

Respiration

Section 1

- 1 Which is INCORRECT?
 - a) the conducting zone of the airways contain 16 generations and extend to the terminal bronchioles
 - b) terminal bronchioles are lined by cilia
 - c) the bronchioles and terminal bronchiole walls contain a mix of cartilage and smooth muscle
 - d) terminal bronchioles have the greatest amount of smooth muscle

- 2 Which is the INCORRECT pairing in bronchi/bronchioles:
 - a) cholinergic discharge → bronchodilation
 - b) β_2 – agonist → bronchodilation
 - c) β_2 – agonist → increased secretion
 - d) VIP → bronchodilation

- 3 Regarding intrapleural pressure, which is INCORRECT?
 - a) at rest (post quiet expiration) it is subatmospheric
 - b) at inspiration it becomes more negative
 - c) strong inspiration gives intrapleural pressures of about -6mmHg
 - d) at rest intrapleural pressure is -2.5mmHg at the bases

- 4 The diaphragm:
 - a) moves up to cause expiration
 - b) moves as much as 7cm with deep breathing
 - c) always contracts as a single unit
 - d) works with the internal intercostals to initiate inspiration

- 5 Which is CORRECT?
 - a) voluntary control of breathing originates in the pons/medulla
 - b) automatic breathing control descends to the respiratory musculature via the corticospinal tract
 - c) the reciprocal innervation in automatic breathing is via descending pathways rather than spinal reflexes
 - d) automatic fibres descend to innervate the external intercostal muscles at each thoracic level to mediate expiration
 - e) there is no output to the phrenic nerves during expiration

- 6 Which abolishes automatic respiration? Destruction of:
- pre-Bottzinger complexes
 - ventral gp respiratory neurons
 - dorsal gp respiratory neurons
 - section at the inferior border of the pons
 - transaction rostral to the pons
- 7 The vagal afferent influence:
- inhibits expiratory neurons
 - excites expiratory neurons
 - if cut, causes gasping respiration
 - can cause inspiratory 'breath-holding' if the pneumotoxic centre is also destroyed
 - if cut, causes shallow rapid breathing
- 8 Which does not stimulate carotid bodies?
- carbon monoxide poisoning
 - cyanide poisoning
 - hypoxia
 - hypercapnia
 - increased H^+ concentration
 - nicotine
- 9 All of the following shift the Hb dissociation curve to the right during exercise EXCEPT:
- increased 2,3 DPG
 - increased pCO_2
 - increased temperature
 - decreased pO_2
- 10 Hypoxia at high altitudes:
- is a form of stagnant hypoxia
 - causes symptoms of cyanosis
 - causes severe symptoms in an unacclimatised person at 3,000m
 - can always be reversed with 100% O_2
- 11 Regarding surfactant:
- infant respiratory distress syndrome can be adequately treated with administration of phospholipids alone
 - cigarette smokers have the same amount of surfactant as non-smokers
 - the phospholipid film is formed by tubular myelin
 - infant respiratory distress syndrome is caused by insufficient surfactant that prevents the alveoli from expanding at first inspiratory effort
 - formation of the phospholipid film is greatly facilitated by the carbohydrate in surfactant

