical spine x ray taken in the neutral position, and measuring the distance between the occiput and the spine of the atlas. When the gap is reduced, extending the head causes bowing of the cervical spine and anterior displacement of the larynx.

In patients with a thyromental distance of less than 6.5 cm, intubation may be difficult, as there is likely to be to insufficient space for displacement of the tongue. A thyromental distance greater than 6.5 cm is not usually associated with difficult intubation.

26) Features compatible with hypertension include which of the following?

True / False

●	○	A loud aortic second heart sound ✓Correct
●	○	A fourth heart sound ✓Correct

○	◉	A tapping apex beat ✓Correct
○	◉	A third heart sound ✓Correct
○	◉	Retinal haemorrhages and soft exudates, indicating a grade 2 hypertensive retinopathy ✓Correct

Hypertensive patients usually have no specific symptoms or signs. Abnormal signs usually only appear after a period of prolonged, severe hypertension.

A fourth heart sound is due to increased atrial activity. It occurs in diastole, preceding the first heart sound and can occur in any form of left ventricular disease.

Hypertension is associated with left ventricular hypertrophy and causes a thrusting apex beat, in contrast to the tapping apex beat characteristic of mitral stenosis.

A loud aortic second heart sound is a classical finding in hypertension.

A third heart sound may be a normal finding in patients under 40 years of age. A pathological third heart sound occurs with:

- Mitral and tricuspid regurgitation
- Constrictive pericarditis
- A dilated left ventricle and
- Acute myocardial infarction.

Hypertensive retinopathy is graded as follows:

- **Grade 1** - arterial narrowing
- **Grade 2** - arteriovenous nipping
- **Grade 3** - haemorrhages and exudates
- **Grade 4** - all of the above plus papilloedema.

27) Which of the following criteria are included in the Goldman Cardiac Risk Index (CRI)?

True / False

○	◉	Age greater than 65 years ✓Correct
◉	○	Aortic stenosis ✓Correct
◉	○	A third heart sound ✓Correct
◉	○	Jugular venous distension ✓Correct
○	◉	More than 10 premature ventricular contractions (PVC) per minute ✓Correct

In 1977 Goldman et al studied patients undergoing non-cardiac surgery and identified nine risk factors, each of which were then allocated a number of points (Goldman Cardiac Risk Index or CRI).

By adding up the total number of points patients were placed in one of four classes. The higher the total score the greater the class, and class III and VI represent a high risk cohort.

The most significant risk factors were:

- A myocardial infarction within the previous six months and
- A third heart sound or gallop rhythm.

Other criteria include:

- Age more than70 years

- Aortic stenosis
- Jugular venous distension
- A rhythm other than sinus, or
- More than five premature ventricular contractions per minute.

The Detsky modification was subsequently introduced, which recognised that major vascular surgery has a higher morbidity and mortality compared with non-vascular surgery.

28) Regarding the ASA classification of physical status, which of the following is/are true/false?

True / False

●	○	ASA grade 1 patients have no organic, biochemical, physiological or psychiatric disturbance ✓Correct
○	●	ASA 3 patients have moderate systemic disease ✓Correct
●	○	ASA 4 patients have severe systemic disease that is life threatening ✓Correct
○	●	The E suffix indicates that the patient required an elective operation ✓Correct
○	●	Was introduced by the Anesthesiology Society of America (ASA) in 1963 ✓Correct

The American Society of Anesthesiologists introduced a new classification of physical status for patients in 1963, which was published in Anesthesiology.

Five classes (not grades) were described and an E suffix indicated that the patient required an emergency operation (not elective).

The physical status of patients is classified as follows:

- ASA 1 patients have no organic, biochemical, physiological or psychiatric disease
- ASA 2 patients have mild to moderate systemic disease
- ASA 3 patients have severe systemic disease that is not incapacitating
- ASA 4 patients have severe incapacitating systemic disease that is a constant threat to life
- ASA 5 patients are usually moribund and have little chance of survival but are submitted to surgery as a last resort (resuscitative effort).

29) In muscular dystrophy which of the following is/are true?

True / False

○	●	Hypokalaemia may occur post-operatively ✓Correct
○	●	Patients quickly develop tolerance to opioids ✓Correct
●	○	Plasma concentrations of creatine kinase may be increased ✓Correct
●	○	Preoperative chest infections are common ✓Correct
●	○	Surgical procedures should ideally be performed under regional techniques ✓Correct

Muscular dystrophies are rare hereditary disorders of muscle. Progressive destruction of skeletal and cardiac muscle occurs by a mechanism thought to involve abnormal muscle membrane function. Plasma creatine kinase concentrations may be increased.

Patients tend to present with limb contractures and they have weak respiratory muscles which impair ventilation and sputum clearance. Pre-existing and post-operative chest infections are common and they are especially sensitive to opioids and other respiratory depressant drugs (not tolerance).

Severe hyperkalaemia (not hypokalaemia) and myoglobinuria may occur following prolonged exposure to volatile anaesthetic agents, therefore regional techniques are preferred.

As arrhythmias and cardiac failure may occur due to myocardial involvement, an ECG and echo will provide valuable pre-operative information on cardiac function.

30) Which of the following is/are true in myasthenia gravis?

True / False

○	●	An overdose of pyridostigmine may cause a myasthenic crisis ✓Correct
○	●	Antibodies against the pre-synaptic acetylcholine receptors are found in 90% of patients ✓Correct
○	●	Infection can provoke a cholinergic crisis ✓Correct
○	●	Pyridostigmine should always be omitted on the morning of surgery ✓Correct
○	●	Twenty five percent 25% of patients have a thymoma ✓Correct

Myasthenia gravis is an autoimmune disease characterised by skeletal muscle weakness and increased fatigability.

90% of patients have antibodies against the post-synaptic acetylcholine receptors (not pre-synaptic) at the neuromuscular junction. 65% of patients with myasthenia gravis have hyperplasia of the thymus and 12% have a thymoma (not 25%).

Treatment is with acetylcholinesterase inhibitors, for example, pyridostigmine, which may cause a cholinergic crisis in overdosage (not myasthenic crisis). Side effects of treatment include diarrhoea, urinary frequency, miosis, excessive salivation and lacrimation.

A myasthenic crisis (sudden worsening and spreading weakness) may be provoked by drug omission, infection (not cholinergic crisis) and stress.

Pre-operative assessment of respiratory function is important in these patients. Pyridostigmine is sometimes withheld on the morning of surgery and restarted in reduced dosage post-operatively. However, consideration should be given to the type of surgery and the mode of patient ventilation (spont vent or IPPV).

Patients who have had a dose omitted can often be extubated within 24 hours, if not immediately after the surgery.

31) When investigating a patient with asthma, which of the following is/are true?

True / False

●	○	A pneumothorax is best seen on a chest x ray taken atend-expiration ✓Correct
○	●	An eosinophilia differentiates extrinsic asthma from intrinsic asthma ✓Correct
●	○	Flow-volume loops provide information on the calibre of small peripheral airways ✓Correct
●	○	Mid-expiratory flow rate is independent of patient effort ✓Correct
○	●	Pulsus paradoxus is specific to asthma ✓Correct

The mid-expiratory flow rate is the expiratory flow rate in the middle of expiration. It mainly measures small airway calibre and is independent of the effort exerted by the patient. Maximum flow-volume loops provide information on inspiratory resistance, airway collapsibility and small airway calibre.

Pulsus paradoxus describes a fall in systolic blood pressure with inspiration and a difference of greater than 5 mmHg is abnormal. It is seen in normal individuals but an exaggerated response is seen in asthma, constrictive pericarditis and cardiac tamponade.

A small pneumothorax may only be visible on an end-expiratory chest x ray and frequently does not require intervention. However, if positive pressure ventilation is planned, the pneumothorax may enlarge significantly or develop into a life-threatening tension pneumothorax.

Eosinophilia is the most common haematological abnormality found in asthma and is a feature of both extrinsic (allergic) and intrinsic asthma.

32) Regarding the oxygen cascade, which of the following is/are true/false?

True / False

●	○	Alveolar PCO_2 is approximately 5.3 kPa (40 mmHg) ✓Correct
●	○	The greatest drop in PO_2 is between the artery and the mitochondria ✓Correct
●	○	The PO_2 at sea level is 21.3 kPa (160 mmHg) ✓Correct
●	○	The PO_2 drops by a third between the air and alveolus ✓Correct
●	○	The PO_2 in the mitochondria is approximately 1.3 kPa (10 mmHg) ✓Correct

The oxygen cascade is a series of steps where the PO_2falls from atmospheric air to the intracellular mitochondria.

A fall in the PO_2 at any stage will cause a decrease in the PO_2 value at all subsequent steps, which may result in insufficient oxygen for aerobic metabolism.

The greatest drop in PO_2 is indeed between the artery (13.3 kPa or 100 mmHg) and the mitochondria (1-5 kPa or 7.5-40 mmHg).

The PO_2 does drop by about one third between the air (21 kPa or 160 mmHg) and alveolus (14 kPa or 106 mmHg).

Humidified tracheal gas has a PO_2 of 19.8 kPa (150 mmHg) and capillaries has a PO_2 of 6-7 kPa (45-55 mmHg). The alveolar PCO_2 is normally between 4.7-6.0 kPa (35-45 mmHg) .

