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Question Papers

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Paper 1

MTF Question 1

Which of the following statements regarding logarithms are true?

- (a) $\text{pH} = \log_{10} [\text{H}^+]$
- (b) A solution with a pH of 6 is twice as alkaline as a solution with a pH of 3
- (c) A solution with a pH of 3 has 1/100th the acidity of a solution with a pH of 5
- (d) An acid with an H^+ concentration of 0.0001M has a pH of 3
- (e) A solution with a pH of 8 is 100 times more acidic than a solution with a pH of 10

MTF Question 2

Which of the following statements about etomidate are true?

- (a) The standard induction dose of etomidate is 0.3 mg/kg
- (b) Etomidate owes its anaesthetic activity to its action as an NMDA receptor antagonist
- (c) Etomidate is not suitable for use in major trauma since it raises intracranial pressure
- (d) Etomidate reversibly blocks the activity of the adrenocortical hormone 11 β -hydroxylase
- (e) Etomidate has intrinsic analgesic activity equivalent to 5–10 mg of intravenous morphine

MTF Question 3

Which of the following are required methods for testing medical gas cylinders in the UK?

- (a) Hydrostatic testing
- (b) Impact testing
- (c) Internal visual inspection
- (d) Ultrasonic testing
- (e) Tensile strength testing

MTF Question 4

Regarding sodium in the human body, which of the following statements are true?

- (a) Sodium is key to the cellular co-transport (symport) or counter-transport (antiport) of virtually every other ion

- (b) It has a marginally higher concentration in cerebrospinal fluid than in plasma
- (c) Its Nernst potential is about -60 mV
- (d) Membrane-bound Na^+/K^+ -ATPase extrudes three sodium ions for every two potassium ions that are taken up
- (e) Adult kidneys filter 25 mol of sodium a day

MTF Question 5

Heparin-induced thrombocytopenia (HIT):

- (a) Is likely to require platelet transfusion
- (b) Usually presents with haemorrhage
- (c) Is mediated via an IgG autoantibody combined with platelet factor 4
- (d) Is most common with bovine heparin
- (e) Usually takes 36 hours to develop following a patient's first exposure to heparin

MTF Question 6

Which of the following statements regarding mathematical concepts about relationships and graphs are true?

- (a) In a multi-compartment pharmacokinetic model, drug can only be eliminated from the central compartment
- (b) A bi-exponential decline is seen in two-compartment models
- (c) Mammillary models have peripheral compartments that are directly linked to each other
- (d) The rate of transfer from the central compartment to a peripheral compartment is constant
- (e) In a multi-compartment pharmacokinetic model, a 'vessel-rich' peripheral compartment is where anaesthetic drugs have their effect

MTF Question 7

Regarding the code used to classify artificial cardiac pacemakers, which of the following are correct?

- (a) The first letter denotes the chamber paced
- (b) The second letter denotes the chamber paced
- (c) The first letter denotes the chamber in which electrical activity is sensed
- (d) The third letter represents rate modulation
- (e) The fourth letter represents rate modulation

MTF Question 8

Regarding diathermy, which of the following are true?

- (a) The current density at the patient plate or neutral electrode is relatively low in monopolar diathermy
- (b) Monopolar diathermy is safer than unipolar diathermy for patients with cardiac pacemakers
- (c) Alternating current at frequencies between 0.5 and 1 MHz is used
- (d) The high frequencies used penetrate the myocardium
- (e) The amount of heat generated by diathermy is proportional to the square of the current divided by the area

MTF Question 9

Regarding changes to the body that occur with ageing and might affect pharmacology:

- (a) Decrease in opioid receptor numbers and increase in receptor affinity are the main causes of toxicity due to opioids in the elderly
- (b) Reduced muscle bulk results in a prolonged effect for remifentanyl
- (c) Bioavailability of drugs absorbed by the gastrointestinal system decreases by 50% by the age of 80 years old
- (d) As you age, you develop a relative decrease in body fat
- (e) As you age your volume of distribution (V_D) for water-soluble drugs decreases

MTF Question 10

Regarding cellular metabolism, which of the following statements are correct?

