Paper 1 Questions

Physiology

1 Pulse pressure

(a) is the median value between the systolic and the diastolic blood pressures
(b) is reduced during tachycardia
(c) is determined by the compliance of the arterial tree
(d) decreases in old age
(e) at a given time is the same throughout the arterial tree

2 Myocardial work increases when there is an increase in

(a) stroke volume
(b) ventricular systolic pressure
(c) contractility
(d) heart rate
(e) systemic vascular resistance

3 Fetal haemoglobin

(a) forms 60% of circulating haemoglobin at birth
(b) is normally replaced by haemoglobin A (HbA) within 6–9 months
(c) has a sigmoid-shaped dissociation curve
(d) has a greater oxygen content at any given PO_2 than adult haemoglobin
(e) binds 2,3-DPG more avidly than HbA

4 In the normal ECG the

(a) Q wave is normally present in lead V6
(b) T wave is normally inverted in aVR
(c) Q wave is normally present in V1
(d) R wave is larger than the S wave in V1
(e) QRS duration depends on the recording electrode

5 Pulmonary vascular resistance is
(a) increased when the haematocrit is abnormally high
(b) decreased when breathing 21% oxygen in 79% helium
(c) increased by the application of 5 cmH_2O positive end-expiratory pressure
(d) increased by hypercapnia
(e) decreased by moderate exercise

6 Concerning baroreceptors
(a) they are located in the carotid sinus and aortic arch
(b) they are stretch receptors
(c) the neuronal discharge decreases as the mean arterial pressure increases
(d) the neuronal firing increases as the heart rate increases
(e) baroreceptors in the carotid sinus are more sensitive than aortic receptors to changes in blood pressure

7 Lung compliance
(a) describes the relationship between pressure and flow
(b) decreases with age
(c) is reduced in the supine position
(d) is normally 1.5–2.0 l/kPa
(e) is related to body size

8 During normal inspiration there is an increase in
(a) intrapleural pressure
(b) alveolar pressure
(c) intra-abdominal pressure
(d) the relative humidity of air in the trachea
(e) the partial pressure of oxygen in the trachea

9 Alveolar dead space is increased in
(a) pulmonary embolism
(b) haemorrhage
(c) increased tidal volumes
(d) changing from the supine to the erect posture
(e) intermittent positive-pressure ventilation

10 Functional residual capacity (FRC)

(a) measurement by the helium dilution technique gives a higher value than that given by body plethysmography
(b) is equal to total lung capacity minus the reserve volume
(c) is increased by changing from the erect to the supine posture
(d) is reduced during pregnancy
(e) is decreased in old age

11 The ascending limb of the loop of Henle

(a) is impermeable to sodium
(b) is involved in the active transport of potassium ions into the lumen
(c) is involved in the transport of chloride out of the lumen
(d) actively transports water
(e) contains hypotonic urine at the distal end

12 In an awake, healthy individual assuming the lateral position the

(a) dependent lung has less ventilation
(b) dependent lung has more perfusion
(c) $\dot{V}/\dot{Q}$ ratio is higher in the dependent lung
(d) PO_2 is higher in the lower lung
(e) P_aCO_2 is lower in the lower lung

13 A pressure volume curve can be used for measuring

(a) the work of breathing
(b) compliance
(c) functional residual capacity (FRC)
(d) respiratory quotient
(e) anatomical dead space

14 Cerebrospinal fluid

(a) is formed by the choroid plexus
(b) has a specific gravity of 1030 at body temperature
(c) total volume in a 70-kg adult is 500 ml
(d) normal pressure in the lateral position is 70–150 kPa
(e) total protein content is more than that of serum proteins

15 Concerning the transport process in the proximal convoluted tubules (PCT)

(a) about 50% of the normal filtered load of HCO_3 ion is absorbed in the proximal tubule
(b) absorption of glucose is linked to sodium reabsorption
(c) normally most of the phosphate filtered is excreted
(d) there are active secretory mechanisms for penicillin and *para*-aminohippuric acid (PAH)
(e) amino acid absorption is independent of sodium reabsorption