33) Which of the following is/are true regarding drugs which bind to receptors?

True / False

○	●	Act only on cell surface receptors ✓Correct
●	○	Are often similar in structure to natural substances ✓Correct
●	○	Can affect the expression of genes in the cell nucleus ✓Correct
○	●	Will always lead to a change in the ionic permeability of the membrane ✓Correct
○	●	Will always lead to the same response ✓Correct

Receptors are macromolecular structures which bind to a ligand and lead to a response.

Receptors are commonly found on the cell surface, often bridging it, but may be bound to the external, for example, acetylcholine, or internal, for example, local anaesthetics, aspect of the membrane.

Steroid receptors are not associated with the cell membrane; their ligand enters the cell and combines with them in the cytoplasm of the cell.

Many receptors change the ionic permeability of the cell membrane, for example, acetylcholine and gamma-aminobutyric acid (or GABA), but a large proportion of receptors act on the cell via intermediate compounds or a second messenger.

Second messengers include

- Inositol trisphosphate (IP3)
- Cyclic adenosine monophosphate (cAMP)
- Cyclic guanosine monophosphate (cGMP).

The response caused by the ligand binding to the receptor often varies, particularly in its intensity. This may be due to up or down regulation of the receptor (for example, suxamethonium in a paraplegic patient) or by the influence of other drugs.

Even 'crosstalk' or interference between second messengers shared by two different receptors may alter the response to a drug. The number of drugs which have similar structures to natural compounds are legion, for example, suxamethonium and acetylcholine, methadone and morphine.

34) In epiglottitis, which of the following is/are true?

True / False

○	◉	Intravenous access should be obtained prior to intubation ✓Correct
○	◉	It is important to view the patient's throat with a spatula ✓Correct
○	◉	It is most common in children less than one year ✓Correct
○	◉	The commonest causative organism is *Streptococcus pneumoniae* ✓Correct
○	◉	The patient looks well ✓Correct

It is important not to disturb or upset the child as this may precipitate total airway obstruction and death.

Epiglottitis is most common in the one to six year age group and is most commonly caused by *Haemophilus influenzae* type B.

The patient usually looks toxic and has a high fever.

35) Does extra-renal nitrogen retention occur in the following?

True / False

◉	○	Anorexia nervosa ✓Correct
◉	○	Intestinal haemorrhage ✓Correct
○	◉	Normal pregnancy ✓Correct
◉	○	Postoperative shock ✓Correct
◉	○	Severe pyloric stenosis ✓Correct

This is excessive catabolism of protein swamping renal excretory capacity.

It can occur in

- Post-operative states
- Gastrointestinal haemorrhage (often urea rises with large GI bleeds)
- Other catabolic conditions, for example, thyroid storm.

36) Is it true/false that acclimatisation to altitude involves the following?

True / False

○	●	A leftward shift of the oxygen dissociation curve ✓Correct
●	○	Decreased affinity of haemoglobin for oxygen ✓Correct
○	●	Decreased red cell 2,3-diphosphoglycerate concentration ✓Correct
○	●	Decreased ventilatory response to carbon dioxide ✓Correct
●	○	Reduced arterial PCO_2 level ✓Correct

The oxygen dissociation curve is shifted to the right with acclimatisation to high altitude, that favours delivery of oxygen to the tissues.

Hypoxia stimulates the carotid body chemoreceptors and this leads to hyperventilation and thus a low pCO_2.

There is no change in the ventilatory response to carbon dioxide.

With acclimatisation there is increased production of 2,3-diphosphoglycerate and erythropoietin.

37) Are the following statements regarding medical lasers true?

True / False

●	○	Argon lasers are used in ophthalmic surgery. ✓Correct
●	○	Argon lasers produce light in the blue-green area of the visible spectrum and so are maximally absorbed by tissues that are red in colour. ✓Correct
○	●	Carbon dioxide lasers produce radiation used for deep tissue penetration. ✓Correct
●	○	Differing mediums are used in order to vary the depth of penetration, wavelength of light and power of the beam. ✓Correct
●	○	Neodymium -aluminium-garnet lasers are used to debulk tumours. ✓Correct

Various types of lasers are available which have variable depth of penetration, wave-length of the light, and the power of the beam. The effect of laser beam radiation on tissues depends on its wavelength.

Carbon dioxide lasers are used to cut tissues and coagulation precisely.

Argon or krypton lasers produce light in the blue-green area of the visible spectrum which is maximally absorbed by red coloured tissues. It is used in ophthalmology, photocoagulation and dermatology.

Neodymium yttrium-aluminium-garnet (Nd YAG) lasers are near infra-red lasers, used to debulk tumours and for photocoagulation.

38) Must an aetiological factor satisfy the following before one can say that it is causally related to a disease?

True / False

●	○	Elimination of the factor decreases the risk of the disease ✓Correct
●	○	Exposure to the factor must precede the development of the disease ✓Correct
○	●	The factor is found in all cases with the disease ✓Correct

●	○	The factor is found more frequently among the diseased than non-diseased ✓Correct
○	●	The factor is not found among persons without the disease ✓Correct

Hill devised criteria for assessing causation and proposed that the cause must precede the effect. Again, Hill's criteria suggest that when assessing causation removing the factor of interest should reduce the risk of disease.

Hill suggested that there should be a dose-response relationship, that is, higher levels of the effect should lead to more severe disease or more rapid disease onset.

To illustrate this principle one can look at rheumatoid factor. It is found in people both with and without rheumatoid arthritis.

Again, autoantibody tests illustrate this principle as they can be found in unaffected patients.

39) Which of the following is/are true regarding meta-analysis of randomised controlled trials?

True / False

○	●	Gives conclusion, making further controlled trials unnecessary ✓Correct
●	○	Is usually performed if individual trials are too small to give reliable answers ✓Correct
●	○	Provides a more stable estimate of the effect of treatment than individual trials ✓Correct
○	●	Should include trials in which patient selection is not randomised ✓Correct
○	●	Should only include peer-reviewed studies ✓Correct

Meta-analyses combine the results from individual studies to produce an estimate of the overall effect of interest. The individual studies do not have to be peer reviewed.

By looking at the effects of numerous small trials, the direction and magnitude of the average effect with an associated confidence interval allows treatment effects with greater power and precision to be detected. This would lead to quality differences as the study designs should be similar. This is the main reason for doing a meta-analysis.

It gives conclusions with both the high power and precision to estimate effects, but also leads to questions that further controlled trials need to address.

40) In a patient fitted with a permanent cardiac pacemaker, which of the following is/are true?

True / False

○	●	Antiarrhythmic drugs should not be administered ✓Correct
●	○	CT (computer axial tomography) scanning does not alter pacemaker settings ✓Correct
○	●	Defibrillator paddles should be placed at least 5 cm away from the pacemaker ✓Correct
○	●	MRI (magnetic resonance imaging) does not alter pacemaker settings ✓Correct
○	●	The pacemaker threshold can fall shortly after successful defibrillation ✓Correct

Antiarrhythmic drugs can alter the stimulation and sensing thresholds of a pacemaker; they should still be used if there is a specific indication.

The pacemaker's generator unit is usually positioned in the left infraclavicular fossa, allowing the defibrillator paddles to be placed in the conventional position.

Current can travel along the pacemaker wires causing burns where the electrode tip makes contact with the endocardium. Placing the paddles at least 10-15 cm from the generator unit should minimise the risk.

If the pacemaker is in the right infraclavicular fossa then the defibrillator paddles should be placed 10-15 cm above and below the heart on the left side of the chest.

An endocardial burn sustained during defibrillation can cause an increase in resistance at the electrode contact point, which may gradually increase (not lower) the pacing threshold. It does not occur immediately, thus the pacemaker threshold should be checked regularly over the next two months.

Routing x rays and CT scans do not affect pacemaker settings and patients fitted with a pacemaker should never be exposed to the magnetic field of an MRI scanner. The strong magnetic field can, in addition to changing the settings, cause displacement of the pacemaker electrodes and heat the ferrometalic components to relatively high temperatures.

41) Which of the following is/are true in acute pulmonary embolism?

True / False

○	◉	A normal chest x ray excludes the diagnosis ✓Correct
◉	○	A normal V/Q scan has a high negative predictive value ✓Correct
○	◉	A raised plasma D-dimer excludes the diagnosis ✓Correct
◉	○	Pulmonary angiography is the most reliable investigation for both proximal and distal emboli ✓Correct
◉	○	Spiral CT of the lungs is a sensitive tool for diagnosing emboli in proximal pulmonary arteries ✓Correct

A spiral CT (following an injection of IV contrast) is a sensitive tool for diagnosing emboli in proximal pulmonary arteries, but is poor at detecting small emboli in distal segmental arteries. There is about 2% chance of missing a pulmonary embolus (PE) with plasma D-dimers.

It has very high sensitivity (good for detection) but poor specificity (poor at exclusion as a number of conditions cause raised D-dimers).

A normal VQ scan has a high negative predictive value, which makes any but the smallest embolism unlikely.

Chest x rays are almost always normal in small acute PEs and cannot exclude the diagnosis.

