

**4: Respiration and the human transport system – Topic questions** **Paper 4**

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

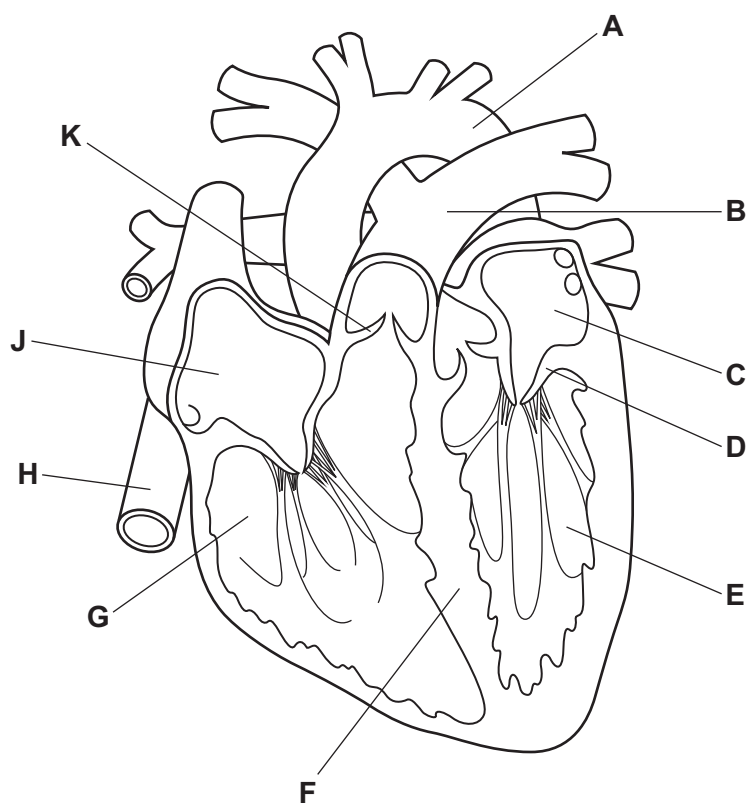
Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
1	2016	June	41
1	2016	June	43
5	2016	November	42

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at [www.cambridgeinternational.org/support](http://www.cambridgeinternational.org/support)

- 1 (a) Fig. 1.1 shows the human heart and the main blood vessels. The functions of the parts of the heart and some of the blood vessels are given in Table 1.1.



**Fig. 1.1**

Complete Table 1.1.

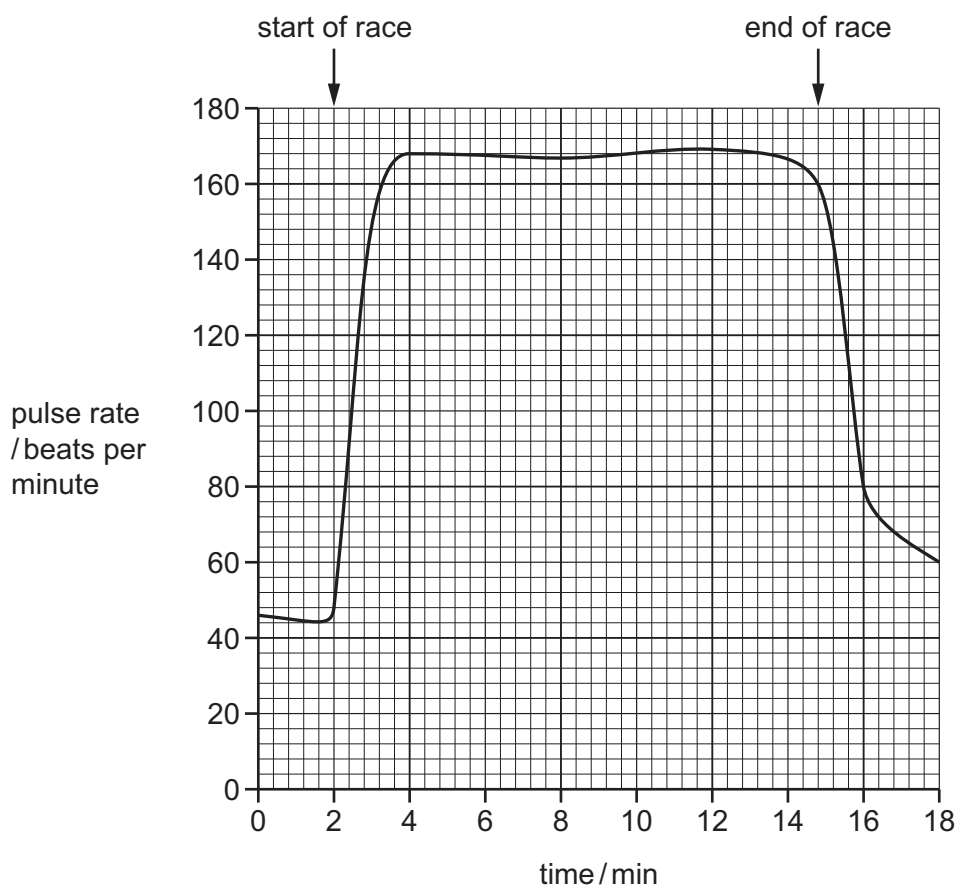
One row has been done for you.