- (a) Aerobic metabolism of glucose is 80% efficient
- (b) 1 mol of glucose yields 38 mol of adenosine triphosphate (ATP) under aerobic conditions
- (c) The hexose monophosphate shunt produces carbon dioxide, ribose-5-phosphate and ATP
- (d) Glycogen is stored in skeletal muscle and the liver in approximately equal proportions
- (e) Under aerobic and anaerobic conditions, glycolysis generates a net gain of two ATP and two NADH

MTF Question 11

Regarding the adrenal glands, which of the following are true?

- (a) The adrenal glands are retroperitoneal structures
- (b) The adrenal cortex develops from mesoderm
- (c) ACTH activates receptors in the zona fasciculata and the zona reticularis
- (d) The inner adrenal cortex produces the glucocorticoids
- (e) The adrenal glands are located inferior to the kidneys

MTF Question 12

Regarding infrared radiation:

- (a) Radiation is the most important route for heat loss from the body during anaesthesia
- (b) Radiation cannot transfer heat between two objects unless they are in contact with each other
- (c) Reflective shiny metallised plastic foil blankets should be used in theatre to prevent heat loss from radiation
- (d) Vasodilation increases heat loss by radiation
- (e) Radiation accounts for up to 50% of normal heat loss from the body

MTF Question 13

As an antiemetic, dexamethasone:

- (a) Is an effective rescue agent for postoperative vomiting
- (b) Should be administered at the beginning of the surgery
- (c) Is contraindicated for use in children

- (d) Should be used intraoperatively as an antiemetic with caution because of an increased risk of immunosuppression and wound infection
- (e) If given to an awake patient may produce uncomfortable perineal sensations

MTF Question 14

Regarding the use of drugs in pregnant women, which of the following agents are tocolytic?

- (a) Inhaled isoflurane
- (b) Intrathecal opioids
- (c) Intravenous glyceryl trinitrate
- (d) Intravenous magnesium sulphate
- (e) Epidural bupivacaine

MTF Question 15

Which of the following are correct in relation to the Doppler effect?

- (a) The Doppler effect describes the phenomenon by which the amplitude of sound waves is altered if the source is moving in relation to the detector
- (b) The amplitude of sound waves is increased if the source of the sound is moving towards the detector
- (c) The frequency of sound waves is reduced if the source of the sound is moving away from the detector
- (d) The Doppler effect is used to measure blood flow velocity in arteries
- (e) The Doppler effect is used in obstetric practice when a fetal heart rate monitor is used

MTF Question 16

Regarding the mechanism of secondary hyperalgesia:

- (a) Dorsal horn cells show reduced excitability in response to persistent pain
- (b) Excitation thresholds for mechanical stimuli in the dorsal horn cells fall
- (c) An increased area of receptive afferent input can be demonstrated
- (d) Secondary hyperalgesia is primarily due to a neuroplastic response in the dorsal horn
- (e) The presence of magnesium ions enhances the activity of NMDA receptors

MTF Question 17

Which of the following statements are true regarding laryngoscope blades?

- (a) The standard Macintosh laryngoscope blade is available in four sizes
- (b) The Magill laryngoscope blade is curved
- (c) The Macintosh laryngoscope blade should be placed anterior to the epiglottis in the vallecula during laryngoscopy for intubation
- (d) The Miller laryngoscope blade should be placed anterior to the epiglottis in the vallecula during laryngoscopy for intubation
- (e) A 'left-sided' version of the Macintosh laryngoscope blade is available

MTF Question 18

Regarding narcotic analgesia in children:

- (a) An 8-year-old child may be prescribed a patient-controlled analgesia (PCA) device
- (b) Parent-controlled analgesia (PrCA) is rarely used because it is likely to produce apnoea or excessive narcosis

- (c) Neonates do not require opioids
- (d) All children under 10 years old receiving an opioid infusion should have continuously monitored pulse oximetry
- (e) Nasal fentanyl is not recommended in children under the age of 10 because of the risk of apnoea

MTF Question 19

Which of the following statements regarding the measurement of cardiac output using thermodilution are correct?