- 12 Regarding the work of breathing during quiet inspiration:
- a) elastic work = 80%
 - b) viscous resistance = 7%
 - c) airway resistance = 13%
 - d) when tidal volume versus intrapleural pressure in quiet inspiration are plotted, a straight line results
 - e) the amount of elastic work required to inflate the whole respiratory system is more than the amount required to inflate the lungs alone
- 13 Regarding gas exchange in the lungs:
- a) PaO_2 in pulmonary capillaries is the same as PaO_2 in the aorta
 - b) diffusing capacity for O_2 ($D_L\text{O}_2$) increases from 25→65ml/min/mmHg during exercise
 - c) $D_L\text{O}_2$ is unaffected by beryllium poisoning and sarcoidosis
 - d) CO_2 retention is frequently a problem in patients with alveolar fibrosis
 - e) decreased secretion of PDGF by alveolar macrophages causes pulmonary fibrosis
- 14 Regarding gas exchange in the lungs:
- a) N_2O is diffusion limited
 - b) CO is perfusion limited
 - c) O_2 is between N_2O and CO but at rest, is perfusion limited
 - d) diffusing capacity of the lung for a gas is inversely proportionate to the surface area of the alveolocapillary membrane and directly proportional to its thickness
 - e) at rest, it takes blood 0.25secs to traverse the pulmonary capillaries
- 15 Regarding bronchial tone:
- a) substance P causes bronchoconstriction
 - b) constriction is caused by sympathetic discharge
 - c) dilation is caused by parasympathetic discharge
 - d) maximal bronchoconstriction occurs at 4am
 - e) VIP causes bronchoconstriction
- 16 Regarding pulmonary function, which of the following is NOT true?
- a) $\text{FRC} = \text{ERV} + \text{RV}$
 - b) IRV in men is about 3,3L
 - c) RV in women is about 1.1L
 - d) inspiratory capacity in men = 4.8L
 - e) total lung capacity = 6L in men, 4.2L in women

- 17 Regarding the glottis:
- when laryngeal adductors are paralysed there is inspiratory stridor
 - abductors contract early in inspiration
 - when abductors are paralysed, aspiration pneumonia may result
 - the adductors are supplied by the vagus nerves, the abduction by the hypoglossal nerve
 - in animals with bilateral cervical vagotomy, pulmonary oedema is purely secondary to aspiration
- 18 Regarding oxygen transport:
- Haemoglobin S has glutamic acid instead of valine in the β chains
 - the O_2 saturation of Hb is the percentage of available binding sites that do not have O_2 attached
 - the oxygenated form of Hb is the T state
 - cyanosis is more obvious in anaemic patients
 - normal P_{50} is 27mmHg
- 19 Regarding the O_2 dissociation curve:
- O_2 affinity of Hb is reduced when the curve is shifted to the left
 - decreased 2,3-DPG shifts the curve to the right
 - the Bohr effect is attributed to the action of PCO_2 on H^+ concentration
 - temperature has no effect on the curve
 - 2,3-DPG levels are reduced at altitude
- 20 Diffusion is inversely proportional to:
- the diffusion constant
 - tissue area
 - solubility of the gas
 - square root of the molecular weight
 - the difference in partial pressure
- 21 In exercise:
- oxygen consumption is about 6L/min in a moderately fit subject
 - the respiratory exchange ratio rises to 0.8
 - diffusing capacity increases 3-fold
 - the change in cardiac output is only about a sixth of the increase in ventilation
 - the oxygen dissociation curve moves to the left

- 22 If alveolar ventilation doubles and CO_2 production remains constant, what happens to arterial PCO_2 ?
- doubles
 - no change
 - halves
 - depends on PAO_2
 - depends on barometric pressure
- 23 Which substance is unaffected by passage through the lung?
- angiotensin I
 - bradykinin
 - histamine
 - serotonin
 - norepinephrine
- 24 Regarding exercise and the respiratory system:
- respiration exchange ratio remains constant
 - O_2 consumption \propto work rate throughout
 - the O_2 -Hb curve moves to the right
 - PCO_2 increases with exercise
 - arterial pH remains constant
- 25 Central respiratory chemoreceptors:
- are located in the medulla near exit of cranial nerve X, XI
 - respond directly to changes in external PCO_2
 - respond directly to changes in arterial PO_2
 - are located on dorsal surface of medulla
 - respond to pH of CSF
- 26 Respiratory peripheral chemoreceptors:
- carotid bodies respond to PO_2 , PCO_2 , and pH
 - peripheral chemoreceptor response to arterial PCO_2 is more important than central chemoreceptor response
 - aortic bodies are located within the aortic valve ring
 - drop in $\text{PO}_2 < 100\text{mmHg}$ causes increase in firing rate
 - carotid bodies respond to venous PO_2
- 27 Ventilatory response to CO_2 is reduced by all EXCEPT:
- sleep
 - barbiturate overdose
 - increasing age
 - decreasing the work of breathing
 - trained athletes and divers

28 The surface area of the lungs is:

- a) three times the area of skin
- b) ten times the area of skin
- c) 30 times the area of skin
- d) 100 times the area of skin
- e) none of the above