Pulmonary angiography is the gold standard investigation, but mortality rate is 0.5%, major complication rate is 1%, and minor complication rate is 0.5%.

42) Are the following recognised complications of foreign body inhalation?

True / False

○	◉	Angioneurotic oedema ✓Correct
◉	○	Bronchospasm ✓Correct
◉	○	Hyperinflation of the affected lung ✓Correct

●	○	Hyperinflation of the opposite lung ✓Correct
●	○	Pulmonary abscess ✓Correct

The symptoms, physical findings and complications of foreign body depend on their nature, location and the degree of obstruction.

Sharp objects cause local oedema with infection, while obstructed objects can produce distal atelectasis with later bronchiectasis, pulmonary abscess or empyema.

A large foreign body in the larynx may produce a cough that becomes croupy with profound obstruction, aphonia, haemoptysis, dyspnoea, bronchospasm and cyanosis.

x Rays may reveal a radio-opaque foreign body.

Obstruction may cause distal collapse with compensatory hyperexpansion of the opposite lung, or may cause a ball valve effect with hyperinflation of the affected lung.

Foreign bodies are most likely to enter the right main bronchus because of its more vertical path. Most can be safely removed by bronchoscopy, but the risk of complication is significantly elevated if diagnosis is delayed more than 24 hours.

Angioneurotic oedema is not a recognised complications of foreign body inhalation.

43) In labour, which of the following is/are true?

True / False

●	○	A fetal heart rate of 140 per minute is normal ✓Correct
●	○	An acceleration in fetal heart rate after a uterine contraction is normal ✓Correct
○	●	Braxton-Hicks contractions signify the onset of the first stage of labour ✓Correct
●	○	Syntocinon may be given during the first and third stages of labour ✓Correct
○	●	The fetus is delivered during the third stage ✓Correct

The first stage of labour is from the commencement of rhythmic, regular contractions until full cervical dilatation.

The second stage is from full cervical dilatation until delivery of the fetus.

The third stage begins after the delivery of the fetus until delivery of the placenta, thus the placenta (not the fetus) is delivered during the third stage.

Braxton-Hicks contractions may occur from 20 weeks and do not necessarily signify the onset of labour.

Syntocinon may be used to augment contractions in the first stage, or contract the uterus in the third stage.

Fetal heart rate may be monitored using a cardio-toco-graph CTG, and a heart rate of 120-160 per minute is normal, as are accelerations after a uterine contraction.

44) Regarding drug therapy during pregnancy, which of the following is/are true?

True / False

●	○	Folic acid supplements should be given to patients taking phenytoin ✓Correct
○	●	Heparin has been shown to cause central nervous system damage in the fetus if given in the second and third trimesters

		✓Correct
○	◉	Methyldopa is contra-indicated throughout ✓Correct
◉	○	Thiazide diuretics have been shown to decrease placental perfusion ✓Correct
◉	○	Treatment with isotretinoin is a recognised indication for a termination ✓Correct

Methyldopa is the only hypotensive that is safe in all stages of pregnancy.

Treatment with isotretinoin is a recognised indication for termination of the pregnancy and contraception is advised for two years after cessation of treatment.

Folic acid supplements reduce the incidence of neural tube defects and should be given to patients taking phenytoin.

Warfarin has been shown to cause central nervous system damage in the fetus if given in the second and third trimesters (not heparin).

Thiazide diuretics have been shown to decrease placental perfusion.

45) Do the following drugs have adverse effects on the developing fetus?

True / False

◉	○	Lisinopril ✓Correct
◉	○	Losartan ✓Correct
○	◉	Methyldopa ✓Correct
○	◉	Paracetamol ✓Correct
◉	○	Sodium valproate ✓Correct

Valproate is associated with neural tube defects (extra folate should be prescribed).

Lisinopril is teratogenic.

Losartan is contraindicated.

Methyldopa is used for hypertension in pregnancy.

Paracetamol is safe throughout a normal pregnancy.

46) Which of the following statements is/are true in carbon monoxide poisoning?

True / False

◉	○	Cortical blindness is a known complication ✓Correct
◉	○	The inhibition of haemoproteins is a feature ✓Correct

○	◉	The P50 is increased ✓Correct
○	◉	The standard pulse oximeter can differentiate between oxyhaemoglobin and carboxyhaemoglobin ✓Correct
○	◉	The tissue hypoxia is due to a rightward shift of the oxygendissociation curve (ODC) ✓Correct

Carbon monoxide has an affinity for the binding sites on the alpha chains of haemoglobin that is 250 times greater than oxygen.

The ODC is shifted to the left (not right), which reduces the P50 (not increases) and results in tissue hypoxia.

An additional feature of carbon monoxide poisoning is that it binds to and inhibits other haemoproteins (myoglobin, cytochrome c and reduced cytochrome P450).

The pulse oximeter is not able to differentiate between oxyhaemoglobin and carboxyhaemoglobin.

Cortical blindness is a known and permanent complication with concentrations of carboxyhaemoglobin above 40%.

47) Regarding a postoperative pulmonary embolus, which of the following statements is/are true?

True / False

◉	○	A chest x ray may be normal ✓Correct
◉	○	Diagnosis can be confirmed by a radioisotope ventilation/perfusion scan ✓Correct
◉	○	ECG may show an S wave in Lead I, a Q wave in Lead III and an inverted T wave in Lead III ✓Correct
○	◉	It is invariably associated with chest pain ✓Correct
◉	○	It is most commonly seen between seven and 10 days after operation ✓Correct

A postoperative pulmonary embolus occurs most commonly between seven and 10 days postoperatively and may occur in the absence of clinical features of a deep venous thrombosis.

Risk factors include

- Immobility
- Malignancy
- Prolonged surgery.

Patients undergoing particular operations (for example, hip surgery) are at particular risk.

The classical clinical presentation is with

- Breathlessness
- Pleuritic chest pain
- Tachycardia
- Hypotension.

A chest x ray may be normal.

The diagnosis can be confirmed by a V/Q can or spiral CT scanning.

48) Which of the following is/are true regarding a fat embolism?

True / False

●	○	Causes a fall in arterial PO_2 ✓Correct
○	●	Causes a rise in arterial PCO_2 ✓Correct
●	○	Fat appears in the urine ✓Correct
○	●	Is invariably fatal ✓Correct
●	○	May be associated with a skin rash ✓Correct

A fat embolism is associated with major trauma and may be manifest as increasing dyspnoea, hypotension and falling saturations.

Both the arterial PO_2 and PCO_2 are low, and critical support may be required, but death is not inevitable.

It is associated with embolisation to the skin causing a petechial rash, and fat may be seen in the urine.

49) Does carbon dioxide have the following effects on cerebral perfusion?

True / False

○	●	A reduction in $PaCO_2$ below 2 kPa (15 mmHg) results in a twofold decrease in cerebral blood flow ✓Correct
○	●	Between $PaCO_2$ values of 4 to 8 kPa (30-60 mmHg) the relationship between cerebral blood flow and $PaCO_2$ is sigmoidal ✓Correct
●	○	Hypercapnia may cause the 'intracerebral steal' effect ✓Correct
●	○	Hypocapnia may cause the 'reverse cerebral steal' effect ✓Correct
○	●	In chronic hypercapnia cerebral blood flow is increased ✓Correct

Arterial PCO_2 is the most important regulator of cerebral blood flow (CBF). Between $PaCO_2$ values of 4 to 8 kPa (30-60 mmHg) the relationship is virtually linear (not sigmoidal).

A fall in $PaCO_2$ below 2 kPa (15 mmHg) does not result in any further decreases in CBF and conversely, an increase above 20 kPa (150 mmHg) does not result in any further increases in CBF.

Hypercapnia increases CBF by vasodilatation but it may cause an intracerebral steal effect where blood is shunted away from ischaemic areas (in which the vessels are already maximally dilated). Conversely, hypocapnia constricts vessels and may divert blood to ischaemic areas (reverse steal effect).

Chronic hypercapnia is associated with a return of cerebral blood flow from increased to normal levels.

50) Regarding a cardiac arrest:

True / False

●	○	In a child weighing 20 kg, the first dose of epinephrine is 0.2 milligrams ✓Correct
○	●	In adults, 10 ml of 1 in 1000 epinephrine should be given intravenously every three to five minutes ✓Correct
●	○	In adults, 10 ml of 1 in 10,000 epinephrine should be given intravenously every three to five minutes ✓Correct
○	●	In children, the first dose of epinephrine is 100 micrograms per kg ✓Correct
○	●	In children, the 1 in 1000 epinephrine solution is used predominantly ✓Correct

In an adult cardiac arrest, 1 mg of epinephrine (adrenaline) is given intravenously every three to five minutes. The usual concentration of epinephrine used in adult cardiac arrests is 10 ml of the 1 in 10,000 solution (not 10 ml of 1 in 1000).

In children the first dose of epinephrine is 10 micrograms per kg. Thus in a 20 kg child the first dose of epinephrine is 0.2 mg (or 2 ml of the 1 in 10,000 solution).

51) Are the following are used in the management of refractory ventricular fibrillation?