- (a) The cold solution should be injected into the right ventricle
- (b) Injection is performed during the inspiratory phase of the breathing cycle
- (c) The graphical data obtained has temperature increasing on the y axis
- (d) Semi-logarithmic data is required for the calculation of cardiac output
- (e) The cardiac output is the area under the temperature–time graph

MTF Question 20

Regarding insulin:

- (a) Some intermediate-acting insulins should not be used in patients with known allergy to heparin
- (b) The majority of insulin used in the UK is structurally human insulin
- (c) Complexing insulin with zinc decreases the rate at which it is absorbed
- (d) 50% of subcutaneously injected insulin enters the circulation by local absorption across the capillary wall and 50% via the lymphatics
- (e) Some insulin preparations become shorter-acting during an acidosis

MTF Question 21

Regarding coaxial breathing systems, which of the following are true?

- (a) The use of a coaxial breathing system will allow the use of a lower fresh gas flow (FGF) without re-breathing compared to the non-coaxial equivalent system
- (b) The coaxial form of the Mapleson D breathing system is known as the Bain circuit
- (c) The diameter of the external breathing hose on a coaxial system is similar to the diameter of the breathing hose in a non-coaxial system
- (d) Disconnection of the inner lumen of a Bain circuit may cause a rise in the inspired CO_2 concentration
- (e) The Lack circuit is functionally similar to a Mapleson A system

MTF Question 22

Furosemide:

- (a) Is not as effective a diuretic as a thiazide in patients with chronic kidney disease
- (b) Is more likely to cause deafness in patients with nephrotic syndrome
- (c) Reduces both cardiac preload and afterload before causing a diuresis
- (d) Potentiates the nephrotoxicity of gentamicin
- (e) Causes a diuresis that is enhanced by the co-administration of non-steroidal anti-inflammatory drugs

MTF Question 23

Which of the following statements regarding enzyme induction and inhibition are correct?

- (a) Phenytoin increases the metabolism of certain drugs, including tricyclic antidepressants
- (b) Induction of an enzyme is caused solely by increased gene expression
- (c) Metronidazole enhances the toxicity of ethanol
- (d) Aminophylline has an increased duration of action in smokers
- (e) Rifampicin enhances the toxicity of ethanol

MTF Question 24

Which of the following are true?

- (a) The SI unit of dynamic viscosity is a newton-second/metre
- (b) The viscosity of blood is dependent on flow rate
- (c) A thixotropic material is a material that becomes less viscous over time when it is agitated or otherwise stressed
- (d) The dynamic viscosity of a gas is independent of pressure
- (e) The relationship between viscosity and temperature and pressure only holds true for those fluids and gases that exhibit 'Newtonian' properties

MTF Question 25

Which of the following statements are correct with regard to units of measurement?

- (a) A tall adult male with a weight of 686 N would not be considered obese
- (b) One kilocalorie is equal to 4.2 joules
- (c) Pipeline pressure on the anaesthetic machine is equal to 3000 mmHg
- (d) Normal body temperature is approximately equal to 97.8 °F
- (e) A mean arterial blood pressure of 109 cmH₂O is not compatible with life

MTF Question 26

Regarding a valve block that is attached to a medical gas cylinder:

- (a) There is a metal seal between the valve and cylinder that will melt at 70 °C, thus reducing the risk of explosion
- (b) It is marked with the tare weight of the cylinder
- (c) It is marked with the chemical symbol of the gas contained in the cylinder
- (d) It is marked with the name of the gas contained in the cylinder
- (e) There is a unique serial number stamped on each valve block

MTF Question 27

Regarding acid–base balance:

- (a) Plasma bicarbonate concentration is increased by urinary excretion of hydrogen
- (b) Renal filtration of hydrogen ions contributes significantly to the maintenance of a normal plasma pH
- (c) The reabsorption of bicarbonate by the renal tubules is dependent on hydrogen excretion
- (d) In the collecting tubule, secreted hydrogen will most likely combine with phosphate, not bicarbonate
- (e) Bicarbonate is freely filtered at the glomerulus

MTF Question 28

Regarding the functional anatomy of the liver, which of the following are correct?

