11. Gas exchange in humans

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Paper 3 and 4

Marking Scheme

Q1.

(a)	**F:** larynx ; **G:** capillary ;	**2**	
(b)	nose | trachea | bronchus | bronchiole | alveoli | blood ;;	**2**	all correct = 2 marks if not all correct: *trachea before alveoli = 1 mark* ***or*** *bronchus before bronchiole = 1 mark*
(c)(i)	*carbon dioxide:* higher ; *oxygen:* lower ; *water vapour:* higher ;	**3**	 **A** the same
(c)(ii)	limewater / AVP ;	**1**	

Q2.

(a)(i)	*any two from:* large surface area ; thin (surface) ; good blood supply ; good ventilation ; moist ;	**2**	
(a)(ii)	breathing system / gas exchange system / respiratory system ;	**1**	

Q3.

(b)(i)	11 / 12 (breaths per minute) ;	**1**	
(b)(ii)	0.5 / 0.6 (dm^3) ;	**1**	
(b)(iii)	greater, amplitude / volume ; greater frequency ;	**2**	

Q4.

(a)	*diagram correctly labelled clockwise from top right:* trachea ; alveolus ; diaphragm ; rib ; bronchus ;	**5**	
(b)	mouth / nose ;	**1**	
(c)	more ; less ; vapour / molecules ;	**3**	
(d)	limewater ;	**1**	

Q5.

(a)(i)	camel ;	1	
(a)(ii)	cat **and** sheep ;	1	
(a)(iii)	buffalo ;	1	
(b)	depth increases ; rate increases ;	2	
(c)(i)	less oxygen ; more water (vapour) ;	2	
(c)(ii)	limewater ; turns, cloudy / milky / AW ;	2	
(d)	**A** trachea ; **B** intercostal muscle ; **C** diaphragm ; **D** alveoli ;	4	

Q6.

(a)(i)	lung correctly identified with a label and a label line ; diaphragm correctly identified with a label and a label line ;	2	
(a)(ii)	trachea ;	1	
(a)(iii)	*any three from* : mouth / nose ; larynx ; bronchus / bronchi ; bronchioles ; alveoli ; capillary wall / AW ; plasma ;	3	
(a)(iv)	diffusion ;	1	
(b)(i)	pulmonary artery ;	1	
(b)(ii)	*any two from* : large surface area ; thin / one cell thick / AW ; good blood supply / many capillaries ; short diffusion, distance / pathway ;	2	
(c)	lower carbon dioxide concentration / less water vapour ;	1	

Q7.

(a)(i)	larynx ; trachea ; bronchiole ; rib ; diaphragm ;	5	must be in this vertical order
(a)(ii)	circulatory (system) / AW ;	1	
(b)	large (surface) area ; thin (wall) ; good blood supply / lots of capillaries / lots of blood vessels ; good ventilation (with air) / AW ; moist ; AVP ; e.g. small / short, diffusion distance (described)	3	

Q8.

(c)	is the movement of substances from high to low concentration ; occurs due to the random movement of particles ;	**2**	

Q9.

(a)	bronchiole, diaphragm, intercostal (muscle), trachea labelled ;;;;	**4**	1 mark for each correct label
(b)	good blood supply ; thin ; ventilated ; large surface (area) ; AVP ; e.g. moist / permeable	**2**	
(c)(i)	more water vapour ; more carbon dioxide ; higher temperature ;	**2**	**A** saturated **A** warmer
(c)(ii)	(aerobic) respiration ;	**1**	**A** removal of lactic acid / oxidation **R** anaerobic respiration
(d)	*cell* red blood cell / ciliated cell / muscle cell / white blood cell ; **A** guard cell *organ* lung / trachea / bronchus / bronchiole / larynx ; **A** leaf	**2**	1 mark for example of a cell / goblet cell 1 mark for example of an organ

Q10.

(a)(i)	**X** external intercostal muscle ; **Y** bronchiole ; **Z** diaphragm ;	**3**	
(a)(ii)	*name:* cartilage ; *function:* support / prevent collapse of / AW, trachea ;	**2**	
(a)(iii)	ciliated (cells) ; goblet (cells) ;	**2**	
(b)	*any five from:* 1 pressure (inside the thorax) decreases then increases ; 2 volume (of air inside the thorax decreases then) increases ; 3 ref to inspiration ; 4 diaphragm, contracts / flattens ; 5 external intercostal muscles contract / internal intercostal muscles relax ; 6 ribs moved, up / out ;	**5**	
(c)	increases / AW ; brain ; depth ;	**3**	

Q11.