True / False

○	◉	Adenosine ✓Correct
◉	○	Amiodarone ✓Correct
○	◉	Bretylium ✓Correct
◉	○	Epinephrine ✓Correct
◉	○	Lidocaine ✓Correct

Ventricular fibrillation (VF) is always associated with cardiac arrest, and together with pulseless ventricular tachycardia (VT), is a shockable rhythm.

1 mg of epinephrine should be given to all adult patients in VF every three to five minutes. An intravenous bolus of amiodarone (300 mg made up to 20 ml with 5% dextrose) is currently the drug of choice, and can be given in refractory VF or pulseless VT after the third shock.

1mg / kg of lidocaine may be given intravenously when amiodarone is unavailable. Previously 5 mg per kg of bretylium was given, but this is no longer recommended by the European Resuscitation Council (ERC).

Adenosine blocks the atrio-ventricular node (AVN) and is used to slow the ventricular rate in patients with a narrow complex tachycardia (or supraventricular tachycardia). It has no role in the management of refractory VF.

52) Do causes of pulseless electrical activity include the following?

True / False

○	◉	100 mg of atenolol taken orally ✓Correct
◉	○	A core body temperature of 31°C ✓Correct
○	◉	A small apical pneumothorax ✓Correct
◉	○	Hypokalaemia ✓Correct
◉	○	Type I respiratory failure ✓Correct

Pulseless electrical activity (PEA), or as it was previously called electromechanical dissociation (EMD), has numerous causes that can be summarised into the 4 H's and 4 T's.

These are:

1. Hypoxia
2. Hypovolaemia
3. Hypothermia
4. Hyper- and hypo- kalaemia;
1. Tension pneumothorax
2. Cardiac tamponade
3. Thromboembolism
4. Toxic or therapeutic disorders.

Type I respiratory failure is characterised by hypoxaemia and a normal or low arterial PCO_2.

Hypothermia is defined as a core temperature below 35°C.

Atenolol is used in the management of hypertension and angina and is frequently prescribed in doses up to 100 mg daily which does not constitute an overdose.

A small pneumothorax is unlikely to cause hypoxaemia at sea level, unless it becomes a tension pneumothorax.

A low serum potassium is a recognised cause of PEA.

53) Haemorrhage

True / False

●	○	Produces venoconstriction ✓Correct
○	●	Produces widespread arteriolar dilatation ✓Correct
●	○	Produces a fall in cardiac output ✓Correct
○	●	Causes splenic contraction ✓Correct
●	○	Increases aldosterone secretion ✓Correct

Haemorrhage produces both venous and arteriolar contraction. Cardiac output is intially reduced. Hypovolaemia increase aldosterone secretion. Renal reabsorption of sodium is increased and volume homeostasis is eventually achieved. Unlike carnivores, the human spleen does not act as a significant resevoir of red blood cells and does not contract in response to blood loss.

54) The following have agonist action at opioid receptors:

True / False

●	○	Buprenorphine ✓Correct
○	●	Naloxone ✓Correct
○	●	Naltrexone ✓Correct
○	●	Diamorphine ✓Correct
●	○	Pentazocine ✓Correct

Buprenorphine and pentazocine are the only drugs listed which are opioid receptor agonists. Buprenorphine is a partial agonist while pentazocine is a mixed agonist-antagonist. Diamorphine (diacetyl morphine) is an inactive prodrug, which acts via its active derivatives, morphine and 6-0-acetylmorphine.
Naloxone and naltrexone are opioid antagonists, and the former has a much shorter duration of action.

55) Infrared analysers can be used to measure the following gases:

True / False

○	●	nitrogen ✓Correct
●	○	carbon dioxide ✓Correct
●	○	nitrous oxide ✓Correct
○	●	oxygen ✓Correct
○	●	helium ✓Correct

Gases with molecules that contain at least two dissimilar atoms absorb radiation in the infrared region of the electromagnetic spectrum. Therefore, carbon dioxide, nitrous oxide and all of the halogenated volatile

anaesthetic agents can be measured using infrared absorption analysers. Oxygen, nitrogen, helium and the inert (or noble) gases do not absorb infrared light and cannot be measured using this technology. Oxygen is measured using the paramagnetic, galvanic or polarographic method.

56) Morphine:

True / False

○	◉	causes direct myocardial depression. ✓Correct
◉	○	increases the production of antidiuretic hormone (ADH). ✓Correct
◉	○	may cause bronchospasm. ✓Correct
◉	○	has a higher affinity for the opioid receptor than diamorphine. ✓Correct
○	◉	is a phenylpiperidine. ✓Correct

Morphine does not causes direct myocardial depression, although it may cause a bradycardia. The hypotension associated with its use is because of a decrease in the systemic vascular resistance (SVR) which is due, in part, to histamine release. The histamine release may also cause bronchospasm. The production of antidiuretic hormone (ADH) is also increased by morphine.

Diamorphine has almost no affinity for the opioid receptor and is a prodrug of morphine. Phenylpiperidines include pethidine and fentanyl, whereas morphine is a phenanthrene.

57) Hypertension one hour following a laparotomy may be due to:

True / False

◉	○	Inadequate analgesia ✓Correct
○	◉	Hypocapnia ✓Correct
◉	○	Urinary retention ✓Correct
◉	○	Hypoxia ✓Correct
◉	○	Malignant Hyperpyrexia ✓Correct

The most common cause of postoperative hypertension is inadequately controlled pain. Hypercapnia due to alveolar hypoventilation can cause hypertension (not hypocapnia). This may be due to respiratory depression following a general anaesthetic or opioids used for analgesia. A full bladder due to urinary retention or a blocked catheter can also cause agitation and pain.

Diffusion hypoxia is a feature of an anaesthetic involving nitrous oxide and supplementary oxygen should be given to patients for about 20 minutes as the residual nitrous oxide diffuses into the alveoli. Hypertension can accompany diffusion hypoxia or any cause of hypoxia.

Malignant hyperpyrexia (MH) is an inherited disease (autosomal dominant) affecting skeletal muscle contraction and metabolism. It follows exposure to triggering agents, particularly volatile anaesthetic agents and suxamethonium. Cardiovascular instability, cyanosis, hypercapnia, hyperkalaemia and hyperthermia are features of this life threatening condition which usually presents early during an anaesthetic but can be delayed for several hours.

58) Clonidine:

True / False

◉	○	reduces the minimal alveolar concentration of volatile anaesthetic agents ✓Correct
◉	○	may cause a dry mouth ✓Correct

○	◉	sudden withdrawal is associated with hypotension ✓Correct
○	◉	stimulates the release of catecholamines ✓Correct
○	◉	is an alpha adrenergic receptor antagonist ✓Correct

Clonidine is an alpha adrenergic receptor agonist (not antagonist), which acts centrally by stimulating presynaptic alpha-2 receptors, causing suppression of catecholamine release (not stimulating) by a negative feedback mechanism. It has been used as an antihypertensive drug, but it also has analgesic and sedative properties. When administered preoperatively it is associated with a reduction in the minimal alveolar concentration (MAC) of volatile anaesthetic agents.

Side effects of clonidine include: sedation, dry mouth, urinary retention and depression. It should be withdrawn slowly, as sudden withdrawal can cause a severe hypertensive crisis (not hypotension).

59) Pethidine analgesia in labour:

True / False

○	◉	analgesic effect takes 30 minutes to become apparent ✓Correct
◉	○	patient-controlled analgesia provides better pain relief than nurse-controlled analgesia ✓Correct
○	◉	causes an elevation of the Apgar scores ✓Correct
◉	○	is 50% protein bound ✓Correct
◉	○	causes loss of foetal cardiac beat-to-beat variability ✓Correct

The analgesic effects of pethidine become apparent after 10-15 minutes (not 30) and it is 40-60% protein bound. Intravenous pethidine administered via a patient-controlled analgesia (PCA) pump provides better analgesia compared with nurse-controlled analgesia (NCA), but almost double the amount of drug is used. Pethidine causes foetal side effects which include loss of beat-to-beat variability, depression of the Apgar scores (not elevation) and respiratory depression.

60) Entonox for labour analgesia:

True / False

◉	○	has been used since the 1960's ✓Correct
◉	○	is more effective than pethidine ✓Correct
○	◉	it should be inhaled as soon as the pains start ✓Correct
◉	○	low dose sevoflurane may be used to augment the analgesia ✓Correct
○	◉	should not be used with other forms of analgesia ✓Correct

Entonox is a gaseous mixture of nitrous oxide and oxygen and has been used since the 1960's. It is twice as effective as pethidine at providing labour analgesia, but inhalation should begin as soon as the uterine contraction is felt, because it takes forty five seconds before the maximum analgesic effect is achieved.

Low dose isoflurane and sevoflurane have been given in addition to entonox which has demonstrated an increased analgesic efficacy over entonox alone. Combining the analgesic effects of entonox with other analgesics agents provides superior analgesia to using entonox alone.

61) Epidural bupivacaine administered during labour may cause:

True / False

◉	○	an increase rate of instrumental delivery ✓Correct

○	◉	pruritus ✓Correct
◉	○	tinnitus ✓Correct
○	◉	decreased uterine contractility ✓Correct
○	◉	total spinal block ✓Correct

High concentrations of bupivacaine may cause an increase in the rate of instrumental delivery but not an increase in the rate of caesarian sections

Pruritus is due to opiates.