29 Site of most / major airway resistance is:

- a) trachea
- b) main bronchi
- c) large bronchi
- d) medium sized bronchi
- e) bronchioles

Respiratory System

Section 1 – Answers

- 1 C
- 2 A
- 3 C
- 4 B
- 5 C
- 6 A
- 7 no answer
- 8 A
- 9 D
- 10 B
- 11 C
- 12 B
- 13 B
- 14 C
- 15 A
- 16 D
- 17 B
- 18 E
- 19 C
- 20 D
- 21 C
- 22 no answer
- 23 no answer
- 24 no answer
- 25 E
- 26 D
- 27 D
- 28 C
- 29 D

Section 2

- 1 In a fit young person, which of the following is/are FALSE?
 - a) body plethysmography measures communicating gas volume, but not trapped gas
 - b) closing capacity = closing volume + residual volume
 - c) total lung capacity = functional residual capacity and vital capacity
 - d) anatomic dead space is about 2ml/kg

- 2 In a patient who starts with PCO_2 of 40, alveolar ventilation doubles, and CO_2 production quadruples:
 - a) $PCO_2 = 40$
 - b) $PCO_2 = 80$
 - c) $PCO_2 = 20$
 - d) $PCO_2 = 60$

- 3 In a patient with $Paco_2 = 30$ mmHg, the mixed expired Pco_2 is 15mmHg. The tidal volume is 500ml:
 - a) $VD_{\text{physiological}}/VT = 0.5$
 - b) $VD_{\text{physiological}}/VT = 0.3$
 - c) If CO_2 production is normal, the alveolar ventilation is increased by one third
 - d) alveolar PCO_2 is 15mmHg

- 4 In a normal person at rest, which of the following are FALSE?
 - a) pulmonary capillary transit time of a red blood cell is 0.25 seconds
 - b) transfer of CO from alveolus to pulmonary capillary is flow limited
 - c) end pulmonary capillary PO_2 is about 5mmHg lower than alveolar PO_2
 - d) transfer of N_2O from alveolus to pulmonary capillary is flow limited

- 5 Concerning the pulmonary circulation in a normal man:
 - a) mean pulmonary artery pressure = 25mmHg
 - b) pulmonary vascular resistance is decreased by hypoxia
 - c) pulmonary vascular resistance is lower at TLC than at FRC
 - d) no blood flow occurs in West's Zone 1

- 6 Metabolic functions of the lung include the following:
 - a) adrenaline is inactivated in the lung
 - b) bradykinin inactivation is catalysed by angiotensin converting enzyme
 - c) lipoxygenase catalyses the conversion of arachidonic acid to prostaglandins and thromboxane A₂
 - d) angiotensin I is converted to angiotensin II

- 7 During pure hypoventilation:
- the alveolar-arterial gradient is increased
 - when breathing air, if the PACO_2 is 100mmHg, the PAO_2 is 25mmHg
 - the PaCO_2 takes longer to reach equilibrium than the PaO_2
 - when breathing 25% O_2 , if the PACO_2 is 100, the PAO_2 is 53mmHg
- 8 Which of the following are not consistent?
- $\text{pH} = 7.22$, $\text{PCO}_2 = 60$, $\text{HCO}_3 = 24$
respiratory acidosis, no metabolic change
 - $\text{pH} = 7.17$, $\text{PCO}_2 = 80$, $\text{HCO}_3 = 28$
uncompensated respiratory acidosis
 - $\text{pH} = 7.35$, $\text{PCO}_2 = 60$, $\text{HCO}_3 = 32$
anion gap respiratory acidosis
 - $\text{pH} = 7.49$, $\text{PCO}_2 = 30$, $\text{HCO}_3 = 22$
uncompensated respiratory alkalosis
- 9 The oxygen dissociation curve is shifted to the right by:
- hypercarbia
 - increased 2,3-DPG
 - hyperthermia
 - carbon monoxide poisoning
- 10 In severe anaemia:
- resting cardiac output is raised
 - arterial PO_2 is decreased
 - mixed venous PO_2 is decreased
 - the oxygen dissociation curve is shifted to the left
- 11 Cyanosis occurs:
- when 5g of reduced Hb are present in capillary blood
 - when $\text{PaO}_2 = 45\text{mmHg}$
 - in circulatory (stagnant or ischaemic) hypoxia when the oxygen extraction ratio for peripheral tissues is very high
 - in histotoxic hypoxia
- 12 A healthy young adult breathing 100% oxygen will have:
- mixed venous PO_2 of 40mmHg
 - mixed venous PO_2 of 713mmHg
 - mixed venous PO_2 of 650mmHg
 - mixed venous PO_2 of 50mmHg
 - mixed venous PO_2 of 100mmHg

