FRCA primary onexamination 3

1 -In mitral stenosis caused by rheumatic heart disease, specific prophylaxis against endocarditis is unnecessary in:

True / False

○	◉	cystoscopy ✓Correct
○	◉	dental scaling ✓Correct
○	◉	lower segment caesarean section ✓Correct
○	◉	cardiac catherization ✓Correct
○	◉	transesophageal echocardiogram ✓Correct

2 - Ventricular septal defects (VSD):

True / False

○	◉	Usually occur in the muscular part of the septum ✓Correct
◉	○	Close spontaneously in more than 50% of affected children ✓Correct
○	◉	Have a benign outcome if accompanied by accentuation of the second heart sound ✓ Correct
◉	○	Causing a large left to right shunt results in the presence of a mid-diastolic murmur ✓ Correct
◉	○	Antibiotic prophylaxis are no longer required for dental extractions ✓Correct

80% of ventricular septal defects (VSDs) occur in the membranous part of the septum. 50% of VSDs are small and over 75% of these close spontaneously, and of the remaining moderate and large VSDs, 10% can be expected to close spontaneously. 90% of those destined to close will have done so before the age of 10 years. A loud second heart sound may indicate the onset of pulmonary hypertension (not benign). A large left to right shunt may increase flow across the mitral valve and cause a 'relative ' mitral stenosis and may result in the presence of a mid-diastolic murmur.

3 - The speed of uptake of volatile agents from the alveoli is directly related to the following factors:

True / False

◉	○	Minute ventilation ✓Correct
◉	○	Cardiac output ✓Correct
○	◉	Blood:Gas solubility coefficient ✓Correct
◉	○	Inspired partial pressure ✓Correct
○	◉	Minimum Alveolar Concentration (MAC) ✓Correct

Minute ventilation and inspired partial pressure of the volatile agent determine delivery of volatile to the site of uptake from the alveoli. Speed of uptake of volatile anaesthetic agents is not related to Minimum Alveolar Concentration value.

4 - With reference to the skeletal muscle myofilaments

True / False

●	○	actin is the major constituent of thin filaments ✓Correct
○	●	myosin and tropomyosin combine to form the thick filaments ✓Correct
●	○	troponin is a constituent of thin filaments ✓Correct
●	○	tropomyosin prevents the interaction of actin and myosin in the resting state ✓Correct
●	○	troponin C has 4 calcium binding sites ✓Correct

The thin filaments are made up of actin, tropomyosin, and troponin. The thick filaments, which are about twice the diameter of the thin filaments, are made up of myosin. Troponin, actin, and tropomyosin all constitute thin filaments. However, during the initiation of muscle contraction, Ca^{2+} binds to troponin C and tropomyosin is displaced laterally, which exposes the binding site for myosin on actin. Troponin C contains 4 Ca^{2+} binding sites for the Ca^{2+} that initiates contraction.

5 - Regarding the cardiac output:

True / False

●	○	it is reduced during sleep ✓Correct
○	●	it is altered by moderate changes in the environmental temperature ✓Correct
○	●	standing up from a lying position eventually results in a decrease in the cardiac output ✓Correct
○	●	histamine release in anaphylaxis may increase the cardiac output ✓Correct
○	●	eating a meal decreases the cardiac output ✓Correct

The fundamental equation in this MCQ is: the mean arterial pressure equals the product of the cardiac output and the systemic vascular resistance, i.e. MAP = CO x SVR. Sleeping is associated with reduced metabolic requirements, a decreased heart rate, blood pressure and hence a reduced cardiac output. Cardiac output is affected by changes in the individuals body temperature, but not by small changes in the environmental temperature. Standing up from a lying position results in a fall in venous return and an initial decrease in the cardiac output but it that eventually results in a compensatory increase in the cardiac output. Histamine is associated with vasodilatation that reduces the SVR and theoretically this may increase the cardiac output. However, in anaphylaxis the cardiac output is reduced and cardiac arrest may also occur. Post-prandially cardiac output is increased by 30%.

6 - The following statements compare alfentanil with fentanyl:

True / False

○	●	Alfentanil is more potent than fentanyl ✓Correct
●	○	Alfentanil is less lipid soluble than fentanyl ✓Correct
●	○	Alfentanil has a smaller volume of distribution than fentanyl ✓Correct

○	◉	Alfentanil has a slower onset of action than fentanyl ✓Correct
○	◉	Alfentanil has a slower offset of action than fentanyl ✓Correct

Alfentanil is less potent than fentanyl because of its lower lipid solubility and greater protein binding. Compared to fentanyl its onset and offset are faster by virtue of the fact that it has a lower pKa (i.e. is less ionized at physiological pH) and has a smaller volume of distribution (due to more protein binding).

7 - Is it true/false that high frequency jet ventilation (HFJV) has the following advantages?

True / False

○	◉	A double lumen tube is necessary ✓Correct
◉	○	Better operating conditions for the surgeon ✓Correct
○	◉	Can be used to administer volatile anaesthetic agents ✓Correct
○	◉	Improves the cardiovascular stability of the patient ✓Correct
◉	○	Is associated with less shear stress ✓Correct

High frequency jet ventilation (HFJV) is associated with the following advantages

- Less shear stress
- Improved operative field and conditions for the surgeon
- Ability to use single lumen tubes.

However, it cannot be used to administer volatile anaesthetic agents.

8 - The following statistical terms are true:

True / False

◉	○	The mode is the most commonly occuring value ✓Correct
○	◉	In distributions which are markedly skewed, the arithmetric mean is a more appropriate measure than the geometric mean ✓Correct
◉	○	The standard deviation is also referred to as the root mean square deviation ✓Correct
○	◉	In a positively skewed distribution, the mean always lies to the left of the mode ✓Correct

The mode refers to the most frequently encountered value, and in normally distributed data it coincides with the mean and median values.

In skewed data the geometric mean is the most appropriate measure (not the arithmetic mean).

Standard deviation (SD) is the square root of the variance and is a measure of distribution of the data.

In positively skewed data the mean usually lies to the right of the mode (not left).

9 - Gabapentin:

True / False		
○	◉	is a potent hepatic enzyme inducer ✓Correct
○	◉	side effects typically include visual field defects with long-term use ✓Correct
○	◉	therapy is best monitored through measuring plasma concentrations ✓Correct
○	◉	is indicated for use in absence attacks (petit mal) ✓Correct
◉	○	requires dose adjustment in renal disease ✓Correct

Gabapentin does not induce cytochrome P450 unlike other anticonvulsants such as phenytoin and phenobarbitone. Vigabatrin may cause visual field defects, which may be irreversible. Rarely have visual disturbances been associated with gabapentin. Gabapentin is of no use in Petit Mal, but is used for add-on therapy in partial or generalised seizures and used in the management of chronic pain conditions. Therapy does not require monitoring of plasma concentrations, but the dose should be adjusted in renal disease.

10 - Which of the following is/are true regarding benzodiazepines?

True / False		
◉	○	Convulsions may occur on withdrawal ✓Correct
○	◉	Long acting compounds are associated with more dependency problems than short acting compounds ✓ Correct
◉	○	Lorazepam has a half life of 12 hours ✓Correct
○	◉	Rebound anxiety may take two weeks to develop following withdrawal ✓Correct
○	◉	Reduce the chloride ion flux ✓Correct

Benzodiazepines have sedative, anxiolytic and anticonvulsant properties, and also cause muscle relaxation and amnesia.

They act by enhancing gamma-aminobutyric acid (GABA) mediated inhibition in the central nervous system, which enhances the chloride ion flux associated with the GABA receptor complex.

Short acting compounds are associated with more dependency problems than long acting compounds.

- Lorazepam has a half life of 12 hours
- Midazolam has a half life of one to three hours
- Temazepam has a half life of six to eight hours
- Diazepam has a half-life of 24 to 48 hours.

Rebound anxiety can occur within two days following withdrawal (not two weeks).

Convulsions may occur on withdrawing benzodiazepines but they are usually associated with rapid withdrawal.

11 - Adjustable pressure limiting valves:

True / False

○	◉	Are used in 'mapleson F' breathing systems ✓Correct
○	◉	In the fully open position are actuated by less than 0.5cmH2O ✓Correct
◉	○	Have 3 ports ✓Correct
◉	○	Are not prone to failure ✓Correct
◉	○	Have a hydrophobic disc as part of their makeup ✓Correct

Adjustable pressure limiting valves allow excess fresh gas and exhaled gases to exhaust from the breathing system. There is an inlet, patient and exhaust port (which can have scavenging attached). They are very reliable although the discs have been reported to have slipped off the spring and jam. The disc rests on a knife edge seating and is hydrophobic to stop condensation in the breathing system from causing the valve to stick.

12 - Which of the following statements concerning the management of trauma patients are/is true:

True / False

○	◉	patients intoxicated with alcohol have a lower peri-operative morbidity than non-intoxicated patients ✓Correct
○	◉	surgery on trauma patients should never be delayed ✓Correct
○	◉	nasal intubation should be performed on head injured patients that require post-operative ventilation on ICU ✓Correct
○	◉	blind nasal intubation is a safe technique in patients with a cervical spine injury ✓Correct
○	◉	suxamethonium should not be used within 24 hours following an extensive burn injury ✓Correct

Alcohol intoxication increases the risk of vomiting and aspiration, causes vasodilatation and cooling, increases the risk of arrhythmias and potentiates the effect of anaesthetic drugs.

Emergency surgery carries a higher risk than the same operation performed electively. Many elderly patients with hip fractures are frequently operated on during normal working hours, days after the injury.

Patients that require post-operative ventilation do not need to have a nasal endotracheal tube. Nasal intubation has a higher failure rate than oral intubation and potentially causes more damage. It is also contraindicated when a basal skull fracture exists. Studies have demonstrated that blind nasal intubation carries more risk of dislocation of fractured vertebrae than when performed using a laryngoscope. Manual in-line stabilization of the head and neck must be maintained whenever the cervical collar / sandbags or tape are removed in order to improve the view at laryngoscopy. The availability of a gum elastic bougie and other difficult intubation equipment should always be confirmed.

Patients with extensive burns have an increased number of extrajunctional acetylcholine receptors. Suxamethonium should be avoided in burns patients from 24 - 48 hours after the injury. Giving suxamethonium to these patients will lead to an increased release of potassium, causing arrhythmias and may lead to cardiac arrest.

13 - Which of the following are appropriate sites for arterial cannulation?

True / False

●	○	Radial artery ✓Correct
●	○	Femoral artery ✓Correct
○	●	Axillary artery ✓Correct
●	○	Dorsalis pedis artery ✓Correct
●	○	Brachial artery ✓Correct

Commonly used sites for the insertion of arterial cannulae include the

- radial artery
- femoral artery
- brachial artery
- dorsalis pedis artery.

Short catheters should be used for the radial and dorsalis pedis arteries. Longer, softer and more flexible cannulae should be used for the femoral and brachial arteries (to minimise injury).

The axillary artery should be avoided because the collateral circulation is limited.

14 - In Wolff-Parkinson-White syndrome:

True / False

●	○	There is abberant conduction between the atria and ventricles ✓Correct
●	○	Broad complex tachycardia is more frequent than narrow-complex tachycardia ✓Correct
○	●	Verapamil is the treatment of choice for an associated supraventricular tachycardia ✓Correct
●	○	Amiodarone increases the refractory period in the accessory path. ✓Correct
●	○	Atrial fibrillation is a well recognised rhythm disturbance ✓Correct

15 - In Wolff-Parkinson-White (WPW) syndrome abberant conduction between the atria and ventricles occurs through the Bundle of Kent. Broad complex tachycardia is more frequent than narrow-complex tachycardia, although orthodromic tachycardia is the commonest which frequently has phasic aberrant conduction making it broad. Amiodarone increases the refractory period in the accessory path and is helpful, but verapamil may exacerbate the rhythm disturbance. Atrial fibrillation is a well recognised rhythm disturbaThe actions of glucagon include:

True / False

●	○	glycogenolysis in the liver ✓Correct

○	◉	inhibition of insulin secretion ✓Correct
○	◉	has a half-life of 20 minutes ✓Correct
○	◉	inhibition of adenyl cyclase ✓Correct
◉	○	a positive inotropic effect on the heart ✓Correct

Glucagon is a hormone secreted by the alpha cells of the pancreatic islets. It causes hepatic adenylate cyclase stimulation, leading to the recruitment of glucose from hepatic stores (glycogenolysis and gluconeogenesis). It stimulates the secretion of growth hormone, insulin and somatostatin. It has a positive inotropic and chronotropic effect on the heart, which is unrelated to adrenergic receptors. Glucagon has a half-life of less than ten minutes.

nce that may progress to ventricular fibrillation.