Tinnitus may occur when bupivacaine is given intravascularly or when the plasma levels of bupivacaine reach toxic levels. A total spinal or high spinal block occurs when a large volume of bupivacaine is injected into the subarachnoid space and is a rare complication of an epidural (read the question).

Epidural bupivacaine does not decrease uterine contractility

62) Oxytocin:

True / False

○	◉	causes hypertension ✓Correct
○	◉	a slow bolus of 10 International Units (IU) is recommended at caesarian section ✓Correct
◉	○	produces an antidiuretic effect ✓Correct
○	◉	decreases the lower oesophageal sphincter pressure ✓Correct
◉	○	promotes lactation ✓Correct

It causes a decrease in blood pressure and tachycardia (not hypertension), and a slow bolus of five International Units (not ten) is recommended at lower segment caesarian section. It promotes lactation, has an antidiuretic effect, but has no effect on the lower oesophageal sphincter pressure.

63) Transfer across the placenta:

True / False

◉	○	oxygen is transferred by flow-limited passive diffusion ✓Correct
◉	○	glucose is transferred by facilitated diffusion ✓Correct
○	◉	calcium is transferred by passive diffusion ✓Correct
◉	○	immunoglobulin IgG is transferred by endocytosis ✓Correct
◉	○	aminoacids are actively transported ✓Correct

Oxygen and carbon dioxide have a very high permeability and are transferred by flow-limited passive diffusion. Glucose is transferred by facilitated diffusion and calcium by active carrier-mediated transport (not passive diffusion). Immunoglobulin IgG crosses by endocytosis and amino acids are actively transported by transporter proteins or a sodium-dependent carrier system.

64) In the pregnant patient:

True / False

◉	○	constipation is common ✓Correct

●	○	lower oesophageal sphincter pressure is reduced ✓Correct
○	●	liver blood flow is increased ✓Correct
●	○	minimum alveolar concentrations of volatile agents are reduced ✓Correct
●	○	epidural pressures are increased ✓Correct

Intestinal motility is reduced in pregnancy resulting in constipation. Progesterone lowers the lower oesophageal sphincter pressure, which makes women more susceptible to reflux. The liver maintains a normal blood flow and size (not increased). The minimal alveolar concentration (MAC) of volatile agents is reduced by 30-40% due to the sedative effect of progesterone and the epidural pressures are higher due to engorgement of the epidural veins.

65) The following normally increase during pregnancy:

True / False

○	●	diastolic blood pressure ✓Correct
●	○	stroke volume ✓Correct
○	●	systemic vascular resistance ✓Correct
○	●	central venous pressure ✓Correct
●	○	heart rate ✓Correct

Stroke volume increases by 20-30% during pregnancy. The systemic vascular resistance decreases by about 30% due to hormone-mediated vasodilation. The systolic and diastolic blood pressures decrease by 10% at 20 weeks gestation. Heart rate increases by 25% in the middle of the third trimester. Central venous pressures and pulmonary capillary wedge pressures remain stable.

66) Weight gain in pregnancy:

True / False

●	○	averages 12 kilograms throughout the pregnancy ✓Correct
●	○	basal metabolic rate is increased by about 15% at term ✓Correct
○	●	fat stores cause a weight increase on average of approximately 6 kilograms ✓Correct
○	●	intracellular fluid volume increases by approximately 3 litres at term ✓Correct
●	○	the majority of the increase in fat occurs in the first half of the pregnancy ✓Correct

The average weight gain is about 12 kilograms and the basal metabolic rate is increased by about 15% at term. Fat stores are laid down by the mother, primarily in the first half of pregnancy and account for approximately 3 kilograms (not 6 kg). The extracellular fluid increases by 3 litres (not intracellular). The other major components of maternal weight gain during pregnancy involve the breasts and uterus.

67) Acute respiratory distress syndrome (ARDS) may be caused by the following:

True / False

○	●	overtransfusion of crystalloid ✓Correct

●	○	cardiopulmonary bypass ✓Correct
○	●	cardiomyopathy ✓Correct
●	○	reperfusion injury ✓Correct
○	●	acute myocardial infarction ✓Correct

The definition of acute respiratory distress syndrome (ARDS) requires that the pulmonary capillary wedge pressure is less than 18mmHg or there is no evidence of raised left atrial pressure.

Over transfusion, cardiomyopathy and acute myocardial infarction will cause respiratory distress with an elevated pulmonary capillary wedge pressure and therefore are excluded as causes of ARDS. Reperfusion injury and cardiopulmonary bypass are known causes of ARDS.

68) In thyroid storm:

True / False

○	●	treatment should be delayed until the thyroid function test results are known ✓Correct
○	●	may be precipitated by infection in a hypothyroid patient ✓Correct
●	○	can be precipitated by surgery ✓Correct
●	○	steroids should be given ✓Correct
●	○	the patient should be cooled ✓Correct

A thyroid storm or crisis is a rare manifestation of hyperthyroidism, and may be precipitated by stress, surgery or infection. Features include arrhythmias, cardiac failure, fever, hyperventilation and coma. Treatment should be started immediately (not delayed until test results are known).

The management involves: cooling and hydrating the patient, and the use of beta-blockers to control the arrhythmias. Corticosteroids, antithyroid drugs (e.g. potassium iodide, carbimazole and propylthiouracil) and plasmapheresis may also be required.

69) An oesophageal intubation:

True / False

○	●	can be reliably detected using a stethoscope ✓Correct
○	●	can be excluded if the arytenoids are anterior to the endotracheal tube ✓Correct
○	●	is highly probable if the oxygen saturation falls immediately after a rapid sequence induction ✓Correct
○	●	is unlikely if resistance is encountered on withdrawing the plunger of an oesophageal detector device ✓Correct
○	●	is unlikely if the coloured membrane in a fenem carbon dioxide detector is purple ✓Correct

Auscultation of the lung fields does not always detect an oesophageal intubation. Transmitted breath sounds can mimic ventilation of the lungs and breath sounds in patients with emphysema or obesity may be inaudible.

If the arytenoids cartilages are seen posterior to the endotracheal tube (not anterior), then an oesophageal intubation is unlikely. If the arytenoids are anterior to the endotracheal tube (ETT), then the tube is in the oesophagus.

Pre-oxygenating patients prior to a rapid sequence induction reduces the incidence of desaturation, and oxygen saturation can remain normal for up to a few minutes. An immediate fall in oxygen saturation (particularly in patients with a normal metabolic rate) is unlikely even with an oesophageal intubation.

An oesophageal detector device is a 60ml catheter tip syringe attached to a normal catheter mount which has a 15mm tracheal tube connector fitted to the distal end. When the endotracheal tube is in the trachea there should be no resistance on withdrawing the plunger of the syringe, and if it is in the oesophagus then resistance will be felt on withdrawing the plunger. Attempting to aspirate air from an endotracheal tube situated in the oesophagus, causes the walls to collapse around the tube, occluding the lumen and providing resistance to withdrawing the plunger.

The Fenem carbon dioxide detector device is inserted between the ETT and the catheter mount, and provides rapid breath by breath monitoring. It has a coloured membrane that is usually purple in colour (indicating that <0.3% carbon dioxide is present). In a tracheal intubation the membrane changes from purple to yellow as the concentration of carbon dioxide increases with exhalation, returning to purple with inspiration. In an oesophageal intubation it remains purple.

70) Lidocaine:

True / False

◉	○	is classified as an amide local anaesthetic ✓Correct
◉	○	can cross the blood brain barrier ✓Correct
○	◉	has mild vasoconstrictor properties ✓Correct
○	◉	is metabolised by pseudocholinesterase ✓Correct
○	◉	is a class IV antiarrhythmic drug ✓Correct

Lidocaine (or lidocaine) is an amide type local anaesthetic, and is also classified as a Vaughan Williams class I antiarrhythmic drug (not class IV). It has no intrinsic vasoconstrictor activity and can cross the blood brain barrier. Lidocaine has a stabilizing effect on central neurones (sodium channel blockade) and has previously been used therapeutically to control seizure activity. However, in overdosage convulsions and coma can occur. Ester type local anaesthetics are metabolised by pseudocholinesterase (not lidocaine).

71) The following may be normal findings in a healthy pregnant patient:

True / False

◉	○	a raised alkaline phosphatase ✓Correct
◉	○	thrombocytopaenia ✓Correct
◉	○	left axis deviation on the electrocardiograph (ECG) ✓Correct
◉	○	a fourth heart sound ✓Correct
◉	○	flattening or inversion of the T wave in lead III ✓Correct

Pregnancy is associated with clinical features that in a non-pregnant patient would point to organic disease. Polyuria, dyspepsia, decreased exercise tolerance, enlargement of the heart (with lateral displacement of the apex), a loud third heart sound and an ejection systolic murmur (loudest at the left sternal edge) are all common.

Less commonly, a fourth heart sound and a diastolic murmur may be present. Left axis deviation with flattening or T wave inversion in lead III can be seen on the electrocardiograph (ECG).

The alkaline phosphatase is frequently elevated but the remainder of the liver function tests should be in the normal range. In many women, mild thrombocytopenia occurs toward the end of pregnancy, and the platelet count returns to normal within days after delivery. The etiology for this phenomenon is unknown. This is the most common cause of thrombocytopenia during pregnancy, occurring in approximately 5% of women at term.