- (a) There are three lobes of the liver
- (b) The Couinaud classification describes eight functional segments of the liver
- (c) The quadrate lobe is segment 1
- (d) Segment 1 is not visible anteriorly
- (e) The Bismuth classification divides segment 4 into 4a and 4b

MTF Question 29

Causes of neuropathic pain include:

- (a) Carpal tunnel syndrome
- (b) Persistent immobility
- (c) Shingles
- (d) Bipolar depression
- (e) Multiple sclerosis

MTF Question 30

The sarcomere is the basic contractile unit of skeletal muscle. Which of the following statements are true?

- (a) Myosin filaments make up the A band
- (b) The H band is the central area where myosin is not overlapped by actin
- (c) The thin filament is composed of two myosin filaments wound together with tropomyosin
- (d) The Z line maintains the spatial relationship of the thin filaments
- (e) Troponin is composed of three subunits: troponin I, troponin T and troponin C

MTF Question 31

Regarding the use of hypertonic saline to control raised intracranial pressure (ICP):

- (a) Patients require regular measurement of serum osmolality for therapeutic monitoring
- (b) The high sodium load makes hypertonic saline more of a potential danger to renal function than mannitol
- (c) Hypertonic saline should be avoided in hyponatraemic patients
- (d) Patients receiving hypertonic saline are more haemodynamically stable than those receiving mannitol
- (e) Current evidence would indicate that hypertonic saline produces a longer-lasting fall in ICP than mannitol osmotherapy

MTF Question 32

Regarding the management of chronic obstructive pulmonary disease (COPD):

- (a) In the absence of significant contraindications, systemic corticosteroids should be prescribed routinely for all patients with exacerbation of COPD admitted to hospital
- (b) Mucolytics such as carbocisteine have no place in the management of stable COPD
- (c) More than 15 hours of oxygen a day when on long-term oxygen therapy (LTOT) is undesirable, as outcome deteriorates because of injury by free radicals
- (d) LTOT improves quality of life but does not prolong survival

- (e) A patient with an infective exacerbation of COPD should only be given a maximum FiO_2 of 0.3 because of the risk of removing hypoxic drive

MTF Question 33

Regarding the pharmacological management of hypertension:

- (a) An angiotensin-converting enzyme (ACE) inhibitor would be better than a thiazide diuretic as a first-line drug in a 50-year-old female Caucasian patient with hypertension
- (b) A trial of single agent use should be assessed at 4 weeks
- (c) Management should target lowering blood pressure to below 140/90 mmHg
- (d) Severe hypertension (>180/110 mmHg) usually requires a different group of drugs to the standard hypertension treatment plan
- (e) Spironolactone would be the best diuretic to add to management of a patient uncontrolled on triple therapy

MTF Question 34

Regarding antigen presentation, which of the following statements are correct?

- (a) Macrophages are capable of presenting foreign particles to B lymphocytes
- (b) Dendrites, present on antigen-presenting cells, improve interaction with T cells
- (c) T-cell receptors will recognise antigens presented via the human leucocyte antigen but not the major histocompatibility complex
- (d) Antigen-presenting cells include epithelial cells
- (e) Activation of T helper cells stimulates further proliferation of human leucocyte antigen molecules on macrophages

MTF Question 35

With regard to the use of endotracheal tubes in children, which of the following statements are true?

- (a) The glottis is the narrowest part of the airway in children
- (b) According to Cole's formula the correct size for a 4-year-old would be 5.0 mm internal diameter
- (c) Nasal endotracheal tubes should be avoided in children under 8 years
- (d) Uncuffed tubes are not suitable for rapid sequence induction
- (e) According to Cole's formula the correct size for a 6-year-old would be 6.5 mm internal diameter

MTF Question 36

Regarding vitamin K:

- (a) It is used as prophylaxis against haemolytic disease of the newborn
- (b) The body carries no significant stores of vitamin K
- (c) It is so named because it was discovered after vitamin J (biotin)
- (d) It is required for the activation of some anticoagulant factors
- (e) Synthetic oral vitamin K should not be administered to neonates

MTF Question 37

Which of the following statements about propofol are true?

- (a) Propofol is contraindicated in patients with an allergy to eggs