16 - Regarding post-dural puncture headache:

True / False

○	◉	abdominal pressure increases the headache ✓Correct
○	◉	after performing an epidural blood patch the patient should have 24 hours bed rest ✓Correct
○	◉	an epidural blood patch is a contraindication to future epidural analgesia ✓Correct
◉	○	it may cause a subdural haematoma ✓Correct
◉	○	it may resolve spontaneously ✓Correct

Abdominal pressure often relieves the pain and abdominal binders use this principle. The patient should remain in bed for 2 hours (not 24) after an epidural blood patch and a blood patch is not a contraindication to subsequent central neurological blockade. Post-dural puncture headaches (PDPH) may resolve spontaneously, however rare complications include subdural haematoma and cranial nerve palsy.

17 - In describing the anatomy of the airways:

True / False

○	◉	There are 24 generations of passages ✓Correct
○	◉	The respiratory bronchioles are part of the first 16 generations ✓Correct
○	◉	Gas exchange occurs only in the alveoli ✓Correct
◉	○	The total cross-sectional area of the alveoli is approximately 12,000cm^2 ✓Correct
○	◉	The airflow velocity in the alveoli is high because of the narrowing in the airway size ✓Correct

The airway consists of 23 generations and the respiratory bronchioles are included in the distal 7 generations.

Gas exchange occurs within the respiratory bronchioles, alveolar ducts and alveoli. The cross-sectional area of the alveoli is 11,800cm^2 (or approximately 50-100m^2).

The velocity of airflow is low because of the large cross-sectional area of airways. In the alveoli gas flow is by diffusion, whereas in the conducting airways it is by bulk flow.

18 - Blood gas analyzers directly measures:

True / False

○	◉	the base excess ✓Correct
◉	○	the pH ✓Correct
○	◉	the bicarbonate concentration ✓Correct
◉	○	the partial pressure of oxygen ✓Correct
◉	○	the partial pressure of carbon dioxide ✓Correct

Blood gas analysers contain electrodes which measure the pH, and partial pressure (or tension) of oxygen and carbon dioxide. Base excess, the bicarbonate concentration and standard bicarbonate are derived from measurement of the pH and PCO_2.

19 - Halothane:

True / False

○	◉	At atmospheric pressure will boil at 70°C. ✓Correct
◉	○	Increases cerebral blood flow more than an equipotent amount of isoflurane. ✓Correct
○	◉	Has no effect on hypoxic pulmonary vasoconstriction. ✓Correct
◉	○	Sensitises the myocardium to catecholamines. ✓Correct
○	◉	Has a MAC (minimum alveolar concentration) of 1.15% ✓Correct

Halothane does cause LESS cerebral vasoconstriction than isoflurane, which explains why isoflurane is popular in neuroanaesthesia.

Halothane boils at 50°C and has a saturated vapour pressure (SVP) of 32.3 kPa. The SVP is almost identical to Isoflurane, and this may allow them be delivered using the same vaporiser e.g. oxford miniature vaporizer. Halothane does cause less cerebral vasoconstriction than isoflurane, which explains why isoflurane is popular in neuroanaesthesia.

All volatile agents inhibit hypoxic pulmonary vasoconstriction and therefore increase shunting. Halothane sensitises the myocardium to circulating catecholamines and this is one reason why surgeons usually ask the anaesthetist prior to infiltrating epinephrine (adrenaline) containing local anaesthetics. The minimum alveolar concentration (MAC) of halothane is 0.7% (not 1.15%).

20 - The insertion of a pulmonary artery catheter (flotation or flow-directed):

True / False

○	◉	is contraindicated in the presence of right bundle branch block ✓Correct
◉	○	is facilitated during deep inspiration in a spontaneously ventilating patient ✓Correct
◉	○	air in the manometer tubing may result in under estimation of the pulmonary artery occlusion pressure ✓ Correct

○	◉	is associated with rupture of a pulmonary vein ✓Correct
○	◉	is associated with a less than 10% incidence of arrhythmias ✓Correct

The complications associated with the insertion of pulmonary artery catheters (PACs) include: arrhythmias (up to 70%), right bundle branch block, pulmonary infarction, pulmonary artery (not vein) rupture (0.2%), sepsis, knotting of the catheter, endocardial damage and complications associated with central venous cannulation (arterial puncture, pneumothorax, air embolism).

For the PAC to enter the pulmonary circulation, it should be advanced during maximal pulmonary blood flow (inspiration with spontaneous ventilation and expiration with positive pressure ventilation). The manometer tubing connecting the pressure transducer to the PAC is fluid filled and it should be free of air bubbles, the presence of which can result in damping of the trace and under estimation of the pulmonary artery occlusion pressure.

21 - In a clinical trial of a new drug treatment, which of the following is/are correct?

True / False

○	◉	Allocation of treatment to each patient should be determined by disease severity ✓Correct
◉	○	Differences in baseline variables in patients allocated to different treatmentgroups are reduced by randomised allocation ✓Correct
◉	○	Patients receiving placebo treatment may improve ✓Correct
○	◉	Random allocation of treatment eliminates assessment bias ✓Correct
◉	○	The null hypothesis is rejected if there are significant differences in response in randomly allocated treatment groups ✓Correct

When comparing a new drug to placebo or current best treatment the best method is a randomised double blind study.

Patients should be unselected and, on entry into the study, randomly allocated to the new drug or the placebo treatment. This can be achieved from a random number table and allocating even numbers to one treatment and odd numbers to the other.

Baseline differences may occur in studies of small numbers of patients, the larger the groups the less likely there is to be a significant difference between the two groups.

Random allocation then allows examination of the null hypothesis which is that there is no difference between the treatments. Significant differences between the two treatment groups allow the null hypothesis to be rejected.

Patients receiving placebo may improve due to the natural history of their disease or to the increased doctor input associated with clinical trials.

Random allocation does not affect assessment bias. This is eliminated by the treatments being blinded to patient and doctor.

22 - In statistics the following are true:

True	False	
◉	○	The standard deviation (SD) is greater than the standard error of the mean (SEM) ✓Correct
○	◉	The SEM determines the accuracy of measurement of the observations ✓Correct
◉	○	The SD is a measure of observation variability ✓Correct
○	◉	SD = SEM/(square root of sample size) ✓Correct
○	◉	The SD equals the SEM in non-parametric tests ✓Correct

The standard error of the mean or SEM equals the standard deviation or SD divided by the square root of sample size. SEM is the standard deviation of all the means of large random samples of size n from a given population. It is of central importance in significance testing. If testing to see if there is a difference between two population means (e.g. t test) then t=difference in means/SEM. The SD is a measure of observation variability and is greater than the standard error of the mean (SEM).

23 - Which of the following statements concerning statistical tests is true:

True	False	
◉	○	regression analysis determines the magnitude of change of one variable produced by the other variable ✓Correct
◉	○	Student's t-test is a parametric test ✓Correct
○	◉	correlation coefficients vary between -10 and +10 ✓Correct
◉	○	r is the symbol denoting coefficent of correlation ✓Correct
◉	○	y=a+bx is a regression equation ✓Correct

Regression analysis determines the magnitude of change of one variable produced by the other variable, and is expressed as the slope of the best line fit. The correlation coefficients vary between -1 and +1 and indicates complete positive or negative association respectively. When r is zero there is no linear correlation. y=a+bx is the equation of a straight line. Student's t-test is a parametric test. The following reference provides some guidance on .

24 - Which of the following is statistically significant:

True	False	
○	◉	r = -1 ✓Correct
○	◉	p < 0.5 ✓Correct
○	◉	t = 1 ✓Correct
◉	○	p < 0.01 ✓Correct
○	◉	chi^2 = 0.5 ✓Correct

A perfect correlation is when r is either -1 or +1, but this may not be statistically significant; the significant p value is < 0.05 (not 0.5); when t is >1.96 it may be significant but it depends on the degrees of freedom; chi^2

must be >= 3.84 to reach conventional level of significance ($p<0.05$). If degrees of freedom is >1, chi^2 needs to be even higher to be statistically significant.

25 - Regarding standard error of the mean (SEM) and standard deviation (SD):

True / False

○	●	SEM is calculate by taking the square root of the SD of the sample means ✓Correct
○	●	SD invariably falls with increasing sample size ✓Correct
○	●	SEM increases with sample size ✓Correct
○	●	If SD is greater than the mean, the distribution is positively skewed ✓Correct
○	●	Student's t test is a non-parametric test ✓Correct

The standard error of the mean, SEM = SD/sq root n. SD does not necessarily fall with sample size as the distribution of values may increase and hence SD increase. SEM would decrease with sample size as can be seen in the above calculation. Skewness does not depends on whether SD is greater than or less than the mean. Student's t test is a parametric test comparing normally distributed data.

26 - In a clinical trial of a new drug:

True / False

●	○	randomization ensures that each patient has an equal chance of being allocated a certain treatment ✓Correct
○	●	patients who withdraw from the study or are lost to follow up cannot be included in the final analysis ✓Correct
○	●	if there are significant differences in response in randomly allocated treatment groups the null hypothesis should be accepted ✓Correct
●	○	increasing the number of patients involved in the trial will reduce the baseline differences between the groups ✓Correct
●	○	stratified random allocation of treatment is appropriate where the number of patients is small ✓Correct

In a clinical trial of a new drug, randomization attempts to ensure that each patient has an equal chance of being allocated a certain treatment. Patients who withdraw from the study or are lost to follow up, may have suffered side effects or even have died from being given the drug, so can't be excluded. The null hypothesis is true if there are no significant differences in response. Increasing the number of patients involved in the trial will reduce the baseline differences between the groups. Stratified random allocation of treatment is appropriate where the number of patients is small and can be by age, sex, disease duration, etc.

27 - Randomised controlled trials in single patients (n of 1 trials):

True / False

○	●	need to be repeated in many patients to achieve significant results ✓Correct
○	●	can guide treatment in other patients ✓Correct
●	○	are useful where the patient doubts the effectiveness of a treatment ✓Correct
○	●	have an advantage in studying drugs with long half lives ✓Correct

In an 'n of 1' trial the treatment and placebo are given at random treatment periods to the same patient. The results are specific to one drug and the patient studied and cannot usually be generalised. They are useful where the patient doubts the effectiveness of a treatment or where the practitioner has doubts. Also useful for dosing or working out if a symptom is a side effect or not. Drugs with short lived effects are best, as long wash-out periods need to be included for long-acting drugs.

28 - In a double blind placebo control clinical trial:

True / False

○	◉	some of the patients are not treated ✓Correct
◉	○	some of the patients receive a placebo ✓Correct
◉	○	the patients do not know which treatment they receive ✓Correct
○	◉	everybody receives both treatments ✓Correct
◉	○	the clinician does not know which treatment the patient has received ✓Correct

In double blind placebo control clinical trials neither the patient nor the clinician knows which treatment option the patient has received. It would hardly be blind to the patient if this were the case. If everybody received both treatments then this would be a 'double blind crossover study'. The clinician remains blind to the treatments received by the patients until the study has finished.