Thrombocytopenia may be associated with HELLP syndrome (haemolysis, elevated liver enzymes and low platelet count), which can lead to foetal and maternal death.

72) In cervical spine trauma with an associated injury to the spinal cord:

True / False

○	●	autoregulation of spinal cord blood flow will protect against moderate hypotension ✓Correct
●	○	autonomic hyper-reflexia occurs in 85% of quadriplegics ✓Correct
●	○	suxamethonium can be used during the first 72 hours following injury ✓Correct
○	●	steroids have no proven benefit ✓Correct
○	●	hypotension should be treated with a rapid infusion of 1 litre of colloid ✓Correct

Autoregulation of blood flow to the spinal cord is the same as for the rest of the central nervous system, and is similarly abolished by trauma. The spinal cord perfusion pressure is the difference between the mean arterial pressure and the cerebrospinal fluid pressure. Autonomic hyperreflexia is seen in 85% of quadriplegics and can develop days to weeks after an injury. It is characterised by hypertension and arrhythmias with cutaneous vasodilatation above the injury and vasoconstriction below the level of the cord lesion.

Suxamethonium can be used safely up to 72 hours following spinal cord injury. Hyperkalaemia and cardiac arrest can occur beyond 72 hours due to the increased potassium efflux and this effect lasts for up to 12 months, or until full recovery has occurred.

The use of high-dose methylprednisolone (30 mg/kg) followed by an infusion, given within eight hours of the injury has a beneficial effect. The protective mechanism is believed to be free-radical scavenging and inhibition of lipid peroxidation. Spinal shock may last for weeks and aggressive fluid resuscitation can precipitate pulmonary oedema. Therefore, fluid administration should be titrated against the central venous pressure (CVP) or pulmonary artery occlusion pressure (PAOP).

73) Creatine phosphokinase:

True / False

●	○	is specific to muscles ✓Correct
●	○	is abnormal in the neuroleptic malignant syndrome ✓Correct
○	●	is decreased in Duchenne muscular dystrophy ✓Correct
○	●	is a reliable predictor of malignant hyperthermia ✓Correct
○	●	is within normal values in 75% of patients susceptible to malignant hyperthermia ✓Correct

Creatine phosphokinase catalyses the formation of ATP at the cross-link formation site between actin and myosin. Malignant hyperthermia susceptible (MHS) patients have a much higher serum creatine phosphokinase levels than malignant hyperthermia negative (MHN) patients. However, the serum levels are within the normal range in 50% of MHS patients and so it is creatine phosphokinase is not a reliable predictor of malignant hyperthermia. Raised serum levels are found in other conditions (muscle trauma, muscular dystrophies and the myotonias), thus is not specific to malignant hyperthermia. The halothane and caffeine muscle contracture tests are therefore the appropriate screening tests for susceptibility to MH. Verapamil, propranolol and dantrolene interfere with the tests.

74) A 30-year-old male has sustained 30% (body surface area) burns to his upper limbs and trunk in a housefire. He is breathing spontaneously, has

palpable peripheral pulses but is unconscious (barely responds to stimulation). The following conditions may explain his unresponsiveness:

True / False

○	●	fluid loss from the burn and subsequent hypovolaemia ✓Correct
●	○	hypoxia ✓Correct
○	●	carbon dioxide poisoning ✓Correct
●	○	alcohol intoxication ✓Correct
●	○	an associated head injury ✓Correct

Whenever the burn injury is extensive (i.e. >15% - 20% of the body surface area (BSA) in adult patients) the patient will require intravenous fluid resuscitation. However, a young healthy patient with a 30% BSA burn is unlikely to be hypovolaemic resulting in unconsciousness. Several fluid resuscitation formulae are known, and are used to calculate the volume of fluid required in the first 24 hours following a burn. With the Parkland formula the normal crystalloid requirements for the first 24 hours, is around 4 ml per % BSA burned per Kg body weight. The rate of fluid resuscitation is subsequently adjusted to maintain a urine output of between 0.5 and 1.0 ml/Kg per hour.

The possibility of associated injuries, inhalation burns, drug overdoses or alcohol intoxication, should always be kept in mind. Alcohol and drug intoxication are both potential causes of unconsciousness. Concomitant mechanical trauma is not infrequently seen in burn victims, and so should always be looked for. An associated head injury could easily account for the reduced conscious level.

If the patient has been exposed to fire or smoke in an enclosed space, eg. in a housefire, then the possibility of inhalation injury, including carbon monoxide (not dioxide) and cyanide poisoning should be considered. A high concentration of carboxyhaemoglobin can cause unconsciousness, convulsions and coma. The resulting hypoxia should be treated with high 100% oxygen.

75) When compared to total parenteral nutrition (TPN), enteral nutrition is:

True / False

●	○	associated with less infections ✓Correct
○	●	more likely to lead to zinc deficiency ✓Correct
○	●	more associated with abnormal liver function or cholestasis ✓Correct
●	○	less expensive ✓Correct
●	○	absorbed by patients without bowel sounds ✓Correct

Feeding by the enteral route (EN) is metabolically, immunologically, nutritionally superior and financially less expensive, to feeding by the parenteral route. The presence of bowel sounds has no influence on when to start enteral feeding. Many patients with absent bowel sound tolerate and absorb nasogastric feeds.

The only indication for TPN is inability to use or failure of the enteral route for nutritional support. TPN usually requires a dedicated central venous catheter (although peripheral intravenous feed is available), which can potentially get colonised by micro-organisms. Abnormal liver function, cholestasis and trace element deficiency (copper, iron, chromium and especially zinc) are common problems associated with TPN.

76) Principles for the management of severe traumatic head injury include:

True / False

○	●	dextrose containing fluids ✓Correct

○	◉	prophylactic anticonvulsant medication ✓Correct
○	◉	hyperventilate to a pCO_2 of 3.0kPa ✓Correct
○	◉	nursing the patient at 30 degrees head down to improve blood flow ✓Correct
◉	○	active treatment of fever ✓Correct

Principles in the management of a head injury include: nursing the patient in a head up tilt of 30 degrees (not down); avoiding hypoglycaemia and hyperglycaemia; using normal saline (0.9%) as the primary maintenance fluid; maintaining normocapnia (not hyperventilation to a pCO_2 of 3.0kPa); active treatment of fever and seizures. The prophylactic treatment of seizures has not shown to be of benefit.

77) Causes of metabolic acidosis include:

True / False

○	◉	hypokalaemia ✓Correct
◉	○	shock ✓Correct
○	◉	hypochloraemia ✓Correct
○	◉	calcium antacids ✓Correct
◉	○	diarrhoea ✓Correct

The causes of a metabolic acidosis include: renal failure, gastrointestinal bicarbonate loss, drug poisoning (e.g. salicylates, diabetes mellitus, starvation and lactic acidosis).

The other options all cause a metabolic alkalosis.

78) Intra-abdominal pressure:

True / False

◉	○	may be measured in the stomach ✓Correct
○	◉	a pressure of 5-10mmHg is normal ✓Correct
○	◉	causes abdominal compartment syndrome when >15mmHg ✓Correct
◉	○	if elevated may cause an increase in systemic vascular resistance ✓Correct
◉	○	surgical decompression is indicated if intra-abdominal pressure is >25mmHg ✓Correct

The normal intra-abdominal pressure is zero or sub-atmospheric. When the intra-abdominal pressure is >25mmHg the abdominal compartment syndrome can occur which usually requires surgical decompression.

The systemic vascular resistance (SVR) is often found to be increased when the intra-abdominal pressure if high. It can be measured directly at laparoscopy or indirectly via the femoral vein, stomach, rectum and bladder.

79) The anion gap:

True / False

○	◉	is normal with lactic acidosis ✓Correct

●	○	normal value is 8-16mmol/l ✓Correct
●	○	depends on plasma chloride ✓Correct
●	○	is raised in diabetic ketoacidosis ✓Correct
●	○	the gap is partially due to phosphate ✓Correct

The anion gap is a method of assessing the contribution of unmeasured anions to acidosis. It is calculated as a difference between the total of sodium and potassium concentration, minus the total of chloride and bicarbonate concentration. Some people omit the potassium. Thus:

Anion Gap = [K+] + [Na+] - [Cl-] - [HCO3-] (plasma concentrations)

The normal range for the anion gap is 8 to 16 mmol/l. The anion gap provides a measure of the difference between unestimated anions - phosphate, acetate and ketones - and cations. The anion gap is likely to abnormally high in most conditions of acidosis except: renal tubular acidosis, treatment with acetazolamide, and ureteric implantation into the colon.

When a metabolic acidosis is due to bicarbonate loss from gut or kidneys, the anion gap may be normal. The anion gap may be elevated when fixed or organic acids (e.g. ketoacidosis, lactic acidosis, uraemia, drugs) are retained.