- 13 During exercise:
- a) arterial PCO_2 rises
 - b) RQ falls
 - c) VO_2 may reach 15 l/min
 - d) minute ventilation may reach 120 l/min
- 14 During hyperbaric O_2 therapy (100%) at 4 atmospheres absolute:
- a) PAO_2 is increased to between 2900 and 3000mmHg
 - b) increased PvCO_2
 - c) normal PaCO_2
 - d) tissue acidosis

- 15 A patient with a right to left shunt:
Mixed venous oxygen content = 15ml/100ml
Pulmonary capillary O_2 content = 20ml/100ml
Arterial O_2 content = 18ml/100ml

What fraction of total cardiac output passes through the shunt?

- a) 10%
 - b) 20%
 - c) 30%
 - d) 40%
 - e) 50%
- 16 Transpulmonary pressure:
- a) equals intrapleural pressure minus alveolar pressure
 - b) is normally negative
 - c) is higher (more negative) at TLC than at RV
 - d) is higher (more negative) in a patient with emphysema, when measured at the same lung volume
- 17 Concerning compliance:
- a) specific compliance is the same for a 70kg adult and a 3kg neonate
 - b) if lung compliance = 200ml/cm H_2O , then total respiratory compliance = 400ml/cm H_2O
 - c) dynamic compliance is a sensitive test for small airways disease
 - d) compliance increases with pulmonary oedema

- 18 The Law of Laplace implies that:
- in an alveolus $P = 4T/R$
 - in a soap bubble $P = T/R$
 - large bubbles empty into small bubbles (if no surfactant is present)
 - in a blood vessel $P = T/R$
- 19 In an erect subject:
- if lung volume is normal, the volume of an alveolus at the apex is higher than at the base
 - if lung volume is normal, compliance is higher at the base than at the apex
 - if lung volume is decreased, compliance is higher at the apex than at the base
 - if lung volume is normal, there is more ventilation per unit volume at the base, than at the apex
- 20 Flow of gas in the bronchial tree:
- is likely to be more turbulent in small airways than in large airways
 - if flow is turbulent, then doubling the pressure will double the flow rate
 - is dependent on viscosity if flow is turbulent
 - turbulence is more likely when the Reynold's number is low
 - breathing a gas mixture containing a low density gas such as helium is less likely to cause turbulence than breathing air
- 21 In a normal adult:
- CSF pH is 7.32
 - the ventilatory response to hypoxia is mediated by both central and peripheral chemoreceptors
 - less than 20% of the ventilatory response to CO_2 is due to stimulation of the peripheral chemoreceptors
 - in acute respiratory acidosis, the change in CSF pH is less than the change in blood pH
- 22 The respiratory quotient:
- is low in high V/Q alveoli
 - is higher at the base of the lung than the apex
 - equals VO_2/VCO_2
 - is 1.0 for carbohydrate

Section 2 – Answers

- 1 A & C
- 2 B
- 3 A & C
- 4 A, B, & C
- 5 D
- 6 B & D
- 7 B, C & D
- 8 A & C
- 9 A, B & C
- 10 A & C
- 11 A, B & C
- 12 D
- 13 D
- 14 All are correct
- 15 D
- 16 A, B & C
- 17 A & C
- 18 D
- 19 All are correct
- 20 E
- 21 A & C
- 22 D

Section 3

- 1 The volume of the anatomical dead space is:
 - a) 50mL
 - b) 100mL
 - c) 150mL
 - d) 200ml
 - e) 300ml