**Table 1.1**

function	letter on Fig. 1.1	name
structure that separates oxygenated and deoxygenated blood		
structure that prevents backflow of blood from ventricle to atrium		
blood vessel that carries oxygenated blood	<b>A</b>	aorta
blood vessel that carries deoxygenated blood		
structure that prevents backflow of blood from pulmonary artery to right ventricle		
chamber of the heart that contains oxygenated blood		
chamber of the heart that contains deoxygenated blood		

[6]

- (b) A group of students used a heart monitor to record the pulse rate of an athlete during a 5000 metre race. The recordings started just before the race began and ended just after it had finished, as shown in Fig. 1.2.



**Fig. 1.2**

- (i) Use data from Fig. 1.2 to describe the effect of exercise on the pulse rate of the athlete.

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[3]

- (ii) Explain the change in pulse rate between 2 minutes and 3 minutes after the recordings started.

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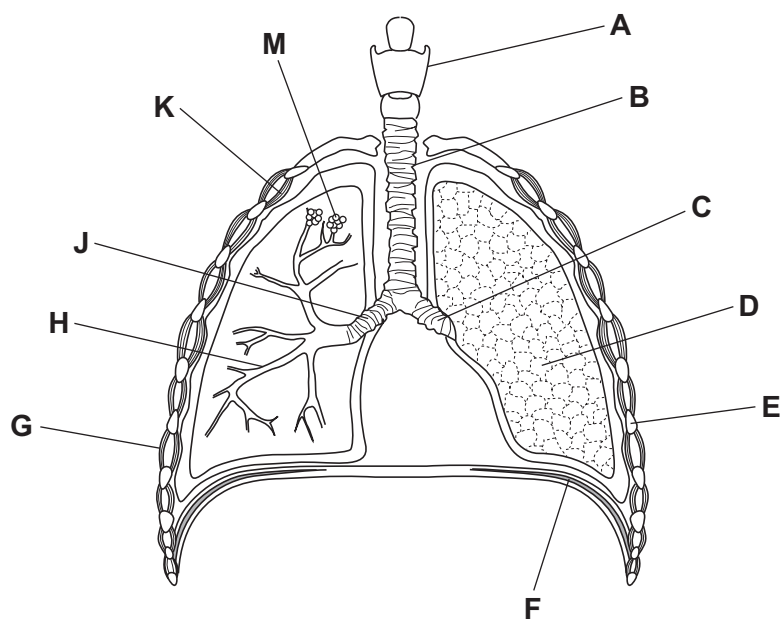
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..... [4]

[Total: 13]

- 1 (a) Fig. 1.1 shows the human gas exchange system. The functions of the parts of the gas exchange system are given in Table 1.1.



**Fig. 1.1**

Complete Table 1.1. One row has been done for you.

**Table 1.1**

function	letter on Fig. 1.1	name
structure that makes sounds	<b>A</b>	larynx
bone that provides protection for the lungs		
airway that allows passage of air only into the right lung		
airway that allows passage of air into both lungs		
contracts to increase volume of thorax		
muscle that contracts to lower the ribcage		
site of gas exchange		

**(b)** The gas exchange system contains cartilage.

Describe the function of cartilage in the gas exchange system.

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..... [2]

**(c)** Soon after starting physical activity the concentration of carbon dioxide in the blood increases.

**(i)** Name the process inside cells that produces carbon dioxide.

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..... [1]

**(ii)** State the effect on breathing of an increase in carbon dioxide concentration in the blood.

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..... [1]

**(iii)** Explain how this effect on breathing is coordinated.

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..... [3]

[Total: 13]

- 5 The numbers of different cells in a blood sample were counted. The results are shown in Table 5.1.