80) Pulmonary capillary wedge pressure (PCWP) may be elevated in the following:

True / False

○	●	right ventricular failure ✓Correct
●	○	mitral stenosis ✓Correct
●	○	mitral regurgitation ✓Correct
○	●	pulmonary stenosis ✓Correct
●	○	atrial myxoma ✓Correct

Fluid overload and left ventricular failure (LVF) cause an increase in pulmonary capillary wedge pressure (PCWP). The PCWP may misrepresent the left ventricular end-diastolic pressure (LVEDP) in pulmonary venous obstruction (pulmonary fibrosis, vasculitis, atrial myxoma) and valvular heart disease (mitral stenosis, mitral regurgitation and aortic regurgitation).

81) The following factors shift the oxygen dissociation curve (ODC) to the left:

True / False

●	○	Foetal haemoglobin ✓Correct
○	●	Haemoglobin S ✓Correct
●	○	Methaemoglobinaemia ✓Correct
○	●	Anaemia ✓Correct
●	○	Carboxyhaemoglobinaemia ✓Correct

Foetal haemoglobin, Methaemoglobin and Carboxyhaemoglobin all shift the curve to the left. Haemoglobin S shifts the curve to the right. Anaemia affects the quantity not the characteristics of the haemoglobin. The curve is only altered if oxygen content, not saturation, is plotted on the y-axis.

82) Acetylcholine is a neurotransmitter at:

True / False

●	○	sweat glands ✓Correct
●	○	the adrenal medulla ✓Correct
●	○	parasympathetic ganglia ✓Correct
●	○	the parotid gland ✓Correct
●	○	the neuromuscular junction ✓Correct

In the skin both the pilomotor muscles and sweat glands have a cholinergic impulse response. The adrenal medulla has a cholinergic impulse response that results in the secretion of both adrenaline and noradrenaline. Acetylcholine is a neurotransmitter at parasympathetic ganglia. All salivary glands have a cholinegric impulse response that results in a profuse, watery secretion. Acetylcholine is a major neurotransmitter at the neuromuscular junction.

83) Dilatation of the peripheral arterial blood vessels can be caused by:

True / False

○	●	thromboxane A2 ✓Correct
○	●	adenosine diphosphate ✓Correct
○	●	endothelin ✓Correct
●	○	prostaglandins ✓Correct
●	○	nitric oxide. ✓Correct

Thromboxane A2 promotes platelet aggregation and vasoconstriction. Adenosine diphosphate leads to a conformational change in the fibrinogen receptor, which secures the platelet plug. Endothelial cells produce endothelin-1, the most potent vasoconstrictor agent yet isolated. Prostaglandins are important in the maintainence of blood flow in the face of reductions induced by vasomotor stimuli. NO evokes relaxation of vascular smooth muscle and inhibits platelet function through activation of soluble guanylate cyclase.

84) Antibiotics that inhibit cell wall synthesis include:

True / False

●	○	Cefuroxime ✓Correct
○	●	Erythromycin ✓Correct
●	○	Vancomycin ✓Correct
○	●	Sulphonamide ✓Correct
●	○	Benzylpenicillin ✓Correct

Like penicillins, cephalosporins inhibit bacterial cell wall synthesis. Erythromycin inhibits protein synthesis by interrupting ribosomal function. Vancomycin is a complex and unusual glycopeptide active against Gram-positive bacteria and inhibits cell wall synthesis. Sulphonamides block thymidine and purine synthesis by inhibiting microbial folic acid synthesis. Penicillins block the terminal cross-linking reaction between alanine and glycine of bacterial cell wall mucopeptide formation.

85) Contraindications to streptokinase are

True / False

○	◉	age over 75 years ✓Correct
○	◉	atrial fibrillation ✓Correct
○	◉	asthma ✓Correct
○	◉	insulin dependent diabetes mellitus ✓Correct
○	◉	background diabetic retinopathy ✓Correct

a - the over 75s benefit as much or more than younger MI patients from thrombolysis e - proliferative diabetic retinopathy Important contraindications to thrombolysis - pregnancy, bleeding (gut, menstrual), recent stroke or surgery, uncontrolled severe hypertension, GI malignancy, prolonged CPR

86) Triggering agents for malignant hyperthermia include:

True / False

○	◉	Haloperidol ✓Correct
○	◉	Dantrolene ✓Correct
◉	○	Trichloroethylene ✓Correct
○	◉	Bromocriptine ✓Correct
◉	○	Cyclopropane ✓Correct

Malignant hyperthermia (MH) is a life threatening autosomal dominant condition linked with other myotonic disorders. Intracellular calcium transport is deranged with generalised muscular contraction generating excess heat. Known triggering agents include suxamethonium and the inhalational anaesthetic agents, e.g. trichloroethylene and cyclopropane, which incidentally are no longer available. Cyclopropane was discontinued because its an explosive gas. It is treated with sodium dantrolene. Haloperidol may cause the neuroleptic malignant syndrome, which also causes hyperthermia but is unlike MH. It may similarly be treated using dantrolene and dopamine agonists like bromocryptine or amantadine.

87) Features of aspirin overdose include:

True / False

◉	○	Lactic acidosis ✓Correct
◉	○	Hypoglycaemia ✓Correct
◉	○	Tinnitus ✓Correct
◉	○	Hyperpyrexia ✓Correct
◉	○	Hyperventilation ✓Correct

Aspirin in overdose may cause hyperventilation (through metabolic acidosis) and can lead to lactic acidosis through hypotension and poor perfusion. Both hypoglycaemia (inhibiting gluconeogenesis from liver) and hyperglycaemia may ensue. Hyperpyrexia and tinnitus may also occur.

88) Nephrogenic diabetes insipidus:

True / False

○	◉	has autosomal recessive inheritance ✓Correct

●	○	can be associated with sickle cell anaemia ✓Correct
○	●	serum vasopressin levels are normal or low ✓Correct
●	○	can be caused by gentamicin ✓Correct
●	○	responds to treatment with thiazides ✓Correct

Nephrogenic diabetes insipidus is usually drug related but a rare X-linked recessive form may also occur (not autosomal recessive). It may be caused by gentamicin, lithium and demeclocycline. Hypercalcaemia and sickle cell anaemia may be associated with the disease. Serum vasopressin levels are normal or high because the kidneys are unresponsive to it. It responds to treatment with thiazides.

89) Intra-operative electrodcardiogram (ECG)

True / False

○	●	The main frequency range is 0.05 50 Hz ✓Correct
○	●	Silver/Silver iodide is used in the electrodes ✓Correct
●	○	Incorrect positioning can lead to skin burns ✓Correct
○	●	CMV5 refers to the electrical standard for ECG electrodes ✓Correct
○	●	50Hz mains interference is common ✓Correct

ECG electrodes consist of silver/silver chloride gel pads connected to shielded wires connected to an amplifier which has a frequency range of 0.05 to 100hz although this can be reduced to 0.5 to 40hz in some instances. Mains frequency of 50Hz can interfere but most amplifiers now have a notch filter at this frequency in their bandwidth. CMV5 refers to the positioning of electrodes to allow detection of ventricular ischaemia.

90) The natural frequency of an arterial monitoring system is:

True / False

●	○	Directly related to the catheter diameter ✓Correct
○	●	Inversely related to the cube root of the system compliance ✓Correct
●	○	Inversely related to the square root of the length of the tubing. ✓Correct
●	○	Inversely related to the square root of the density of the fluid in the system ✓Correct
○	●	Is at least 20 times the fundamental frequency ✓Correct

The natural frequency is the frequency at which the system is resonant. The natural frequency should be at least 10 times the fundamental frequency. (the fundamental frequency is the lowest frequency at which the system resonates. A harmonic is a multiple of this frequency). The above questions are true except for an inverse relation to the SQUARE root of the system compliance.

91) Angiotensin-converting enzyme (ACE) inhibitors:

True / False

○	●	can reduce the serum bradykinin concentration ✓Correct

●	○	can worsen silent renovascular disease ✓Correct
●	○	can decrease plasma atrial natriuretic peptide levels ✓Correct
●	○	in combination therapy they can reduce mortality in chronic heart failure ✓Correct
●	○	may attenuate left ventricular enlargement following a myocardial infarction ✓Correct

Increased bradykinin concentrations and deteriorating renal function in renal artery stenosis are effects of ACE inhibitor therapy. ACEI are known to reduce mortality in trials of heart failure with combination therapy, e.g. ATLAS and assits with remodelling.

92) The following drugs can be given via the endobronchial route (down the endotracheal tube):

True / False

○	●	Amiodarone ✓Correct
●	○	Lidocaine ✓Correct
●	○	Diazepam ✓Correct
●	○	Epinephrine ✓Correct
●	○	Atropine ✓Correct

When intravenous or intraosseous access has yet to be established or has been lost certain emergency drugs may be administered by the endobronchial route. Specific catheters are available that may be introduced into an endotracheal tube or a laryngeal mask airway in order to administer the drug.

During a cardiac arrest epinephrine (adrenaline) can be administered via the endotracheal tube providing the dose is increased by 2 to 3 times the intravenous dose. Thus 2 – 3mg of epinephrine should be used. Atropine, lidocaine, diazepam, naloxone, and isoprenaline can all be administered by the endobronchial route. Amiodarone can only be given by the intravenous and intraosseous routes.