- 2 Which respiratory volume is INCORRECT?
 - a) tidal volume is the normal breathing volume
 - b) vital capacity is the volume from maximal inspiration followed by maximal expiration
 - c) residual volume is the volume remaining in lungs after maximal expiration
 - d) functional residual capacity is the volume after normal inspiration
 - e) total lung capacity is the vital capacity plus residual volume

- 3 The diffusion constant is proportional to:
 - a) tissue thickness
 - b) square root of the molecular weight
 - c) difference in partial pressures
 - d) tissue area
 - e) gas solubility

- 4 Mean pressure (mmHg) in the main pulmonary artery is:
 - a) 2
 - b) 5
 - c) 8
 - d) 15
 - e) 25

- 5 Regarding pulmonary blood flow:
 - a) increased arterial pressure leads to increased pulmonary vascular resistance
 - b) localised vasoconstriction is directly due to arterial PO_2 hypoxia
 - c) regional differences are due to hydrostatic pressure differences
 - d) at the apex $Pa > Pv > PA$
 - e) pulmonary arteries and veins have transmural pressures equal to alveolar pressure

- 6 Which is not inactivated by the lungs?
- serotonin
 - bradykinin
 - leukotrienes
 - prostaglandin E₂
 - vasopressin
- 7 Regarding the alveolar gas equation:
- the respiratory quotient nears 1.0 with exercise
 - P_{IO_2} = barometric pressure – water vapour pressure
 - $P_{ACO_2} > P_{aCO_2}$
 - P_{AO_2} is normally 150mmHg
 - remains valid if there is CO₂ present in the inspired gas
- 8 The amount of O₂ in blood with a PaO₂ of 100mmHg is:
- 0.003ml O₂/100ml
 - 0.3ml O₂/100ml
 - 3ml O₂/100ml
 - 3ml O₂/mL
 - 0.3ml O₂/L
- 9 Regarding the O₂ dissociation curve:
- increased PCO₂ has a direct effect on the curve, shifting it to the right
 - 2,3-DPG levels rise as altitude
 - the deoxy form of Hb is in the relaxed state
 - CO moves the curve to the left as it has 100 times the affinity of O₂ for Hb
 - P₅₀ is at a PO₂ of 40mmHg
- 10 Which respiratory principle is INCORRECT?
- Fick's law states that "the volume of gas per unit time that moves across a sheet of tissue is proportional to the area of the sheet, but inversely proportional to its thickness"
 - the Bohr effect is "the effect of PCO₂ on the O₂ dissociation curve due to the action of PCO₂ on H⁺ concentration"
 - Henry's law states that "the amount of gas dissolved is proportional to the partial pressure of that gas"
 - the chloride shift is "the diffusion of HCO₃⁻ in to the cell, with the outward diffusion of Cl⁻ ions to maintain electrical neutrality"
 - the Haldane effect is that deoxygenation of the blood increases its ability to carry CO₂

- 11 Given a $PCO_2 = 600\text{mmHg}$ and a $HCO_3^- = 28\text{mEq/l}$ there is a:
- metabolic acidosis
 - metabolic acidosis with renal compensation
 - respiratory acidosis
 - respiratory acidosis with renal compensation
 - respiratory alkalosis
- 12 Regarding the elastic properties of the lung:
- the lung volume at any given pressure during inflation is larger than during deflation
 - the area under the pressure-volume curve is known as the compliance
 - surface tension is the force acting across an imaginary line in the surface of the liquid
 - pressure generated in an alveolus equals $4T/R$
 - surfactant, produced by Type I alveolar cells, reduces surface tension in alveoli
- 13 Halving the radius of an airway increases resistance:
- 2-fold
 - 4-fold
 - 8-fold
 - 16-fold
 - has no effect on resistance
- 14 The major site of resistance in the bronchial tree is the:
- segmental bronchii
 - medium-sized bronchii
 - small bronchii
 - large bronchioles
 - terminal bronchioles
- 15 Lung compliance increases with:
- asthma
 - alveolar oedema
 - pulmonary hypertension
 - atelectasis
 - pulmonary fibrosis