<table>
<tr><td>(a)(i)</td><td>produce / secrete, mucus ;
traps / catches / AW, pathogens / bacteria / particulates / AW ;
AVP ; e.g., water in mucus moistens surface in, nose / airways</td><td>2</td><td></td></tr>
<tr><td>(a)(ii)</td><td>any two from:
ciliated / has cilia / has hair-like cilia ;
move / sweep / waft / AW, mucus (with pathogens / AW) ;
AVP ;</td><td>2</td><td>e.g., many mitochondria to provide energy for movement of cilia</td></tr>
<tr><td>(a)(iii)</td><td>bronchi / bronchioles / AVP ;</td><td>1</td><td>e.g., nose / pharynx / throat / oviduct / uterus / cervix / ear / testes</td></tr>
<tr><td>(b)</td><td><table><tr><td>feature</td><td>action</td></tr><tr><td>diaphragm</td><td>contracts / lowers / flattens ;</td></tr><tr><td>external intercostal muscles</td><td>contract ;</td></tr><tr><td>pressure in the thorax</td><td>decreases / AW ;</td></tr><tr><td>ribs</td><td>move, up / out ;</td></tr><tr><td>volume of the thorax</td><td>increases / AW ;</td></tr></table></td><td>5</td><td></td></tr>
<tr><td>(c)</td><td>carbon dioxide / water vapour ;</td><td>1</td><td></td></tr>
<tr><td>(d)</td><td>any two from:
large (surface) area ;
thin (surface) / one cell thick / short diffusion distance ;
good blood supply / AW ;
AVP ;</td><td>2</td><td>e.g., moist / ref. to surfactant</td></tr>
<tr><td>(e)</td><td>alveoli ;</td><td>1</td><td></td></tr>
</table>

Q12.

(a)(i)	<table><tr><th>function</th><th>name of the structure</th><th>letter on Fig. 6.1</th></tr><tr><td>traps particles (before they enter the airway) / mechanical barrier to pathogens / AW</td><td>hairs in the nose</td><td>**A**</td></tr><tr><td>prevents collapse of the airway</td><td>cartilage</td><td>**J / B**</td></tr><tr><td>contracts to decrease the pressure in the thorax</td><td>external intercostal muscles</td><td>**F**</td></tr><tr><td>contracts to, reduce the pressure / increase the volume, in the thorax</td><td>diaphragm</td><td>**C**</td></tr><tr><td>protects the lungs from mechanical damage</td><td>rib(cage)</td><td>**E**</td></tr><tr><td>contain cilia to move mucus out of the airway</td><td>trachea / bronchi / bronchiole</td><td>**J / B / G**</td></tr><tr><td>site of gas exchange / AW</td><td>alveoli</td><td>**H**</td></tr></table> ;;;;;;;	**7**	*one mark for each correct row*

(a)(ii)	*any three from:* thin / one cell thick ; large surface area ; (which) reduces diffusion distance / AW ; good blood supply ; AVP ;	**3**	*e.g.* moist lining / presence of surfactant

Q13.

(a)(i)	**X** – larynx ; **Y** – trachea ; **Z** – bronchus ;	**3**	
(a)(ii)	cartilage ;	**1**	
(b)	*any four from:* **1** external intercostal muscles contract (and internal intercostal muscles relax) ; **2** lifts ribs, upwards / outwards; **3** diaphragm, contracts / flattens; **4** volume of, thorax, increases ; **5** pressure in, thorax, decreases ; **6** causing air to flow, down a pressure gradient / into the lungs / lungs inflate ; **7** equalising pressure between atmosphere and lungs ;	**4**	
(c)	alveoli / alveolus ;	**1**	

Q14.

(a)	*one mark for each column:*	4

	diaphragm	intercostal muscles		pressure change in the thorax
		internal	external	
breathing in	contract	relax	contract	decreases (**A** increases)
breathing out	relax	contract / relax	relax	increases (**A** decreases)

;;;;

(b)	*any two from:* thin / short distance (for diffusion) ; well supplied by blood / surrounded by capillaries / AW ; good ventilation with air ;	2
(c)(i)	a group of cells with similar structures ; working together to perform a shared function ;	2
(c)(ii)	*any two from:* forms incomplete rings around, trachea / bronchi ; keeps (named) airways open ; reduces resistance to movement of air ; protects (named) airways ; sound production in larynx ;	2

Q15.

(a)	ref. to, mechanical / chemical, barriers ; nasal hairs, trap / filter / AW, pathogens ; mucus traps pathogens / pathogens stick to mucus ; mucus, produced / secreted, by goblet cells ; cilia move mucus (upwards / towards mouth / away from alveoli) ; coughing / sneezing / swallowing ; phagocytes / phagocytosis / described ;	4	