16 The stretch reflex

(a) consists of only one synapse within the central nervous system
(b) involves gamma motor fibres as the efferent link
(c) causes jerkiness of body movements
(d) involves glutamate as a neurotransmitter at the central synapse
(e) is highly facilitated in a decerebrate animal

17 Following major surgery a young fit 70-kg man will normally excrete, in 24 h

(a) 500 ml water
(b) 30 mmol Na^+
(c) 10 mmol K^+
(d) 20 mmol urea
(e) 10 mmol Cl^-

18 During periods of starvation in humans

(a) glycogen stores are depleted in 24 h
(b) amino acids are converted to glucose
(c) tissue breakdown initially provides 900 calories per day
(d) urinary nitrogen loss progressively increases
(e) a loss of 40% body cell mass is compatible with survival

19 In the fetal circulation the

(a) foramen ovale closes due to pressure change
(b) ductus venosus carries mixed venous blood
(c) blood can reach the aorta from the superior vena cava without passing through the left atrium or the left ventricle
(d) saturation of fetal haemoglobin (Hb F) in the descending aorta is more than in the aortic arch
(e) oxygen saturation in the umbilical vein is 45%

20 Delta waves on the EEG are associated with

(a) hypoxia
(b) hypercarbia
(c) sleep
(d) closing eyes
(e) deep general anaesthesia

21 Erythropoietin

(a) is a circulating hormone without which hypoxia has little or no effect on red cell production
(b) is formed in the kidney and in the liver
(c) production is stimulated by epinephrine and norepinephrine
(d) production is increased within minutes of the development of hypoxia
(e) activity is decreased when the red cell volume is increased

22 The following receptors are present in the chemoreceptor trigger zone (CTZ)

(a) opioid
(b) dopaminergic D_1 receptors
(c) muscarinic M3 receptors
(d) adrenergic $\alpha 1$ and $\alpha 2$
(e) serotogenic $5HT_3$

23 With regard to the vomiting reflex the

(a) diaphragm relaxes
(b) glottis opens
(c) epiglottis closes
(d) oesophageal sphincter closes
(e) respiration stops

24 Aldosterone

(a) does not directly affect renal blood flow
(b) increases the acidity of urine
(c) reduces the sodium content of sweat
(d) potentiates the effects of vasopressin in hypovolaemia
(e) is excreted in response to angiotensin

25 The respiratory quotient (RQ)
(a) is the ratio of CO_2 to O_2 at any given time
(b) is the ratio in the steady-state of the volume of CO_2 produced to the volume of O_2 consumed per unit of time
(c) is 0.7 with a diet of carbohydrate
(d) is decreased during hyperventilation
(e) increases during severe exercise

26 Compensatory reactions activated by haemorrhage include
(a) decreased movement of interstitial fluid into the capillaries
(b) decreased plasma protein synthesis
(c) increased secretion of ADH
(d) decreased glomerular filtration rate
(e) decreased filtration fraction

27 In the renal tubule
(a) hydrogen ions are excreted in combination with ammonia
(b) hydrogen ions are excreted mostly as phosphate
(c) aldosterone increases sodium absorption in the distal convoluted tubule (DCT) and collecting duct
(d) ADH increases water permeability in the DCT
(e) almost 99% of the glomerular filtrate is reabsorbed

28 When compared to normal people athletes have
(a) a larger stroke volume at rest
(b) a lower heart rate at any given level of exercise
(c) a decreased maximal oxygen consumption ($\dot{V}O_{2\ max}$)
(d) a smaller increase in blood lactate production with exercise
(e) a higher muscle blood flow

29 Plasma proteins
(a) exert an osmotic pressure of approximately 5.3 kPa (40 mmHg)
(b) provide one-half of the buffering capacity of the blood
(c) include plasminogen
(d) are mostly in the anionic form
(e) are the main source of carbamino groups

30 The motility of the gastrointestinal tract is increased by
(a) vagotomy
(b) complete transection of the spinal cord at T3

(c) stellate ganglion block
(d) mechanical bowel obstruction
(e) neostigmine

Pharmacology

31 The following statements are true regarding drug receptors
(a) they are found only in cell membranes
(b) drug receptor activity is always G-protein-coupled
(c) the concentration of receptors in the cell membranes is dynamic
(d) GABA receptors are ligand-gated ion channels
(e) competitive antagonists bind reversibly to the receptors