Regarding these chemoreceptors:

- a) central receptors
- b) carotid bodies
- c) aortic bodies
- d) pulmonary stretch receptors
- e) irritant receptors
- f) J receptors
- g) nose and upper airway receptors
- h) joint and muscle receptors

- 16 Which responds quickly to chemicals injected into the pulmonary circulation?
- 17 Which are believed to be important in the early stages of exercise?
- 18 Which are the most important for minute-by-minute control of ventilation?
- 19 Which show sustained activity with lung inflation?
- 20 Which rapidly adapting receptors lie between airway epithelial cells?
- 21 Which contain glomus cells of two types, with Type I cells containing large amounts of dopamine?
- 22 Which respond to PO_2 and PCO_2 but not pH?
- 23 Which initiate the Hering-Breuer reflexes?
- 24 Which respond to mechanical and chemical stimulation?
- 25 Which respond to blood CO_2 , not O_2 or H^+ concentrations?
- 26 The ventilatory response to CO_2 is increased by:
 - a) sleep
 - b) increasing age
 - c) trained athlete
 - d) morphine
 - e) decreased PO_2

- 27 Normally the FEV₁ is what percentage of FVC?
- 50%
 - 60%
 - 70%
 - 80%
 - 90%
- 28 The calibre of extra-alveolar vessels is primarily determined by:
- the difference between alveolar pressure and the pressure within them
 - the pressure in the pulmonary artery
 - the lung volume
 - the cardiac output
 - the patient's fluid status
- 29 Which statement regarding hyperbaric oxygen therapy is INCORRECT?
- males eliminate carboxy haemoglobin faster than females
 - gas around the body is normal air compressed to the same high pressure
 - it produces marked increases in dissolved oxygen in the blood
 - oxygen is administered at up to 3 atmospheres pressure
 - toxicity includes optic neuritis
- 30 All of the following are features of acclimatisation to high altitude EXCEPT:
- shift to the right of the oxygen dissociation curve
 - increased number of capillaries in peripheral tissues
 - pulmonary vasodilation
 - polycythaemia
 - increased maximum breathing capacity
- 31 Which of the following statements is TRUE?
- pulmonary stretch receptors lie within the airway epithelial cells
 - J receptors, when stimulated, cause slow deep breathing
 - irritant receptors, when stimulated, send impulses up the vagus in unmyelinated fibres
 - irritant receptors are rapidly adapting
- 32 Which one of the following statements regarding ventilation is INCORRECT?
- tidal volume in the average human is 500ml
 - anatomical dead space is the volume of the conducting airway and is about 160ml
 - upper regions of the lung ventilate better than the lower regions
 - you can measure physiological dead space via Bohr's method to get what is called a Bohr equation which is: $\frac{VD}{VT} = \frac{PACO_2 - PECO_2}{PACO_2}$
 - None of the above

- 33 The diffusion capacity (DI) of the lung accounts for:
- P1-P2
 - area of lung
 - the thickness
 - diffusion constant
 - all of the above
- 34 Regarding movement to high altitude, which statement is INCORRECT?
- hyperventilation occurs due to hypoxic stimulation of peripheral chemoreceptors
 - pro-erythroblasts mature into erythrocytes more rapidly than normal
 - renal bicarbonate excretion increases
 - increased numbers of mitochondria appear in the tissues
 - FiO_2 decreases with increasing altitude
- 35 Metabolic functions of the lung include all of the following EXCEPT:
- conversion of AI to All by ACE
 - metabolism of All
 - inactivation of bradykinin
 - removal of serotonin
 - metabolism of arachidonic acid metabolises
- 36 Which of the following is INCORRECT?
- O_2 toxicity causes convulsion
 - O_2 at 100% in premature infants causes retrolental fibroplasia
 - acclimatisation to high altitudes include a shift to the left of the O_2 dissociation curve
 - polycythaemia is a feature of acclimatisation
 - acute mountain sickness is due to hypoxaemia and alkalosis
- 37 Regarding the neural control of breathing, which statement is INCORRECT?
- medullary centres are close to but separate from central chemoreceptors
 - during quiet respiration, expiration is a passive event
 - inspiratory medullary neurons supply both phrenic nerves
 - ventral medullary neurons are expiratory and do not discharge spontaneously
 - inspiratory medullary neurons discharge spontaneously at a rate of 12-15 times/minute
- 38 The transport of which of the following gases is DIFFUSION LIMITED?
- O_2
 - N_2O
 - CO_2
 - CO
 - halothane