29 - The following statistical statements are true:

True / False

◉	○	the geometric mean is always less (or at most equal) in value than the arithmetic mean ✓Correct
◉	○	the arithmetic mean is the preferred measure in symmetrically distributed data ✓Correct
◉	○	the median is also called the measure of central value ✓Correct
○	◉	the standard deviation is a poor measure of dispersion ✓Correct
○	◉	the mode is the value of a variable which occurs with the least frequency ✓Correct

The geometric mean is the nth root of the product of (a1 ... aN) and the arithmetic mean is (a1+ ...+aN)/N hence the geometric mean will always be less than (or at most equal if all values are equal) the arithmetic mean. The arithmetic mean is preferred in normal stats as it generally represents the average. The standard deviation (SD) provides a good indication (not poor) of distribution about the mean. The mode represents the number occuring with greatest frequency (not least frequency).

30 - Are the following electrocardiogram (ECG) changes associated with a suspected myocardial infarction?

True / False

○	◉	In a subendocardial MI, S-T elevation and T wave inversion occurs in leads facing the infarcted area ✓Correct
○	◉	Myocardial infarction cannot be diagnosed in the presence of right bundle branch block ✓Correct
◉	○	Myocardial infarction causes 'convex upwards' S-T elevation ✓Correct
◉	○	Right ventricular infarction cannot be diagnosed using a standard 12 lead ECG ✓Correct

○	◉	True posterior left ventricular infarction is characterised by pathological Q waves, tall R waves and inverted T waves in V_1 and V_2 ✓Correct

The usual ECG changes following an acute myocardial infarction include S-T elevation greater than 1 mm (convex upwards, concave downwards) developing within the first few hours. Tall peaked T waves may also be seen in the acute stages.

Pathological Q waves (representing transmural infarction), a reduction in R wave height and deeply inverted T waves (in the leads facing the infarcted muscle) may develop over the next 72 hours.

The absence of Q waves implies partial-thickness infarction. A subendocardial MI is associated with flat S-T depression (not elevation) and T wave inversion in leads facing the infarction.

The S-T segment changes following a myocardial infarct usually resolve within days. The T wave changes often persist for weeks but may be permanent. The Q waves are usually, but not always, permanent.

It is possible to diagnose an acute MI in the presence of right bundle branch block and also in left bundle branch block when using non-standard ECG criteria.

True posterior left ventricular infarction is characterised by tall R waves, S-T depression and peaked upright (not inverted) T waves in leads V_1 and V_2. Right ventricular infarction does not produce a specific pattern in the standard 12 lead ECG, so the use of right-sided precordial leads (V_4R - V_6R) are required.

31 - A fixed inspired oxygen concentration (FiO2) can be delivered by:

True / False

◉	○	high air flow oxygen enrichment (HAFOE) devices ✓Correct
◉	○	venturi systems ✓Correct
◉	○	an oxygen tent ✓Correct
◉	○	the Mapleson A system with a fresh gas flow greater than the minute volume ✓Correct
◉	○	demand valves ✓Correct

An accurate inspired oxygen concentration (FiO_2), which is independent of the respiratory rate and the peak inspiratory flow rate, can be delivered by fixed performance devices.
High air flow oxygen enrichment devices (HAFOE) use the venturi effect and provide a fixed FiO_2. Oxygen tents also provide a fixed FiO_2 and demand valves can form part of fixed FiO_2 devices.

A Mapleson A system with a fresh gas flow equal to the minute volume will deliver a fixed FiO_2. However, maintaining a fresh gas flow that is greater than the minute volume is excessive and wasteful of fresh gas.

32 - The classification of breathing system:

True / False

◉	○	Open and semi-open systems are examples of the Conway classification ✓Correct
○	◉	The Mapleson classification of breathing systems is a further description of Conway's semi-open systems ✓Correct
○	◉	The Bain is classified as a Mapleson A ✓Correct
○	◉	The Bain is a coaxial version of the Magill ✓Correct
○	◉	The Jackson Rees modification is a Mapleson D with an open ended bag ✓Correct

Breathing systems have been classified by Conway and Mapleson.

The Conway classification includes four categories

1. Open
2. Semi-open, e.g. Schimmelbusch mask
3. Semi-closed, e.g. the Mapleson classification (not semi-open)
4. Closed, e.g. the circle.

Mapleson classified breathing systems into five groups A to E:

1. Mapleson A, e.g. Magill and Lack (coaxial A)
2. Mapleson B
3. Mapleson C
4. Mapleson D, e.g. Bain (coaxial D)
5. Mapleson E (T piece).

Jackson Rees later modified the Mapleson E by adding an open ended bag, which has since become known as the Mapleson F.

33 - Diffusion capacity of carbon monoxide:

True / False

○	◉	Is a specific measure of lung perfusion ✓Correct
◉	○	Depends on the thickness of the alveolar wall ✓Correct
◉	○	Depends on the surface area available for gas exchange ✓Correct
○	◉	Is increased in cigarette smokers ✓Correct
○	◉	Is increased in emphysema ✓Correct

By Fick's law, the volume of gas diffusing across a membrane equals A/T x D x difference in partial pressure.

In life it is impossible to measure accurately the area (A) or the thickness (T), and these are subsumed into a single constant, the diffusion capacity for carbon monoxide.

DL=volume of transferred carbon dioxide divided by partial pressure difference between the alveoli and the capillary blood. Since the capillary blood normally does not contain carbon dioxide this term disappears.

Diffusion will be increased in healthy compared with unhealthy lungs, where the thickness is likely to increase and the surface area available for gas exchange to decrease.

Ventilation-perfusion imbalances can indirectly interfere with carbon dioxide diffusion capacity by decreasing the available area of lung for gas exchange, but it is not a specific measure of lung perfusion. Is is not increased in cigarette smokers or in emphysema.

34 - Regarding carbon dioxide absorbers:

True / False

○	●	Baralyme consists mainly of barium hydroxide ✓Correct
●	○	Silicates are used to prevent crumbling of the soda lime granules ✓Correct
●	○	Soda lime mainly consists of calcium hydroxide ✓Correct
●	○	1 kg of soda lime can absorb up to 250 litres of carbon dioxide ✓Correct
●	○	The ideal size of the granules is approximately 0.5 cm in diameter ✓Correct

Baralyme contains barium hydroxide, whereas soda lime contains calcium hydroxide (not sodium hydroxide), but both mainly consist of calcium hydroxide (80% and 94% respectively).

Soda lime granules contain: 94% calcium hydroxide, $Ca(OH)_2$; 5% sodium hydroxide, NaOH; 1% potassium hydroxide, KOH; 15% water; and a pH indicator that changes colour when the soda lime is exhausted. The reaction between sodium hydroxide and carbon dioxide is exothermic: $2NaOH + CO_2 = Na_2CO_3 + H_2O + HEAT$

Baralyme contains about 20% barium octahydrate and 80% calcium hydroxide but is less efficient than soda lime at absorbing carbon dioxide. It produces less heat and is more stable in dry atmospheres.

Silicates are used to prevent crumbling of the granules which are approximately 0.25-0.5 cm in diameter which corresponds to 4-8 mesh. 100 g of soda lime can absorb 25 litres of CO_2.

35 - When blood passes through systemic capillaries

True / False

●	○	Bicarbonate ions pass from the red cells to the plasma ✓Correct
●	○	Its oxygen dissociation curve shifts to the right ✓Correct
○	●	The concentration of chloride ions in the red cells falls ✓Correct
○	●	The pH increases ✓Correct
●	○	The velocity of blood flow is less than in the aorta ✓Correct

CO_2 diffuses into plasma and the red blood cells; HCO_3^- is formed faster in the red blood cells because of carbonic anhydrase, and therefore HCO_3^- moves out of the cells into the plasma.

The rise in CO_2 shifts the curve to the right (Bohr effect), i.e. with an increased PCO_2, haemoglobin has a diminished ability to bind O_2, and therefore gives it up to the tissue more readily.

Increasing temperature and a decrease in pH will also cause a rightward shift in the curve. Even though the volume must be the same as that in the aorta, the flow must be lower because the total cross sectional area is greater.

36 - Which of the following is/are true regarding pulse oximetry?

True / False

●	○	Hypothermia produces a left shift in the oxygen dissociation curve ✓Correct
○	●	If the readings are very poor the cause is most likely to be mechanical ✓Correct
○	●	Is unaffected by the carboxyhaemoglobin level ✓Correct

◉	○	Is unreliable when used on the same side as the blood pressure cuff ✓Correct
○	◉	The relationship between the partial pressure of oxygen in arterial blood ($Pa0_2$) and percentage oxygen saturation ($\%SaO_2$) is linear ✓Correct

Pulse oximetry is a non-invasive method of assessing arterial oxygen saturation and heart rate.

Any cause of poor peripheral perfusion causes unreliable readings including external compression by a blood pressure cuff.

Though there may be mechanical causes for poor pulse oximetry readings you should always look for a physiological cause first. For example vasoconstriction is one of the first compensatory mechanisms employed by the body following blood loss. In these situations it is often helpful to check pulse rate in comparison to the ECG.

Other causes of error include abnormal pigments such as

- bilirubin
- methaemoglobin
- carboxyhaemoglobin.

Jaundice underestimates the actual oxygen saturation, whereas carbon monoxide poisoning overestimates the level of saturation.

When the partial pressure of oxygen is plotted against percentage saturation, a sigmoidal curve is produced. The middle range of the curve is therefore particularly important, as small changes in partial pressure will cause large changes in saturation.

Certain factors may result in 'shifts' in the curve. Reduced pH, increased temperature, partial pressure of carbon dioxide and 2,3-diphosphoglycerates cause a right shift in the curve. This means that haemoglobin gives up oxygen more easily to the tissues.

37 - *Pneumocystis jirovecii*:

True / False

◉	○	Predisposes to pneumothorax ✓Correct
◉	○	Can cause pneumonia with few signs on chest x ray ✓Correct
○	◉	Is an obligate intracellular organism ✓Correct
◉	○	May cause extrapulmonary infection ✓Correct
○	◉	Is usually diagnosed by finding a increasing titre of neutralising antibodies ✓Correct

Pneumocystis jirovecii pneumoniae (PCP) is a life-threatening infection occurring in immunosuppressed hosts.

With rare exceptions, the organism is localised to the lungs. It is a common extracellular parasite (not intracellular), that has attributes of both fungi and protozoa. It affects 40% of infants and children with AIDS and 12% of those with leukaemia if prophylaxis is not given.

It causes big problem in adults with AIDS, and is an AIDS defining illness. Cell mediated immunity is the major defence mechanism, so PCP is common in those with severe combined immune deficiency, while it is rarely found in X-linked agammaglobulinaemia.

There are two clinical forms:

1. Epidermic infantile, which occurs in 3-6 month old infants, with subtle onset of tachypnoea but no fever. There is progressive recession and increased work of breathing with cyanosis.
2. Sporadic, which occurs in children and adults with immune deficiency where there is
    3.

    1. an abrupt fever
    2. tachypnoea
    3. dyspnoea
    4. cough with cyanosis.

Added sounds are usually minimal in both forms.

The chest x ray reveals bilateral diffuse alveolitis, initially perihilar, progressing peripherally, with apical sparing. However, the x ray may be normal in adults and the presenting features may include only high fever and hypoxia. Pneumothorax is common.

Definitive diagnosis requires demonstration of the organism in the lung by bronchio-alveolar lavage, tracheal aspirates, or bronchial brushings, transbronchial lung biopsy, needle aspiration or open lung biopsy (not an increasing titre of neutralising antibodies).

Treatment is high dose septrin plus steroids. Extrapulmonary infections do occur.

38 - In trauma patients, the treatment of acute pain is associated with which of the following?

True / False

◉	○	Decreased incidence of pulmonary complications ✓Correct
◉	○	Decreased muscle spasm ✓Correct
◉	○	Decreased risk of thromboembolism ✓Correct
○	◉	Improved identification of clinical signs ✓Correct
○	◉	Increased metabolic processes ✓Correct

Appropriate analgesia should be given to all trauma patients.