93) In the management of cardiac arrest:

True / False

○	●	Adrenaline (or epinephrine) is always given ✓Correct
○	●	In pulseless electrical activity (PEA) cycles of CPR (chest compressions and ventilations) last 3 minutes. ✓Correct
○	●	Hypotension is a reversible cause of PEA ✓Correct
●	○	Amiodarone may be of used in refractory ventricular fibrillation and pulseless ventricular tachycardia. ✓Correct
○	●	Calcium gluconate has a role in the management of hypokalaemia. ✓Correct

In ventricular fibrillation (VF) and pulseless ventricular tachycardia (VT) adrenaline is not given until immediately before the 3rd defibrillation shock.
If either of the first 2 shocks are successful then adrnaline is not needed. 2 minute cycles of cardio-pulmonary resuscitation (CPR) are used during cardiac arrest.

Hypovolaemia rather than hypotension is a reversible cause of PEA. Hypotension by definition is always present or may be unrecordable during a cardiac arrest and is not a reversible cause, whereas hypovolaemia is reversible with fluid resuscitation.

Amiodarone is used in refractory VF or pulseless VT, and may be considered after adrenaline. Calcium salts are used in the treatment of hyperkalaemia and hypocalcaemia but calcium chloride should be used rather than calcium gluconate.

94) In paracetamol poisoning, N-acetyl cysteine:

True / False

●	○	Improves the microcirculation ✓Correct
○	●	Should be discontinued after 48 hours ✓Correct
●	○	Is effective when given 36 hours after the overdose ✓Correct
○	●	Should only be withheld until plasma paracetamol levels are known ✓Correct
●	○	Has antioxidant properties ✓Correct

There is evidence that N-acetyl cysteine (NAC) is effective when administered more than 24 to 36 hours after paracetamol overdose and is also clinically beneficial in non-paracetamol acute liver failure. It should be administered at the earliest opportunity, regardless of blood results and paracetamol concentrations, as early treatment has a great impact on outcome. NAC maintenance should be continued until the INR improves to less than 2.0. The microcirculation has been shown to improve. Non-toxic sulphation of paracetamol is increased by NAC and it has additional antioxidant properties.

95) Non-depolarising neuromuscular blocking drugs are prolonged by:

True / False

●	○	Lidocaine ✓Correct
○	●	Hyperthermia ✓Correct
●	○	Verapamil ✓Correct
●	○	Amitriptyline ✓Correct
○	●	Hypocarbia ✓Correct

Tricyclic antidepressants, e.g. amitriptyline, potentiate the action of non-depolarising neuromuscular blocking drugs by closed channel block. Verapamil and lidocaine potentiate the effect of these muscle relaxants by an open channel block mechanism. During hypothermia, enzyme activity is decreased, which reduces clearance and prolongs the duration of action of non-depolarising muscle relaxants. Acidosis and hypercarbia prolongs their effect (not hypocarbia).

96) Neostigmine:

True / False

●	○	Causes bronchospasm ✓Correct
●	○	Decreases cardiac output ✓Correct
○	●	Easily crosses the blood brain barrier ✓Correct
○	●	Causes mydriasis ✓Correct
●	○	Causes skeletal muscle contraction ✓Correct

Neostigmine is a quaternary ammonium anticholinesterase compound, which via a direct action causes skeletal muscle contraction. It has no effect on Phase I block caused by suxamethonium, but it does transiently antagonise Phase II block. Bradycardia is the predominant effect on heart rate leading to a decrease in cardiac output. It causes bronchospasm and constriction of the pupillary sphincter muscle leading to miosis (not mydriasis). Neostigmine does not cross the blood brain barrier due to the quaternary ammonium group rendering it lipid insoluble.

97) Nitrous oxide:

True / False

○	◉	Is an NMDA agonist ✓Correct
○	◉	Decreases the cerebral metabolic rate of oxygen consumption (CMRO2) ✓Correct
○	◉	Decreases cerebral blood flow ✓Correct
○	◉	Maintains cerebral autoregulation ✓Correct
◉	○	Maintains carbon dioxide reactivity ✓Correct

Nitrous oxide causes direct cerebral stimulation which subsequently increases cerebral blood flow. Increased metabolism specifically in the frontal lobes and limbic system is seen which increases the cerebral metabolic rate of oxygen consumption (CMRO2). Cerebral autoregulation is impaired, but when used with propofol it is maintained. Nitrous oxide antagonises NMDA receptors (it is not an NMDA agonist), which may result in neurological damage, but this effect may be limited by the concurrent use of GABA agonists or inhalational anaesthetics. Carbon dioxide reactivity remains unaffected.

98) Helium:

True / False

○	◉	affects the performance of vaporizers ✓Correct
○	◉	is supplied in brown bodied cylinders with brown and white quartered shoulders ✓Correct
○	◉	is more dense than nitrogen ✓Correct
○	◉	is the lightest element ✓Correct
○	◉	is highly soluble in water ✓Correct

Helium is an inert gas that is found in air (5.25 ppm at sea level). It is the second lightest element in the periodic table with an atomic number of 2 and atomic weight 4.0026 g/mol. Helium has a low boiling point, low density, low solubility and high thermal conductivity. It has a density of 0.1785 g/L at 20oC, which is less than nitrogen. It is the least soluble of all gases in water. It is supplied in brown cylinders at 137 bar, but when mixed with oxygen the cylinders have a brown body and white/brown quartered shoulder. The presence of helium in the carrier gas has been shown to have negligible effects on the output of inhalational anaesthetic agents from vaporizers. Thus, helium/oxygen mixtures can be used with modern vaporizers without adversely affecting their performance.

99) The following are consistent with brainstem death:

True / False

◉	○	Absence of pupillary light reflexes ✓Correct
◉	○	Absence of cold caloric relex ✓Correct
○	◉	Periodic breathing ✓Correct
○	◉	Absent tendon reflexes ✓Correct
○	◉	Cheyne Strokes breathing. ✓Correct

Brain stem death is characterised by apnoea, fixed or non-reactive pupils (not necessarily dilated), and no response to cold caloric testing. However, spinal reflexes may be preserved.

100) QT prolongation:

True / False

◉	○	is a recognised feature of sotalol therapy ✓Correct
◉	○	is a feature of treatment with amiodarone ✓Correct

●	○	predisposes to ventricular fibrillation ✓Correct
○	●	characteristically predisposes to atrial fibrillation ✓Correct
●	○	is a recognised feature of treatment with cisapride ✓Correct

Since the original work by Dessertenne, it has been well recognised that many conditions may cause prolonged or abnormal repolarisation (that is, QT interval prolongation and/or abnormal T or T/U wave morphology), which is associated with Torsades de Pointes. If TdP is rapid or prolonged, it can lead to ventricular fibrillation and sudden cardiac death. Essentially, TdP may be caused by either congenital or acquired long QT syndrome (LQTS). QT prolongation predisposes to TdP and is a feature of many drugs and groups of drugs: antiarrhythmics (sotalol, amiodarone); antihistamines (mainly terfenadine and astemizole); prokinetics (cisapride); neuroleptics (phenothiazines, thioridazine, haloperidol, chlorpromazine, trifluoperazine, pericycline, prochlorperazine, and fluphenazine); tricyclic antidepressants (amitriptyline, doxepin, desipramine, imipramine, and clomipramine); macrolides (erythromycin, clarithromycin); fluoroquinolones; antifungals; and antimalarials. It is also seen with hypocalcemia, hypokalemia and with Type 1a antiarrhythmic drugs. QT prolongation does not predispose to atrial fibrillation.

101) Which of the following statements are true regarding breathing systems:

True / False

○	●	when in the open position, a pressure of 2 cm of water (0.2 kPa) is needed to actuate the adjustable pressure limiting or expiratory valve ✓Correct
●	○	the reservoir bag can limit the pressure in the breathing system to about 40 cm of water ✓Correct
○	●	the Mapleson A system is suitable for use in patients up to 20 Kg ✓Correct
○	●	in a coaxial Mapleson A system (or Lack) the inner tube has a diameter of 20 mm and the outer tube has a diameter of 30 mm ✓Correct
○	●	the Mapleson E system has an double-ended reservoir bag ✓Correct

Mapleson classified breathing systems into A, B, C, D and E. Jackson-Rees subsequently modified the Mapleson E by adding a double-ended bag to the end of the reservoir tubing, creating the Mapleson F. A Mapleson E or T-piece does not have a reservoir bag.

A Mapleson A system is a very efficient system for use during spontaneous ventilation. However, it is not suitable for use with patients less than 25 Kg, due to the increased dead space at the distal / patient end. This system can be modified into a Lack system or coaxial Mapleson A, where the fresh gas flows through an outer tube (30 mm) and exhaled gases flow through the inner tube (14 mm).

The adjustable pressure limiting valve (APL) or expiratory valve allows exhaled gas and excess fresh gas to leave the breathing system. It is a one-way, adjustable spring-loaded valve, and gases escape when the pressure in the system exceeds the valve opening pressure. During spontaneous ventilation a pressure of less than 1 cm of water (0.1 kPa) is needed when the valve is in the open position (not 2 cm of H_2O).

The reservoir bag is highly compliant and when over inflated, the rubber bag can limit the pressure in the system to about 40 cm of H_2O. This is due to the law of Laplace, which states that the pressure will fall as the radius of the bag increases:
Pressure = 2 x Tension/Radius