32 The following drugs are extensively metabolised
(a) prilocaine
(b) digoxin
(c) chlorpromazine
(d) diazepam
(e) paracetamol

33 The following drugs are well absorbed from the stomach
(a) morphine
(b) diamorphine
(c) midazolam
(d) loperamide
(e) propranolol

34 The following factors enhance the diffusion of a drug across the blood-brain barrier
(a) high plasma protein binding
(b) high degree of ionisation at physiological pH
(c) high molecular weight
(d) high lipid solubility
(e) high plasma–brain concentration gradient

35 pH alters the structure of the following drugs
(a) diazepam
(b) midazolam
(c) lidocaine

(d) atracurium
(e) suxamethonium

36 The following drugs induce the enzyme cytochrome P450
(a) carbamazepine
(b) nitrazepam
(c) metronidazole
(d) ranitidine
(e) rifampicin

37 The following anaesthetic agents cause direct sympathetic stimulation
(a) enflurane
(b) sevoflurane
(c) desflurane
(d) halothane
(e) isoflurane

38 The following speed up the induction of anaesthesia with volatile anaesthetics
(a) use of CO_2
(b) increased cardiac output
(c) agents with a high blood/gas solubility coefficient
(d) increased alveolar ventilation
(e) hypotension

39 The following cause dystonic reactions
(a) ondansetron
(b) metoclopramide
(c) cyclizine
(d) prochlorperazine
(e) domperidone

40 Etomidate
(a) reduces intraocular pressure
(b) is solubilised in propylene glycol
(c) causes a higher incidence of venous sequelae than thiopentone

(d) reduces plasma cortisol concentrations by an action on the pituitary gland
(e) is excreted unchanged in the kidney

41 Prilocaine
(a) has a p*K*a of 5.0
(b) has a longer duration of action than lidocaine
(c) is metabolised by plasma cholinesterase
(d) has a higher p*K*a than bupivacaine
(e) is more protein bound than bupivacaine

42 Lidocaine (lignocaine)
(a) prolongs the duration of action of the cardiac action potential
(b) inhibits plasma cholinesterase
(c) causes sedation
(d) causes atrioventricular block
(e) has a high hepatic extraction ratio

43 Which of the following are true of the mechanisms of opioid action?
(a) there are currently five separate opioid receptors
(b) the mu (μ) receptor has been classified as the op1 receptor
(c) opioid receptors are found at peripheral sites
(d) buprenorphine is a partial agonist at the mu (μ) receptor
(e) nalbuphine is an effective mu (μ) receptor antagonist

44 Naloxone
(a) is a kappa receptor agonist
(b) has a high oral bioavailability
(c) has an elimination half-life of 1–2 h
(d) causes pulmonary oedema
(e) prevents conversion of angiotensin I to angiotensin II

45 The following are $5HT_3$ blockers
(a) octreotide
(b) methysergide
(c) cyproheptadine
(d) ketanserine
(e) ondansetron

46 Flumazenil
(a) is a competitive benzodiazepine antagonist
(b) is an inverse agonist at the benzodiazepine receptor
(c) has a relatively short half-life
(d) is useful in treating hepatic encephalopathy
(e) is indicated in status epilepticus

47 Midazolam when compared with diazepam
(a) is more lipid soluble
(b) produces longer-acting active metabolites
(c) causes less discomfort on injection
(d) has a significantly lower volume of distribution
(e) has a shorter elimination half-life

48 Neostigmine
(a) is a tertiary amine
(b) is metabolised in the liver
(c) may prolong the action of suxamethonium
(d) inhibits both cholinesterase and pseudocholinesterase
(e) if given during pregnancy can cause fetal muscle weakness

49 Potentiation of neuromuscular block by neomycin is
(a) more likely with a non-depolarising block than with a depolarising block
(b) intensified by enflurane
(c) lessened by the administration of calcium
(d) antagonised by the administration of neostigmine
(e) increased by simultaneously administering trimethoprim

50 Class 1a anti-arrhythmic drugs usually
(a) slow depolarisation
(b) increase the threshold potential
(c) increase the action potential
(d) are indicated for atrial arrhythmias
(e) have local anaesthetic activity