Pain will usually cause immobilisation of the patient and thus increases the risk for the development of venous thrombosis and venous thromboembolism. When in pain, patients have shallow respirations and usually are reluctant to cough or sigh. This causes atelectasis and increases the risk of pulmonary infections. When adequate analgesia is provided, tidal volumes are greater with less atelectasis and a reduced incidence of pulmonary complications is seen.

Pain causes adrenergic stimulation and this increases metabolic responses, e.g.

- gluconeogenesis
- glycolysis
- lipolysis
- production of free fatty acids.

Treatment of pain will decrease this response.

Pain associated with fractures can cause skeletal muscle spasm, which if left untreated only helps to maintain the pain, but can also make the reduction of fractures very difficult.

Although analgesia improves patient co-operation during examination and radiological investigation, some important clinical signs and symptoms can be masked. The interpretation of an abdominal examination may be more difficult and some cervical spine fractures have also been missed following the administration of analgesia.

39 - May tourniquets be used in the following?

True / False

○	◉	Deep vein thrombosis ✓Correct
◉	○	Diabetes ✓Correct
◉	○	Elderly patients ✓Correct
○	◉	Limb infections ✓Correct
○	◉	Sickle cell disease ✓Correct

Tourniquets may be used in the elderly and in diabetics who do not have peripheral neuropathy.

They are contraindicated in patients with

- sickle cell disease
- any peripheral vascular disease (including deep vein thrombosis)
- limb infections.

40 - Regarding acute pulmonary embolism:

True / False

○	◉	D-dimer assay has high specificity ✓Correct
◉	○	If associated with a pleural effusion, is characteristically haemorrhagic ✓Correct
○	◉	If the x ray is normal then one must question the diagnosis ✓Correct
◉	○	It may occur in patients with a raised white count ✓Correct
◉	○	It may remain undetected until up to 50% of pulmonary vascular bed is involved ✓Correct

Acute pulmonary embolism (PE), is associated with numerous diseases and has many risk factors.

The D-dimer assay has high sensitivity but low specificity, with positive results seen in DIC, malignancy and following surgery.

If the PE is associated with a pleural effusion, the exudate is commonly haemorrhagic.

The x ray is often normal and so is often not very helpful.

An elevated white cell count is characteristically associated with malignancy and trauma etc., which are both associated with PE.

41 - Cavitation on the chest x ray may be seen in:

True / False

○	◉	Sarcoidosis ✓Correct
◉	○	Pulmonary infarction ✓Correct
○	◉	Legionnaires' disease ✓Correct
◉	○	Klebsiella pneumonia ✓Correct
○	◉	Viral pneumonia ✓Correct

Causes of cavitating lesions seen on chest x ray include

- squamous cell carcinoma
- abscess (*Staphylococcus aureus*, *Klebsiella*and *Pseudomonas aeruginosa*)
- pulmonary infarction
- lymphoma
- rheumatoid nodule
- Wegener's granulomatosis.

Sarcoidosis causes pulmonary fibrosis and hilar lymphadenopathy, and Legionnaires' disease causes atypical pneumonia.

Viral pneumonia is not associated with cavitating lesions.

42 - In acute pancreatitis:

True / False

○	◉	A necrotic pancreas is an indication for early surgery ✓Correct
○	◉	A poor prognosis may be indicated by a serum urea greater than 10 mmol per litre ✓Correct
◉	○	A 'sentinel loop' may be visible on the abdominal x ray ✓Correct
◉	○	Acute pancreatitis may be associated with hyperglycaemia ✓Correct
○	◉	The serum calcium is usually high ✓Correct

Acute pancreatitis is an auto-digestive process which is commonly associated with biliary tract disease or excessive alcohol intake.

Other recognised causes include

- abdominal trauma
- mumps
- hypothermia

- diuretic and steroid therapy.

The classical laboratory findings include

- raised serum amylase
- leucocytosis
- hyperglycaemia
- hypocalcaemia
- hypoproteinaemia
- hyperlipidaemia.

An abdominal x ray may reveal a 'sentinel loop' of small bowel overlying the pancreas. The chest x ray can show a wide range of pathology.

Poor prognosis may be indicated by

- age >55 years
- systolic blood pressure <90 mmHg
- white cell count >15 x 10^9/l
- temperature >39°C
- glucose >10 mmol/l
- PaO_2 <8 kPa
- urea >15 mmol/l
- calcium <2 mmol/l
- haematocrit reduced by over 0.1
- abnormal liver function tests.

Surgery may be required for drainage of an abscess or pseudocyst, but the resection of a necrotic pancreas early in the disease has a high mortality.

43 - Causes of calcification on the chest x ray include:

True / False

◉	○	Asbestosis ✓Correct
◉	○	Mitral stenosis ✓Correct
○	◉	Rubella ✓Correct
◉	○	Sarcoidosis ✓Correct
◉	○	Varicella zoster virus infection ✓Correct

Causes of calcification on the chest x ray include

- mediastinal tuberculosis
- pleural tuberculosis
- fungal infections (histoplasmosis, coccidioidomycosis)
- silicosis (5%, eggshell calcification of hilar nodes)
- sarcoidosis (pebble-like or eggshell of hilar nodes but no intrapulmonary calcification)
- Hodgkin's disease
- calcified blood vessels
- calcified mediastinal tumours
- empyema
- haemothorax
- encysted pleural effusion
- asbestosis
- working with talc
- interstitial nodules
- previous varicella pneumonia (especially if adult onset)
- hydatid disease
- mitral stenosis (secondary to haemosiderosis)
- malignancy
- pneumoconiosis
- Caplan's syndrome.

Rubella is not associated with calcification on the chest x ray.

44 - Do the drugs used for treating phaeochromocytoma have the following properties?

True / False		
○	◉	Labetalol has stronger alpha blocking than beta blocking properties ✓Correct
○	◉	Phenoxybenzamine is a pure alpha-1 blocker ✓Correct
◉	○	Phentolamine blocks both alpha-1 and alpha-2 receptors ✓Correct
○	◉	Prazosin blocks both alpha-1 and alpha-2 receptors ✓Correct
◉	○	Tachyphylaxis may occur to alpha adrenergic blockers ✓Correct

Labetalol is a stronger beta-blocker than an alpha-blocker (3-7 times greater).

Phenoxybenzamine and phentolamine block alpha-1 and alpha-2 receptors.

Prazosin is a selective alpha-1 blocker.

Tachyphylaxis can occur to alpha adrenergic blockers.

45 - Which of the following are SI unit?:

True / False

○	◉	A newton is the unit of power ✓Correct
○	◉	A watt is the unit of energy ✓Correct
○	◉	A hertz is the unit of frequency ✓Correct
◉	○	A metre is the unit of length ✓Correct
○	◉	A gram is the unit of mass ✓Correct

The system of units or SI (Système international d'unités) was introduced in 1960 and is based on the metric system. There are seven base units:

1. metre
2. second
3. kilogram
4. ampere
5. kelvin
6. candela
7. mole.

Derived units include the newton, pascal, joule, watt and hertz.

46 - Thrombocytopaenia is a recognised side effect of:

True / False

◉	○	Aspirin ✓Correct
◉	○	Quinine ✓Correct
◉	○	Thiazide diuretics ✓Correct
◉	○	Gold ✓Correct
◉	○	Alpha-methyldopa ✓Correct

Thrombocytopaenia is a platelet count below 100 x 10^9. It is a recognised side effect of

- thiazide diuretics
- aspirin
- alcohol toxicity
- quinine
- gold

- heparin
- alpha-methyldopa.

47 - Which of the following is/are true regarding a ventricular septal defect?

True	False	
◉	○	Causes 'fixed splitting' of the second heart sound. ✓Correct
◉	○	Is associated with plethoric lung fields on chest x ray in a ten week old infant. ✓Correct
○	◉	Is likely to cause heart failure in the first week of life. ✓Correct
○	◉	Responds well to surgical correction if central cyanosis occurs. ✓Correct
○	◉	Requires surgical correction in all but a few cases. ✓Correct

A ventricular septal defect (VSD) is unlikely to present until after the first month of life and is associated with pulmonary plethora. The majority of cases will resolve spontaneously.

Central cyanosis indicates shunt reversal and pulmonary hypertension, which implies poor prognosis and response to operative repair of the VSD.

The second heart sound is normally split.

48 - Regarding prophylactic antibiotic administration:

True	False	
○	◉	The dose of antibiotic given should reflect the severity of infection ✓Correct
◉	○	A second dose should be given if the surgical procedure exceeds 4 hours ✓Correct
○	◉	Must be given at induction of anaesthesia ✓Correct
◉	○	A single dose is usually sufficient ✓Correct
○	◉	Is not required in ‘clean’ surgical procedures ✓Correct

In adults, the full dose of antibiotic should be administered unless there is a concern regarding excretion of the drug, e.g. in renal failure. The dose is not usually adjusted to account for the severity of the infection. In procedures lasting more than four hours, a second dose of antibiotic is advised. Otherwise, single-dose antibiotic prophylaxis is sufficient and effective in most clinical situations. Antibiotics should be administered at a convenient time close to the start of surgery. This can be pre-operatively or peri-induction, in order to achieve high plasma levels of the antibiotic prior to inflating tourniqets or incising the skin. Clean surgical procedures where synthetic materials are implanted do require antibiotic prophylaxis.

49 - The following statements regarding intravenous solutions are correct.

True	False	
○	◉	Normal saline contains 180 mmol/l of sodium ✓Correct
◉	○	Ringer's lactate solutions is designed for extracellular fluid replacement ✓Correct
◉	○	Sodium bicarbonate 8.4% is a hyperosmolar solution ✓Correct
○	◉	0.18 saline in 4.0% dextrose is appropriate for the initial management of an infant with signs of peripheral

		circulatory failure ✓Correct
◉	○	Normal saline with added potassium is appropriate therapy to correct a non-respiratory alkalosis ✓Correct

Normal saline contains 154 mmol/l of sodium.

Ringer's solution is also known as Hartmann's solution. It is a crystalloid and contains 131 mmol/l of sodium and 111 mmol/l of chloride. It is ideally balanced. In an extracellular loss such as diarrhoea or haemorrhage sodium falls and therefore administration of a hyponatraemic solution may further compound the problem. Ringer's is more appropriate.

Sodium bicarbonate 8.4% is a hyperosmolar solution with an osmolarity of approximately 2000 mOsmol/l.

0.18% saline in 4% dextrose is also called dextrose saline. It is a crystalloid containing 30 mmol/l of sodium and 30 mmol/l Cl. A child showing signs of hypovolaemia or signs of a peripheral circulatory collapse needs to be resuscitated with plasma expanders preferably. These include colloid fluids such as blood or plasma. They exert an oncotic pressure and thus retain fluid in the circulating volume. Crystalloid fluids containing iso or hypotonic concentrations of sodium do not remain in the plasma volume following IV administration. The volume of distribution of these fluids is extracellular and thus only provides a short term expansion of the circulating volume.

Normal saline with additional potassium is used in the correction of metabolic alkalosis.

50 - Differences between the adult and paediatric airway include which of the following?

True / False

○	◉	A Macintosh laryngoscope is preferred in neonates ✓Correct
◉	○	The angle of the tracheal bifurcation is greater in a child ✓Correct
◉	○	The larynx of a child is higher and more anterior ✓Correct
○	◉	The soft tissues of a child's oropharynx are large compared to the oral cavity making intubation easier ✓Correct
◉	○	When intubating an adult the tip of the laryngoscope should be anterior to the epiglottis and in a child behind the epiglottis ✓Correct

Anatomical differences between adults and children must be considered during intubation.

For instance the angle of tracheal bifurcation is greater and the main bronchi come off at the same angle in children, whereas in adults the right main bronchus is more vertical and therefore more prone to inadvertent intubation.

However, children have comparatively larger soft tissues, including a floppy epiglottis.

In paediatric intubation a straight bladed laryngoscope (i.e. McCoy) is placed behind the epiglottis holding it in position, so that it may be lifted to expose the slightly more antero-caudal placed cords.

In adults a curved Macintosh blade, with the tip in the vallecula anterior to the epiglottis, is used.