- 39 With regard to anatomic dead space, all of the following are true EXCEPT:
- it is calculated by Bohr's method
 - the normal value is about 150ml
 - it increases with large inspirations
 - depends on the size of the subject
 - it is equivalent to the conducting zone
- 40 Which of the following is INCORRECT?
- haemoglobin S causes the O₂ curve to shift to the left
 - the O₂ dissociation curve is shifted to the right by an increased PCO₂, H⁺ concentration and temperature
 - carboxy haemoglobin has 240 times the affinity of O₂ for Hb
 - COHB shift the O₂ dissociation over to the left
- 41 Regarding the chemical control of breathing, which statement is INCORRECT?
- central chemoreceptors are located in the medulla oblongata
 - hypoxia makes an individual more sensitive to increases in arterial carbon dioxide
 - arterial oxygen less than 70mmHg markedly stimulates respiration via the carotid bodies
 - carotid bodies have the highest blood flow, per unit time per 100g, of any tissue in the body
 - carbon dioxide is more important than oxygen in respiratory control
- 42 Fick's law states that:
- $V_a = (V_{CO_2}/PCO_2) \times K$
 - $V = (A.D.(P_1 - P_2))/T$
 - $pH = -\text{LOG}[H^+]$
 - $P_1V_1 = P_2V_2$
 - $V_1/V_2 = T_1/2$
- 43 Regarding surfactant, which statement is INCORRECT?
- it predominantly consists of phospholipid
 - it is increased by long-term 100% oxygen therapy
 - hydrophobic "tails" face into alveolar lumen
 - it is decreased by cigarette smoking
 - pulmonary oedema is a consequence of its absence
- 44 Which of the following DOES NOT shift the O₂ dissociation curve to the right?
- increased temperature
 - increased PCO₂
 - increased H⁺
 - increased DPG
 - increased carboxy haemoglobin

- 45 Regarding exercise, which statement is INCORRECT?
- a) the energy cost of breathing is up to 10% of total energy expenditure
 - b) total pulmonary ventilation increases by up to 20 fold
 - c) total oxygen consumption increases by up to 20 fold
 - d) total carbon dioxide production increases by up to 40 fold
 - e) P_{50} increases
- 46 Total lung capacity is equal to:
- a) vital capacity + tidal volume
 - b) vital capacity + functional residual capacity
 - c) tidal volume + residual volume
 - d) functional residual capacity + tidal volume
 - e) vital capacity + residual volume
- 47 Regarding compliance, which statement is INCORRECT?
- a) functional residual capacity is the equilibrium volume when elastic recoil of lung is balanced by normal tendency for chest wall to spring out
 - b) hysteresis is due to frictional resistance to air movement
 - c) compliance is greater in expiration than in inspiration
 - d) compliance is increased in emphysema
 - e) compliance is a dynamic measure of lung and chest wall recoil
- 48 Which of the following is NOT involved in the control of ventilation?
- a) peripheral chemoreceptors
 - b) lung stretch receptors
 - c) basal ganglia
 - d) pons
 - e) respiratory muscles
- 49 Which of the following DOES NOT decrease lung compliance?
- a) left ventricular failure
 - b) atelectasis
 - c) pulmonary fibrosis
 - d) advancing age
 - e) raised pulmonary capillary wedge pressure