51 - Management of the airway may be difficult in which of the following syndromes and conditions?

True / False		
●	○	Crouzon's syndrome ✓Correct
●	○	Cystic hygroma ✓Correct
●	○	Edwards' syndrome ✓Correct
●	○	Goldenhar's syndrome ✓Correct
●	○	Hurler's syndrome ✓Correct

All of the syndromes and conditions listed are associated with difficult airway management.

Crouzon's syndrome is an autosomal dominant craniofacial disorder. Features of this syndrome include hypoplastic maxillae and a high arched palate, which is occasionally cleft.

A cystic hygroma may occasionally appear high in the anterior triangle and have an associated intraoral lymphangioma. The airway compromise can be compounded by mediastinal extension of the hygroma.

Trisomy 18 or Edwards' syndrome is associated with apnoeic spells and micrognathia.

Goldenhar's syndrome (oculoauriculovertebral dysplasia) is a combination of micrognathia and an abnormal cervical spine, including odontoid elongation. The risk of cord injury is high and the airway management plan may require tracheostomy.

Hurler's syndrome is an autosomal recessive disorder characterised by an L-iduronidase deficiency. Deposition of acid mucopolysaccharide occurs in every organ system and they are prone to upper airway obstruction (large tongue, laryngeal and pulmonary lymphoid tissue infiltrates).

52 - Are the following statements concerning the laryngeal mask airway true?

True / False		
○	●	A size 2.5 laryngeal mask has a cuff inflation volume of 10 ml ✓Correct
●	○	A size 4 laryngeal mask has an internal diameter of 10 mm ✓Correct
●	○	Downfolding of the epiglottis occurs in 10% of patients ✓Correct
●	○	Reinforced laryngeal masks have a higher flow resistance ✓Correct
○	●	When the laryngeal mask is correctly positioned the black line on the tube should face the lower lip ✓Correct

The laryngeal mask airway (LMA) is a widely used device and provides an alternative to the face mask or tracheal tube during anaesthesia. Seven different sizes of LMA are available that are designed for use in infants to large adults.

The recommended cuff inflation volumes on LMA sizes 1, 2, 2.5, 3, 4, 5 and 6 are 4, 10, 14, 20, 30, 40 and 50 ml respectively.

In order to reduce the flow resistance to a minimum, LMAs have wide internal diameters (e.g. the internal diameter of sizes 2, 3, 4, and 5 are 7, 10, 10 and 11 respectively).

Reinforced LMAs are longer and have smaller internal diameters than standard LMAs, causing an increase in flow resistance.

At the junction of the tube and the cuff on the LMA, there are slits that prevent the epiglottis from obstructing the airway. However, 10% of patients still develop an obstructed airway due to downfolding of the epiglottis.

Rotation of the LMA can result in complete obstruction of the airway.

A black line is present along the length of the tube and when an LMA is correctly orientated, the black line should face the upper lip (not lower lip).

53 - Are the following statements true regarding intravenous fluids?

True	False	
○	◉	5% dextrose has a pH of 6.0 ✓Correct
◉	○	Haemaccel causes histamine release ✓Correct
◉	○	Hartmann's solution contains 131mmol/l of sodium ✓Correct
○	◉	Normal saline contains 150 mmol/l of both potassium and chloride ✓Correct
◉	○	The average particle size in hydroxyethyl starch is 70,000 kDa ✓Correct

All dextrose containing crystalloid solutions have a pH of 4.0 (not 6.0).

Haemaccel does cause histamine release and at 0.15% has a low incidence of allergic reactions.

Hartmann's solution (compound sodium lactate or Ringer's lactate) contains 131 mmol/l of sodium, 111 mmol/l of chloride, 5 mmol/l of potassium, 2 mmol/l of calcium and 29 mmol/l of lactate.

Normal saline or 0.9% sodium chloride contains 154 mmol/l of both sodium and chloride in water, and it does not contain potassium.

At 70,000 kDa hydroxyethyl starch has an average particle size similar to albumin.

54 - Characteristic features of acute intermittent porphyria include

True	False	
○	◉	Excessive faecal protoporphyrin excretion ✓Correct
○	◉	Excessive urinary porphobilinigoen between acute attacks ✓Correct
○	◉	Hypernatraemia during attacks ✓Correct
○	◉	Photosensitivity ✓Correct
○	◉	Autosomal recessive inheritance ✓Correct

Acute intermittent porphyria is a autosomal dominant disorder caused by a defect in porphobilinogen deaminase activity.

Many cases exist in latent form, but in manifest cases it is more frequently seen in women. The estimated prevalence of the disorder is 5-10 cases per 100,000 population.

The latent form of the disease may exist indefinitely, but certain drugs, infections, and excessive dieting (starvation) can precipitate attacks. The most common drugs are sulfonamides and barbiturates (often seen when given phenobarbital for pain relief with dental surgery). The defect in porphobilinogen deaminase causes a build up of ALA and porphobilinogen (PBG) which causes their increased secretion in the urine.

Attacks of neurological dysfunction are associated with increased levels of ALA and PBG excretion in the urine, with the levels dropping as the patient's condition improves.

At the time of an acute attack, screening tests like the Hoesch or Watson-Schwartz test for the detection of PBG in urine should be carried out. A positive screening test should always be confirmed by a quantitative test for PBG in the urine.

To discriminate acute intermittent porphyria from variegate porphyria and hereditary coproporphyria, which also can have increased PBG in the urine, a specific test for erythrocyte PBG deaminase activity is required.

55 - An elderly man with emphysema is scheduled for his fourth revision of an amputation wound in as many weeks.

Which of the following pre-operative investigations are essential?

True / False

○	◉	Chest x ray ✓Correct
○	◉	Lung function tests ✓Correct
○	◉	A 12 lead ECG ✓Correct
○	◉	Arterial blood gases ✓Correct
◉	○	Full blood count and urea and electrolytes ✓Correct

The main point to note in this question is that the patient is about to have his fourth operative procedure in as many weeks.

The patient is known to have emphysema and will undoubtedly have been extensively investigated before his previous operations. Therefore, unless his pulmonary function or general condition has changed or deteriorated over the last four weeks, the only essential preoperative investigations would be to repeat his FBC and U&Es.

To repeat the chest x ray and lung function tests would be totally unnecessary, as it is unlikely to change his peri-operative management.

The 12 lead ECG and arterial blood gases taken prior to the previous operations should provide sufficiently up-to-date information, thus repeating them would unnecessary.

56 - The High Dependency Unit (HDU):

True / False

○	◉	Has a nurse to patient ratio of 1:1 ✓Correct
◉	○	Accepts patients with single organ system failure. ✓Correct
○	◉	Routinely accepts ventilated patients. ✓Correct
◉	○	Is suitable for monitoring the pulmonary artery occlusion pressure ✓Correct
○	◉	Every patient with a central venous catheter should be transferred to the HDU. ✓Correct

The High Dependency Unit (HDU) is a critical care environment with a nurse to patient ratio of 1:2, whereas the ITU has a ratio of 1:1. Patients with single organ failure can be managed or treated on the HDU. However, patients that require ventilation or have more than one organ system that requires support, should be admitted

to the ICU (not HDU). The HDU is not an environment where patients are routinely ventilated, although some centres can ventilate patients for short periods or offer non-invasive ventilation. Monitoring the pulmonary artery occlusion pressure requires the insertion and use of a pulmonary artery catheter, which is usually reserved for use in critically ill patients. The ideal location for these patients is the ITU, though this can be performed on the HDU and CCU. Patients have central venous catheters inserted for a variety of clinical reasons but not every patient requires admission to the HDU, e.g. some patients receive parenteral nutrition (TPN) in non-critical care areas.

57 - A 63-year-old patient has a serum potassium of 6.5 mmol/l (3.5-4.9). Which of the following may be used effectively in the management of the hyperkalaemia?

True / False

●	○	10 ml of 10% calcium chloride given intravenously ✓Correct
○	●	50 ml of 8.4% sodium carbonate given intravenously ✓Correct
○	●	10 ml of insulin (actrapid) given subcutaneously ✓Correct
●	○	10 ml of 10% calcium gluconate given intravenously ✓Correct
○	●	40 mg of furosemide given intravenously ✓Correct

Hyperkalaemia is a serum potassium over 5.0 mmol/l, and if left untreated may lead to arrhythmias and cardiac arrest. It can be treated in a number of ways. Giving IV calcium 5-10 mmol intravenously (IV) is effective, as it acts as a physiological antagonist of potassium and protects the heart against arrhythmias.

50 ml of 8.4% sodium bicarbonate (not carbonate) used to be given for the treatment of hyperkalaemia, but is no longer recommended as it has limited effect.

Subcutaneous insulin will take too long to work. Thus, 20 units of insulin made up into 100 ml of 20% dextrose given as an infusion over 30 minutes will drive the potassium back into the cells.

Oral or rectal calcium resonium (an ion exchange resin) and dialysis are also recognised methods.

Furosemide will reduce the serum potassium, but it will also induce a marked diuresis, which may compromise the patient and consequently, due to this diuretic effect, it is not as effective as the other methods.

58 - Methaemoglobinaemia is a recognised complication following ingestion of, or exposure to, the following:

True / False

●	○	Potassium perchlorate ✓Correct
●	○	Nitroglycerine ✓Correct
○	●	Aniline dyes ✓Correct
●	○	Paraquat ✓Correct
○	●	Ascorbic acid ✓Correct

Other drugs causing methaemoglobinaemia include

- sulphonamides

- cyclophosphamide
- prilocaine
- chloroquine.

59 - In pulmonary disease are the following recognised associations?

True / False

●	○	Bronchopulmonary aspergillosis and wheezing ✓Correct
○	●	Clubbing and pneumoconiosis ✓Correct
●	○	Lung carcinoids and haemoptysis ✓Correct
●	○	Pulmonary embolism and right bundle branch block ✓Correct
○	●	Pulmonary fibrosis and hypercapnia ✓Correct

Although pneumoconiosis is a cause of pulmonary fibrosis it does not cause clubbing.

Lung carcinoids can cause haemoptysis but they usually present with airway obstruction, and the epithelium overlying them remains intact.

Pulmonary embolism does cause acute right ventricular strain and dilatation which can then delay conduction in the right bundle, causing a right bundle branch block on the ECG.

Pulmonary fibrosis is usually associated with type 1 respiratory failure and hence a reduced pCO_2 (not hypercapnia).

Allergic bronchopulmonary aspergillosis is caused by *Aspergillus fumigatus*, which can present with asthma and eosinophilia.

60 - Which of the following is/are true in a normal electrocardiogram?

True / False

●	○	P, QRS and T are mostly negative in lead AVR ✓Correct
●	○	The P wave represents depolarisation of the atria ✓Correct
○	●	The QRS complex typically shows a small initial positive wave in lead V6 ✓Correct
○	●	The ST segment is typically more than 1 mm above the isoelectric (PT) line ✓Correct
●	○	The T wave represents ventricular repolarisation ✓Correct

The P wave represents depolaristion of the atria, the QRS complexes depolarisation of the ventricles and the T wave repolaristion.

The Q wave is typically down going in V6.

In AVR the P wave, QRS complex and T waves are predominantly negative.

An initial upstroke may suggest left bundle branch block.

Elevation of the ST segment may be pathogenic due to ischaemia/infarction or ventricular disease.

61 - The following are required for the diagnosis of pre-eclampsia:

True	False	
○	◉	>24 weeks gestation ✓Correct
○	◉	High urate levels ✓Correct
○	◉	Low plasma magnesium levels ✓Correct
◉	○	Proteinuria ✓Correct
○	◉	Oedema ✓Correct

The following are required for the diagnosis of pre-eclampsia:

- A systolic blood pressure more than 140 mmHg,**or** a diastolic blood pressure more than 90 mmHg
- **With** proteinuria (more than 300 mg/24 hours)
- In a female more than 20 weeks gestation (not more than 24).

High urate levels and oedema are often present but are not diagnostic, but pathological or severe oedema in association with other signs helps with diagnosis.

Plasma hypomagnesaemia is not required to make the diagnosis.

62 - Regarding intravenous cannulae, which of the following is/are true?

True	False	
○	◉	A 14 gauge cannula has a flow rate of approximately 500 ml per minute ✓Correct
◉	○	A 20 gauge cannula has a flow rate of approximately 60 ml per minute ✓Correct
○	◉	Longer cannulae have faster flow rates ✓Correct
○	◉	The flow rate is calculated from the Bernoulli equation ✓Correct
◉	○	The flow rate through the cannula is directly proportional to the radius to the power of 4 ✓Correct

The Hagen-Poiseuille equation is used to calculate flow through tubes and cylinders (not the Bernoulli equation).

$$\dot{q} = \frac{\Pi P r^4}{8 \eta l}$$

[Where (P) is the pressure gradient across the tube of length (l) and radius (r) to the power of 4. (π) is Pi and (η) the viscosity of the fluid or gas.]

Thus wider and shorter cannulae have faster flow rates. The flow rate through intravenous cannulae varies between manufacturers, but a 14 G and 20 G cannulae have approximate flow rates of 300 ml/min and 60 ml/min respectively.

63 - Which of the following is/are true regarding laminar flow through a tube?

True / False		
○	◉	An increase in length would result in increased flow ✓Correct
○	◉	An increase in radius doubles the flow ✓Correct
◉	○	Flow is directly proportional to pressure difference ✓Correct
○	◉	Flow is directly proportional to the radius ✓Correct
◉	○	Flow is inversely proportional to the viscosity ✓Correct

Laminar flow is when the entire stream flows in a straight line. A tube by definition has a length considerably greater than its diameter. Flow is determined by the Hagen-Poiseuille equation:

$$\dot{q} = \frac{\Pi P r^4}{8 \eta l}$$

Where flow (q) is: directly proportional to the pressure gradient (P), π and the radius to the power of 4. It is also indirectly proportional to the viscosity (η), length and a factor of 8.

Therefore, an increase in length would result in a decrease in flow, and an increase in radius would result in an increase in flow to the power of 4.

64 - Regarding the laminar flow of fluids, which of the following is/are true?

True / False		
○	◉	If the radius of a tube is halved, the resistance increased 14 fold ✓Correct
◉	○	Reynolds' number predicts when the flow of a fluid becomes turbulent ✓Correct
○	◉	The density of inspired gas alters the resistance ✓Correct
◉	○	The flow profile is cone shaped ✓Correct
◉	○	When the length of the airway is doubled, resistance is doubled ✓Correct

The Hagen-Poiseuille equation can be modified for flow resistance:

$$\dot{q} = \frac{\Pi P r^4}{8 \eta l}$$

Where:
q = flow
P = pressure difference
r = radius of the vessel
η = viscosity
l = length of tube

Therefore, if the length is doubled, the resistance will be doubled, as they are directly proportional.

If the radius of the tube is halved, then the resistance is increased by 16 fold. The viscosity (η) of the gas, (not density) affects resistance in laminar flow.

In laminar flow the flow profile is cone shaped and the gas in the centre of the tube travels twice as fast as the average velocity.

Reynolds' number (Re) predicts when the flow of a fluid becomes turbulent, where
Re = (density x tube diameter x velocity) / viscosity.

In smooth, straight tubes, flow is more likely to be turbulent when the Reynolds number is greater than 2000, whereas flow will be laminar when the Reynolds number is less than 2000.

65 - In paediatric cardiac arrest, which of the following statements is/are true?

True / False

◉	○	An infant should receive 15 compressions to 2 ventilations ✓Correct
◉	○	Cardiac massage can be performed with one hand on a 5-year-old child ✓Correct
◉	○	In infants there are two techniques for cardiac massage ✓Correct
○	◉	Initially the SOFT approach should be used ✓Correct
◉	○	The compression rate at all ages is 100/minute ✓Correct

Children at all ages should receive 15 compressions to 2 ventilations.

In infants cardiac massage can be done with two fingers or two thumbs (hand-circling technique).

Over one year of age, compressions can be done with either one or two hands so long as one third of the chest is compressed.

The initial approach is known as the SAFE approach:

- Shout for help
- Approach with care
- Free from danger
- Evaluate the ABC.

66 - Do the following drugs increase the rate of gastric emptying?

True / False

◉	○	Cisapride ✓Correct
○	◉	Dopexamine ✓Correct
◉	○	Erythromycin ✓Correct
○	◉	Loperamide ✓Correct
○	◉	Vancomycin ✓Correct

Pro-kinetic drugs increase the rate of gastric emptying and intestinal motility. Metoclopramide, cisapride and erythromycin have all been successfully used in this role.

Loperamide is an opioid agonist which reduces intestinal motility.

Dopexamine increases splanchnic perfusion but does not have pro-kinetic properties.

Vancomycin similarly has no therapeutic effect on intestinal motility.

67 - Regarding pulmonary function tests, are the following true?

True / False

○	◉	Functional residual capacity is the volume of gas remaining in the lungs at the end of forced maximal expiration ✓Correct
○	◉	Residual volume is the volume of gas remaining in the lungs at passive end-expiration ✓Correct
◉	○	The inspiratory capacity is the sum of the tidal volume and the inspiratory reserve volume ✓Correct
○	◉	The total lung capacity is the sum of the inspiratory reserve volume, tidal volume and the expiratory reserve volume ✓Correct
◉	○	The vital capacity is equal to the difference between the total lung capacity and the residual volume ✓Correct

The total lung capacity (TLC) is the sum of

- The inspiratory reserve volume (IRV)
- Tidal volume (TV)
- Expiratory reserve volume (ERV) and the
- Residual volume (RV).

Alternatively it is the sum of the inspiratory capacity (IC) and the functional residual capacity (FRC).

The vital capacity (VC) is equal to the difference between the TLC and the RV. It is also the sum of the ERV, TV and the IRV.

The IC is the sum of the TV and the IRV.

The RV is the volume of gas remaining in the lungs at the end of forced maximal expiration, whereas the FRC is the volume of gas remaining in the lungs at passive end-expiration.

68 - Can the following information be obtained from invasive arterial pressure monitoring?

True / False

◉	○	Heart rate ✓Correct
◉	○	Hypovolaemia ✓Correct
◉	○	Left ventricular contractility ✓Correct
◉	○	Pulse pressure ✓Correct

●	○	Stroke volume ✓Correct

Invasive arterial cannulation provides accurate beat-to-beat blood pressure monitoring.

Other parameters can be measured and estimated such as

- Myocardial contractility
- Stroke volume
- Vascular tone (systemic vascular resistance)
- Pulse pressure and
- Heart rate.

The presence of a respiratory swing (during mechanical and spontaneous ventilation) can also be detected from the arterial pressure trace.

Specific software is available which allows measurement of this systolic pressure variation (SPV) which gives an indication of the volaemic status of the patient. In hypovolaemia the SPV is high and when the patient is over filled the SPV is low.

69 - In pancreatitis, which the following may indicate a poor prognosis?

True / False

●	○	Age more than 60 years ✓Correct
○	●	An elevated haematocrit ✓Correct
●	○	Blood glucose more than 15mmol/l ✓Correct
●	○	Systolic blood pressure less than 90 mmHg ✓Correct
○	●	Temperature more than 38 degrees Celsius ✓Correct

Acute pancreatitis is an autodigestive disease process, where pancreatic proteolytic enzymes are activated and subsequently destroy the pancreatic parenchyma.

The gland can be destroyed by oedema, haemorrhage and fat necrosis, which release exudates into the peritoneal cavity causing peritonitis. Sepsis, respiratory and renal failure may occur which increases the mortality from this disease.

A poor prognosis may be indicated by

- Age more than 55 years
- Systolic blood pressure less than 90 mmHg
- White cell count more than 15
- Temperature more than 39 Celsius
- Blood glucose more than 11 mmol/l
- Arterial PO_2 less than 8 kPa (60 mmHg)
- Plasma urea more than 15 mmol/l

- Serum calcium less than 2 mmol/l
- A reduced haematocrit by more than 10% and
- Deranged liver function tests.

70 - Regarding nerve fibres, are the following statements true?

True / False		
○	◉	Motor function and proprioception is carried by Class A-alpha fibres ✓Correct
◉	○	Motor function to muscle spindles is provided by Class A-gamma fibres ✓Correct
○	◉	Pain, cold sensation is carried by Class A-beta fibres ✓Correct
○	◉	Postganglionic fibres are myelinated ✓Correct
○	◉	Preganglionic autonomic fibres are unmyelinated ✓Correct

Class A-alpha fibres provide motor function and proprioception sensation.

Class A-beta fibres carry touch and pressure sensation.

Class A-gamma fibres provide motor function to muscle spindles.

Class A-delta fibres carry pain, cold and touch sensation.

Myelinated Class B nerves are autonomic preganglionic fibres.

Unmyelinated Class C nerves are autonomic postganglionic fibres which also carry pain and temperature sensation.

71 - Are the following statements correct for aortic stenosis?

True / False		
○	◉	A. Syncope typically occurs after exertion ✓Correct
○	◉	B. Angina means that coronary artery disease is also present ✓Correct
◉	○	C. May be associated with reverse splitting of the second heart sound ✓Correct
◉	○	D. May be severe even in the absence of a murmur ✓Correct
◉	○	E. May be severe if the gradient across the aortic valve is 30mmHg ✓Correct

Syncope will generally occur during exertion due to an imbalance between coronary supply and demand. This is also the cause of angina associated with stenosis.

The presence of a murmur needs good LV function, and thus in end stage stenosis when LV function is poor, the murmur may reduce in intensity.

A severe gradient across a valve is classed as above 50mmHg.

72 - Are recognised virulence factors in bacteria included in the following?

True / False

◉	○	Ig A-proteases ✓Correct
○	◉	Beta lactamases ✓Correct
◉	○	Gonococcal pili ✓Correct
◉	○	Streptococcal M protein ✓Correct
◉	○	The capsular polysaccharides in *Haemophilus influenzae* ✓Correct

Regarding virulence factors:

- Can be exotoxins or endotoxins (such as the cell wall of *Haemophilus influenzae*)
- M protein on some bacteria prevent phagocytosis
- Pili on gonococcus allow them to adhere to mucosal surface
- Beta lactamase or penicillaminase hydrolyse penicillin but have no direct effect on host tissue.

73 - Is it true that the following occurs when a normal person lies down?

True / False

◉	○	Blood flow in the apices of the lungs increases ✓Correct
○	◉	Cerebral blood flow settles to a higher level than when standing ✓Correct
○	◉	Heart rate settles to a higher level than when standing ✓Correct
○	◉	Lower limb veins constrict actively ✓Correct
◉	○	Venous return (VR) is immediately increased ✓Correct

After initially lying down there is a rise in BP, increased VR and hence reduction in heart rate, because gravity normally has an effect in the standing position giving lower perfusion in the upper parts of the lungs when compared with the base.

74 - Which of the following is/are true with respect to the heart?

True / False

◉	○	At rest, denervation of the heart would result in a rise in heart rate ✓Correct
○	◉	In exercise, systole shortens more than diastole ✓Correct
◉	○	Sympathetic stimulation increases the force of atrial contraction ✓Correct
◉	○	The spread of excitation through the walls of the ventricles is from the endocardial surface outwards ✓Correct
◉	○	Vagal stimulation decreases the force of ventricular contraction ✗Incorrect answer selected

The excitation impulse is spread from the endocardial surface outwards with vagal stimuli reducing heart rate rather than force.

Sympathetic stimulation causes increased heart rate and increased atrial contraction. With increased heart rate there is a greater shortening of diastole. This is because vagal tone would be removed and the heart would beat at its intrinsic rate (about 100 beats per minute).

75 - In experimental conditions, may ultrasound produce biological effects on tissue by the following means?

True / False		
○	●	Acceleration of cell division ✓Correct
●	○	Cavitation ✓Correct
○	●	Duplication of chromosome numbers ✓Correct
●	○	Heat generation ✓Correct
●	○	Microstreaming ✓Correct

There are two principal bioeffects of ultrasound - thermal and mechanical.