- 50 Regarding ventilation / perfusion (V/Q) relationships, which statement is INCORRECT?
- a) V/Q ratio is greatest at the lung apex
 - b) V/Q ratio is about one at level of third rib when upright
 - c) ventilation decreases proportionately more than perfusion from base to apex
 - d) V/Q ratio for whole lung at rest is about 0.8
 - e) exercise increases the V/Q ratio
- 51 Regarding pulmonary perfusion, which statement is INCORRECT?
- a) apical perfusion is less than basal
 - b) E.coli endotoxin causes venodilatation
 - c) total pulmonary blood flow increases 3-6 fold during exercise
 - d) pulmonary vascular resistance increases at small lung volumes
 - e) in zone 2, pulmonary arterial pressure is greater than alveolar pressure
- 52 Regarding pulmonary ventilation, which statement is INCORRECT?
- a) physiological dead space is normally larger than anatomical dead space
 - b) basal ventilation is greater than apical
 - c) normal tidal volume is about 7ml/kg
 - d) airway resistance decreases at large lung volumes
 - e) total pulmonary ventilation can increase by up to 20 fold during exercise
- 53 Which of the following DOES NOT constrict pulmonary arterioles?
- a) adrenaline
 - b) thromboxane B₂
 - c) noradrenaline
 - d) prostaglandin F₂ α
 - e) isoproterenol
- 54 Regarding the lung volumes in a healthy 70kg male, 183cm tall, which is INCORRECT?
- a) tidal volume = 500ml
 - b) residual volume = 1200ml
 - c) expiratory reserve volume = 1000ml
 - d) inspiratory capacity = 3300ml
 - e) vital capacity = 4800ml
- 55 Regarding carbon dioxide transport in blood, which statement is INCORRECT?
- a) oxygen is about 20 times less soluble in blood
 - b) deoxygenation of blood increase its ability to carry carbon dioxide
 - c) arterial blood transports about 20% in dissolved form
 - d) venous blood has higher haematocrit than arterial blood
 - e) carbamino compounds are formed by reaction with both plasma proteins and Hb

- 56 Which of the following does NOT increase synthesis of 2, 3-DPG?
- a) growth hormone
 - b) phosphate deficiency
 - c) thyroid hormone
 - d) exercise for one hour
 - e) androgens
- 57 Which of the following DOES NOT shift the oxygen-haemoglobin dissociation curve to the right?
- a) decreased phosphate
 - b) increased altitude
 - c) cortisol
 - d) decreased pH
 - e) aldosterone
- 58 Regarding alveolar cells, which statement is INCORRECT?
- a) type I pneumocytes repair alveolar epithelium
 - b) pulmonary alveolar macrophages are derived from blood monocytes
 - c) mast cell membranes bind IgE via Fc portion to heavy chain
 - d) APUD (neuroendocrine) cells are of endodermal origin
 - e) type II pneumocytes are membranous
- 59 Which of the following substances is NOT removed from the blood by the lung?
- a) prostaglandins
 - b) noradrenaline
 - c) acetylcholine
 - d) adrenaline
 - e) bradykinin
- 60 Which statement regarding gas exchange in the lungs is INCORRECT?
- a) gases generally cross by simple diffusion
 - b) diffusion capacity for carbon dioxide is much greater than for oxygen
 - c) nitrous oxide is a diffusion limited gas
 - d) carbon monoxide does not reach equilibrium in 0.75 seconds
 - e) oxygen is a perfusion limited gas
- 61 Which of the following substances is NOT synthesised by the lung?
- a) prostaglandins
 - b) serotonin
 - c) dipalmityl phosphatidylcholine
 - d) histamine
 - e) kallikrein

62 Exercise has all of the following effects on blood gases EXCEPT:

- a) increased $P_{A}CO_2$
- b) increased $P_{A}O_2$
- c) unchanged $P_{a}CO_2$
- d) unchanged $P_{a}O_2$
- e) increased $P_{v}CO_2$

Section 3

1 C
2 D
3 E
4 D
5 C
6 E
7 A
8 B
9 B
10 D
11 C
12 C
13 D
14 B
15 A
16 F
17 H
18 A
19 D
20 E
21 B
22 C
23 D
24 G
25 A
26 E
27 D
28 C
29 A
30 C
31 D

32 C
33 A
34 E
35 B
36 C
37 D
38 D
39 A
40 A
41 C
42 B
43 B
44 E
45 A
46 E
47 E
48 C
49 D
50 C
51 B
52 A
53 E
54 D
55 C
56 B
57 A
58 E
59 D
60 C
61 B
62 A