Thermal is created through the impact of acoustic energy upon tissue.

Mechanical bioeffects include cavitation through particulate streaming associated with the violent agitation of particles within the medium.

76 - Can nalorphine antagonise the respiratory depression caused by the following?

True / False		
●	○	Diamorphine ✓Correct
○	●	Diazepam ✓Correct
○	●	Pentazocine ✓Correct
●	○	Pethidine ✓Correct
○	●	Thiopentone ✓Correct

Nalorphine is an opioid agonist-antagonist, that is equally potent with morphine as an analgesic but is not clinically useful due to a high incidence of dysphoria.

It can displace opioid agonists from mu receptors, helping to reverse respiratory depression.

It is not effective at reversing respiratory depression due to barbiturates / benzodiazepines.

Pentazocine is also an opiod agonist-antagonist.

77 - Which of the following statements regarding blood groups and blood products are true?

True / False		
○	●	Group O and rhesus positive is the universal donors'blood. ✓Correct

●	○	Stored blood becomes progressively more acidotic andhyperkalaemic with time ✓Correct
○	●	Stored blood contains a normal amount of clotting factors ✓Correct
●	○	Stored whole blood contains dextrose, phosphate and citrate ✓Correct
●	○	The ABO system is inherited in an autosomal dominant pattern ✓Correct

The universal donors' blood is blood group O.

The universal recipient is blood group AB.

Red blood cells (RBCs) are the blood component most frequently used for transfusion.

A transfusion of RBCs increases the amount of oxygen that can be carried to the tissues of the body.

RBCs that have been separated from the liquid plasma (packed RBCs) should be administered to patients who have anaemia or who have blood loss.

The plasma contains the clotting factors.

78 - In the pathogenesis of thrombosis which of the following is/are true?

True / False

●	○	Contact with subendothelial collagen causes platelet aggregation ✓Correct
●	○	Platelets synthesise thromboxane A2 ✓Correct
○	●	Prostacyclin induces platelet aggregation ✓Correct
○	●	Thrombin inhibits platelet aggregation ✓Correct
●	○	Thromboxane (TBX) A2 induces vasoconstriction ✓Correct

Prostacyclin is thought to have a role in inhibiting platelet aggregation.

TBX A2 is synthesised by platelets and its effects are to induce vasoconstriction and procoagulant.

Other factors mediating platelet aggregation include contact with the subendothelium, thrombin, fibrin, exposed collagen, etc.

79 - Which of the following is/are true regarding burns in children?

True / False

●	○	Additional intravenous fluids are calculated according to the percentage burn and weight of the child ✓Correct
○	●	Assessment of depth and surface area is an important part of the primary survey ✓Correct
●	○	Body heat is lost rapidly ✓Correct
○	●	Partial thickness burn may extend beyond the dermis ✓Correct
●	○	Smoke inhalation is the usual early cause of death ✓Correct

Smoke inhalation is the usual early cause of death and inhalational injury should be suspected if carbonaceous sputum is present or if there are deposits around the mouth and nose.

Burnt children lose heat rapidly and should be covered unless being examined.

Assessment of the depth and surface area are important components of the secondary survey and additional fluid replacement is calculated according to the following formula:

Additional fluid = % burn x weight (kg) x 4

Partial thickness burn may extend to the dermis and full thickness beyond the dermis into deeper structures.

80 - Which of the following is/are true regarding the intravenous administration of thiopentone sodium?

True / False

◉	○	Binds to protein ✓Correct
◉	○	Crosses the placenta ✓Correct
○	◉	Is a potent muscle relaxant ✓Correct
◉	○	Is fat soluble ✓Correct
○	◉	Is predominantly excreted by the kidney ✓Correct

Thiopentone sodium produces general anaesthesia.

Although bound to plasma proteins thiopentone sodium rapidly crosses the blood-brain barrier.

Thiopentone sodium is slowly metabolised by the liver.

Only a small proportion of the active drug is excreted in the urine

81 - Regarding meta-analysis of randomised controlled trials, which of the following is/are true?

True / False

◉	○	Is usually performed when individual trials are too small to give reliable answers. ✓Correct
◉	○	Provides a more stable estimate of the effect of treatment than individual trials ✓Correct
○	◉	Provides conclusions which make the performance of further controlled trials unnecessary ✓Correct
◉	○	Should exclude trials in which patient selection is not randomised ✓Correct
○	◉	Should only include published, 'peer-reviewed' studies ✓Correct

Meta-analyses of randomised, controlled trials are usually performed when individually the trials are too small to give reliable answers.

There are a number of reasons for performing meta-analysis which include:

(i) to examine variability between trials

(ii) to perform subgroup analysis

(iii) to identify the need for major trials

(iv) to obtain a more stable estimate of the effect of treatment.

Only randomised, controlled trials should be included in such analysis, but if only published studies (which tend to be positive) are used this will introduce bias. If unpublished but properly controlled studies are available they should be used in the analysis.

It is important that patient selection and outcomes are comparable in the studies.

Meta-analysis does not take the place of properly controlled large studies to answer important questions but may help in the appropriate design of such trials.

82 - A report of a clinical trial of a new antihypertensive drug states: 'In a comparison between the new drug and a placebo, a higher proportion of patients taking the new drug had a fall in diastolic blood pressure of more than 5 mmHg (P<0.05)'.

In these circumstances, can it be inferred whether the following are true/false?

True	False	
○	◉	A placebo response is likely to have occurred in 5% of patients ✓Correct
○	◉	Blood pressure should be performed using a random-zero sphygmomanometer ✓Correct
◉	○	The 95% confidence intervals of the change in blood pressure would be more useful than a 'p' value ✓Correct
◉	○	The result should be regarded as reaching conventional levels of statistical significance ✓Correct
○	◉	The trial was a randomised double-blind placebo controlled study ✓Correct

The design of the trial cannot be inferred from the above statement.

Such a trial should be randomised, double blind and placebo controlled.

The report indicates the effect of the drug on diastolic blood pressure is unlikely to be due to chance (p<0.05) and the 'null hypothesis' can be rejected.

If the null hypothesis is true (that is, no difference) this will be wrong on less than one occasion in twenty.

The conventional level of statistical significance is 5% (probability (p) = 0.05). This is a good guideline for significance but should not be taken as an absolute demarcation.

83 - Which of the following is/are true concerning relative risk?

True	False	
◉	○	Is a useful measure of the association between a disease and a risk factor ✓Correct
○	◉	Is best assessed in retrospective case control studies ✓Correct
○	◉	Is defined as the incidence rate of disease in an exposed group ✓Correct
○	◉	Is equivalent to an odds ratio ✓Correct
◉	○	Of two indicates a doubling of risk between the groups ✓Correct

Relative risk may be determined in prospective and retrospective studies and is a useful measure of the strength of association between disease and a risk factor.

In a prospective study of a population, participants are selected without reference to the presence or absence of disease. After excluding prevalence cases the population is followed over time. The number of new cases occurring thereafter is divided by the population at risk, giving an incidence rate.

84 - When calculating the size of a sample required for a study comparing a new drug to placebo, which of the following is/are true?

True / False

◉	○	An estimate of the standard deviation of the parameter of interest is required ✓Correct
◉	○	It is necessary to define the most important end point for the study ✓Correct
◉	○	Maximum power is usually achieved by having equal numbers in both groups ✓Correct
○	◉	Only variables which are continuous can be used ✓Correct
◉	○	The probability of rejecting the null hypothesis when it is false is termed the power ✓Correct

Sample sizes can be calculated for population studies, clinical trials and most forms of studies.

Binary, ordered categorical and continuous variables can be used.

It is very important before commencing clinical trial to determine which variable will be the primary end point, what magnitude of difference is clinically relevant and have an estimate of the standard deviation (SD).

From these data and statistical significance (a), usually p = 0.05, the probability of rejecting the null hypothesis when it is false can be determined and is called the power (1-b).

With the expected mean difference/SD and a decision of significance and power a sample size can be calculated.

Maximum power is achieved by having equal groups, but unequal group size can be used.

85 - Which of the following is/are true regarding phenytoin?

True / False

○	◉	Has a short half life ✓Correct
◉	○	Is associated with gum hypertrophy ✓Correct
○	◉	Is rapdily absorbed from the intestinal tract ✓Correct
◉	○	It has a narrow therapeutic range ✓Correct
◉	○	Undergoes hepatic metabolism ✓Correct

Phenytoin has a narrow therapeutic range hence small increases in the dose can cause toxicity.

Side effects include gum hypertrophy, hirsutism, ataxia and hepatic impairment.

It has a long half life and is slowly absorbed from the gastrointestinal tract.

It undergoes hepatic metabolism and renal excretion.

86 - In acute spinal cord injury, are the following beneficial?

True / False

○	●	Hyperglycaemia ✓Correct
○	●	Induced hyperthermia ✓Correct
○	●	Intraoperative hypercarbia ✓Correct
○	●	Intraoperative hypotension ✓Correct
●	○	Intravenous methylprednisolone ✓Correct

In acute spinal cord injury preserving perfusion and preventing ischaemic and secondary injury to the cord is of paramount importance.

In an attempt to achieve these aims the following should be ensured

- Avoid hypotension, which does reduce intraoperative bleeding but can exacerbate ischaemic damage
- Mild hypocarbia may help decompress the cord, which exhibits carbon dioxide reactivity
- Avoid hyperglycaemia as this can cause further damage to ischaemic cells
- Avoid hyperthermia as the damaged tissue has impaired thermoregulation and this may exacerbate secondary injury.

These factors are equally relevant during surgical procedures.

NASCIS trials (National Acute Spinal Cord Injury Study) showed improved long-term neurological recovery following high dose methylprednisolone.

87 - Choose whether the following are true or false:

True / False

●	○	A. Post-operative heparin can cause a decrease in the platelet count. ✓Correct
○	●	B. Patients with metallic valves should not routinely be anti-coagulated post-operatively as there is a high risk of bleeding. ✓Correct
○	●	C. It is safe to stop clopidogrel post-operatively in people with coronary stents. ✓Correct
●	○	D. NSAIDs should be combined with asprin and anticoagulants only after careful consideration. ✓Correct
●	○	E. People bleeding post-operatively should have their coagulation routinely tested. ✓Correct

A. Heparin induced thrombocytopenia (HIT) is well described in the literature.

B. Liaise closely with cardiology, metallic valves often need continuous heparin infusions to prevent thrombotic events and valve damage.

C. Liaise closely with cardiology, drug-eluting stents can re-stenose if clopidogrel is not continued.

D. The risk of gastrointestinal haemorrhage increases when these are combined.

E. Post-operative bleeding may be surgical or coagulation related.

88 - Choose whether the following are true or false:

True	False	
◉	○	A. Mild pyrexia and hypoxia post-operatively should alert the possibility of pulmonary embolus (PE). ✓Correct
◉	○	B. Atelectasis routinely occurs post-operatively ✓Correct
○	◉	C. Post-operative oxygen therapy should be limited due to the risk of free radial damage. ✓Correct
◉	○	D. Respiratory depression post-operatively may be due to intraoperative opioids. ✓Correct
○	◉	E. Post-operatively sore throat in major surgery is normally due to gastrointestinal reflux. ✓Correct

A. PE can often be confused with a chest infection as both can feature pyrexia.

B. Due to both surgical factors (that is, abdominal pain) and anaesthetic factors (that is, intubation and ventilation).

C. Whilst there are theoretical concerns about free radial damage, ensuring adequate patient oxygenation is the main aim.

D. Morphine can take up to 40 minutes to have its maximal effect.

E. It is normally due to tracheal intubation intra-operatively.

89 - Can the following be given safely in acute intermittent porphyria (AIP)?

True	False	
◉	○	A. Pethidine ✓Correct
◉	○	B. Gentamicin ✓Correct
○	◉	C. Alcohol ✓Correct
◉	○	D. Aspirin ✓Correct
◉	○	E. Chlorpromazine ✓Correct

In acute intermittent porphyria (AIP) the following drugs are safe

- Opiates
- Gentamicin and penicillins
- Aspirin
- Chlorpromazine.

Barbiturates, alcohol and the oral contracepive pill are unsafe.

D. And paracetamol.

E. Lithium, nortriptyline, chlordiazepoxide and oxazepam are also safe.

90 - Do the causes of thrombocytopenia include the following?

True / False

●	○	Aspirin ✓Correct
●	○	Bendroflumethiazide ✓Correct
●	○	D-penicillamine ✓Correct
○	●	Isoniazid ✓Correct
●	○	Low molecular weight heparin ✓Correct

Low molecular weight heparin may cause thrombocytopenia, although it is more typical with unfractionated heparin.

Aspirin causes a qualitative reduction in platelet activity and numbers.

Bendroflumethiazide can cause thrombocytopenia and more rarely pancytopenia.

D-penicillamine can reduce the platelet count.

Isoniazid is not associated with thrombocytopenia but can cause agranulocytosis.

91 - Which of the following is/are true regarding ninety-five percent confidence intervals in a large sample?

True / False

○	●	Are a test of the null hypothesis ✓Correct
●	○	Are calculated as ± 1.96 times the standard error of the mean ✓Correct
●	○	Are useful when comparing two populations ✓Correct
●	○	Can be calculated for non-parametric data ✓Correct
●	○	Indicate the range in which there is a 95% chance of the true population mean lying ✓Correct

In a normal distribution of a large population (greater than 30), 95% confidence intervals can be calculated as ± 1.96 times the standard error of the mean.

This means there is a 95% chance that the true population mean will lie within the range of values.

Ninety five percent confidence intervals can be calculated for non-parametric or interval data but this uses a different method than 1.96 x sem

When comparing the effects of two treatments (for example, active drug and placebo or two populations) 95% confidence intervals indicate the size of any effect rather than just indicating if there was an effect as in significance testing.

There is a close relationship between the use of confidence intervals and the two-sided hypothesis test.

92 - In a normal or Gaussian distribution which of the following statements is/are true?

True / False

◉	○	95% of observations lie between the mean ± 2 standard deviations (x ± 2SD). ✓Correct
○	◉	25% of observations lie between the mean + 1 standard deviation (x + 1SD). ✓Correct
○	◉	Data should be log10 transformed prior to analysis. ✓Correct
◉	○	The mean, median and mode coincide. ✓Correct
○	◉	The 95% confidence interval may be calculated as the product of 1.96 and the standard deviation in populations of greater than n = 30. ✓Correct

The normal or Gaussian (Gauss 1777-1855) distribution is the most important frequency distribution in statistics.

The properties of a normal distribution are

(a) Symmetrical about the mean so that the mean, median and mode coincide

(b) Sixty eight percent of observations lie within 1SD (s) of the mean m: x ± 1SD, 95% lie between x ± 2SD, 99.7% lie between x ±3SD

(c) Because of this symmetry, about 34% of observations lie between x and x + 1SD.

Data from a normal distribution are suitable for parametric tests without prior transformation.

Observations which do not conform to a normal distribution may be log-normally distributed and can be transformed to a normal distribution by converting values to log10.

Counts of events (for example, bacterial colonies, radioactive counts) may follow a Poisson distribution and may be suitably transformed by taking the square root value.

The 95% confidence interval gives information about the range of values within which the true population is likely to lie.

The mean 95% confidence interval is calculated as the mean 1.96 times the standard errors of the mean (sem) for populations of greater than 30.

For smaller populations the appropriate value of t can be taken from appropriate tables such that the 95% confidence levels are calculated as x-(t ± sem) - x + (t ± SE), where t is taken for the appropriate degrees of freedom associated with a confidence of 95% 100(1-a)%, that is, 0.05.

93 - Which of the following is/are associated with Down's syndrome?

True / False

●	○	Atrial septal defect ✓Correct
●	○	Complete atrioventricular canal ✓Correct
●	○	Patent ductus arteriosus ✓Correct
●	○	Tetralogy of Fallot ✓Correct
●	○	Ventricular septal defect ✓Correct

Firty percent of Down's syndrome births have congenital heart disease and the commonest defect is complete atrioventricular canal.

Down's is associated with other heart defects and in decreasing order of frequency include

- Ventricular septal defect
- Patent ductus arteriosus
- Tetralogy of Fallot
- Atrial septal defect.

94 - Regarding sickle cell disease, which of the following statements is/are true?

True / False

●	○	It is caused by the substitution of glutamic acid by valine at position 6 on the beta chain of haemoglobin ✓Correct
○	●	Osteomyelitis is typically caused by *E. coli* bacteria ✓Correct
○	●	The erythrocytes of haemoglobin AS patients can sickle at a PO_2 of 5 - 6 kPa (40 - 50 mmHg) ✓Correct
●	○	The erythrocytes of haemoglobin SC patients may sickle at a PO_2 of 4 kPa (30 mmHg) ✓Correct
○	●	The Sickledex test involves adding a reagent to blood, which identifies the type of haemoglobinopathy ✓Correct

Sickle cell disease is a haemoglobinopathy caused by the substitution of glutamic acid by valine at position 6 (from the N-terminal) of the beta chain.

Inherited as an autosomal gene, heterozygous (HbAS) and homozygous (HbSS) forms exist.

A low partial pressure of oxygen (PO_2) causes HbS to polymerise and precipitate, resulting in sickling of the erythrocyte. HbSS patients sickle at PO_2 of 5 - 6 kPa and HbAS patients sickle at PO_2 of 2.5 - 4 kPa (not 5 -6 kPa).

A mild disease is produced when heterozygotes for HbS combine with other haemoglobins, for example, haemoglobin C, creating HbSC, with sickling occurring at around 4 kPa.

Osteomyelitis is typically caused by unusual organisms, for example, *Salmonella*.

Diagnosis of sickle cell disease requires the detection of HbS.

The Sickledex test involves the addition of reagent to blood; turbidity only confirming the presence of HbS, but it gives no information on other haemoglobins.

Haemoglobin electrophoresis is the only investigation that can determine the nature of the haemoglobinopathy.

95 - May the following be causes of lower gastrointestinal bleeding in children?

True / False

●	○	Child abuse ✓Correct
●	○	Inflammatory bowel disease ✓Correct
●	○	Intussusception ✓Correct
●	○	Meckel's diverticulum ✓Correct
○	●	Oesophageal varices ✓Correct

Causes of lower gastrointestinal bleeding in children include

- Meckel's diverticulum (1 month - 1 year)
- Intussusception (1 - 2 years)
- Polyps, child abuse and inflammatory bowel disease (2 - 12 years).

Oesophageal varices are a cause of upper gastrointestinal bleeds.

96 - Do complications associated with a burn injury include the following?

True / False

●	○	Acute renal failure ✓Correct
●	○	Haemoglobinuria ✓Correct
○	●	Methaemoglobinaemia ✓Correct
●	○	Myoglobinuria ✓Correct
●	○	Peptic ulceration ✓Correct

A full thickness burn (or third degree burn) can result in haemoglobinuria and myoglobinuria, and are commonly encountered following a high-voltage electrical injury.

In the presence of haemoglobinuria and myoglobinuria the patient may subsequently develop acute renal failure (ARF), and the use of diuretics (for example, mannitol 0.5g/kg) may help. The development of ARF in a burned patient is associated with a high mortality.

Additional complications of thermal injury include

- Peptic ulceration (Curling's ulcer)
- Congestive cardiac failure
- Myocardial infarction
- Pulmonary embolism
- Encephalopathy and
- Hypertension.

Methaemoglobinaemia is not a known complication of a burn injury.

97 - In pyloric stenosis, which of the following is/are true?

True / False		
○	●	Hartmann’s solution is the resuscitation fluid of choice ✓Correct
●	○	Inadequate correction of the biochemical abnormality may result in postoperative apnoea and hypoventilation ✓Correct
○	●	Initially the kidneys excrete an acid urine ✓Correct
○	●	Pyloromyotomy should not be delayed in the presence of persistent vomiting ✓Correct
○	●	The biochemical abnormality found in these patients is characterised by a hyperchloraemic alkalosis ✓ Correct

Congenital pyloric stenosis usually presents in male infants in the first two months of life.

The electrolyte abnormality is characteristically hypochloraemic alkalosis (not hyperchloraemic), due to the loss of chloride and hydrogen ions during vomiting.

The initial response by the kidneys is to excrete alkaline urine (not acid), which also contains sodium and potassium ions. Conservation of water, sodium and chloride ions causes the kidneys to excrete potassium and hydrogen ions in exchange for sodium ions. The acidic urine exacerbates the alkalaemia resulting in hypokalaemia.

Performing a pyloromyotomy is not a surgical emergency, and it should be delayed until the infant has been fluid resuscitated and the biochemical profile normalised. Acceptable plasma electrolyte values are:

- Chloride ions >90mmol/l
- Sodium ions >135mmol/l
- Bicarbonate ions < 25mmol/l.

Postoperative apnoea and hypoventilation may occur if surgery is performed before correction of the biochemical abnormality, and is due to an alkaline cerebrospinal fluid.

Normal saline is the fluid of choice as it is a hydrogen ion donor and does not contribute to the bicarbonate load.

Hartmann's solution should be avoided in patients with metabolic alkalosis.

98 - Do characteristic findings in an Addisonian crisis (acute adrenal insufficiency) include the following?

True / False		
○	●	Pancytopenia ✓Correct
●	○	Hyperkalaemia ✓Correct
●	○	Hypochloraemia ✓Correct
●	○	Reduced plasma bicarbonate concentration ✓Correct
○	●	Reduced plasma urea concentration ✓Correct

The characteristic laboratory findings in acute adrenal insufficiency are:

- Hyponatraemia
- Hyperkalaemia
- Metabolic (acidosis reduced plasma bicarbonate concentration)Elevated plasma urea
- Hypochloraemia
- Hypoglycaemia
- Normochromic normocytic anaemia
- Neutropenia
- Eosinophilia and
- Lymphocytosis.

Hypercalcaemia occurs in 10 - 20% of cases.

99 - Which of the following are recognised complications of a lower segment caesarean section (LSCS) performed under regional anaesthesia?

True / False

●	○	Aspiration of gastric contents ✓Correct
●	○	Delayed respiratory depression with hydrophilic opioids ✓Correct
●	○	Evidence of myocardial ischaemia on the electrocardiograph (ECG) ✓Correct
●	○	Postural headache ✓Correct
●	○	Venous air embolism ✓Correct

The addition of opioids to local anaesthetics solutions used in regional anaesthesia is associated with delayed respiratory depression, and this is more likely to occur with hydrophilic opioids than with lipophilic opioids.

The risk of aspiration of gastric contents is reduced under regional anaesthesia but it can still occur, especially with a high block or total spinal.

The incidence of a venous air embolism (VAE) during lower segment caesarean section (LSCS) under regional is about 25% (using Doppler ultrasound and echocardiography). Thrombus and amniotic fluid emboli have also been reported.

The incidence of electrocardiograph (ECG) ischaemic changes demonstrated in ASA 1 females undergoing LSCS is about 35%. This is believed to be due to the increase in myocardial work and oxygen demand that occurs secondary to the hypotension induced by the sympathetic blockade.

A postural headache usually suggests that there is a cerebrospinal fluid leak close to the level of insertion of the regional block. This may be an indication for an epidural blood patch in order to seal the puncture.

100 - Which of the following conditions are causes of atrial fibrillation?

True / False

○	●	Anxiety ✓Correct

◉	○	Cardiac surgery ✓Correct
○	◉	Hypothyroidism ✓Correct
◉	○	Pneumonia ✓Correct
◉	○	Recent myocardial infarction ✓Correct

Atrial fibrillation is associated with ischaemic heart disease, mitral stenosis and hyperthyroidism.

It is a common complication post-cardiac surgery and is seen in pulmonary embolism, sepsis and pneumonia.