**Table 5.1**

cell type	number/per mm <sup>3</sup>	percentage
red blood cells	4 820 000	94.91
lymphocytes	1 900	0.04
phagocytes	6 000	0.12
platelets	250 000	
total	5 077 900	100.00

- (a) Complete the table by calculating the percentage of platelets. Write your answer in Table 5.1 to two decimal places. [1]

- (b) State the role of platelets in the blood **and** describe the process they are involved in.

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..... [4]

- (c) Lymphocytes are white blood cells that are produced in bone marrow. Lymphocytes travel in the blood from bone marrow to lymph nodes throughout the body.

If a pathogen infects the body, some of these lymphocytes are activated.

State the role of lymphocytes in defence against pathogens.

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- (d) During a second infection of the same pathogen the response by lymphocytes is much faster. Explain how this happens.

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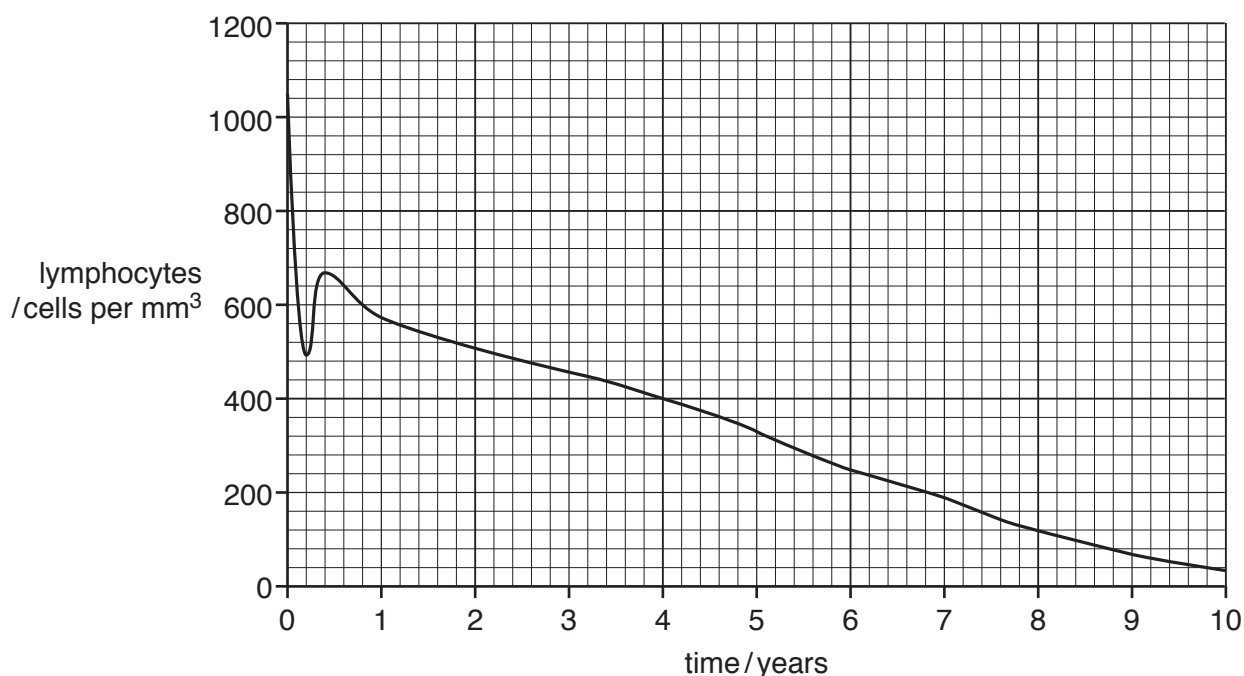
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..... [2]



- (e) HIV invades specific lymphocytes that coordinate immune responses.

Fig. 5.1 shows the change in numbers of these lymphocytes following an HIV infection that has not been treated.



**Fig. 5.1**

- (i) Describe the changes in lymphocyte numbers following HIV infection.

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(ii) Describe the effects on the body of an untreated HIV infection as shown in Fig. 5.1.

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..... [3]

**[Total: 14]**

### Abbreviations used in the Mark Scheme:

;	separates marking points
/	alternatives
I	ignore
R	reject
A	accept (for answers correctly cued by the question, or guidance for examiners)
AW	alternative wording (where responses vary more than usual)
AVP	any valid point
ecf	credit a correct statement / calculation that follows a previous wrong response
ora	or reverse argument
( )	the word / phrase in brackets is not required, but sets the context
<u>underline</u>	actual word given must be used by candidate (grammatical variants excepted)
max	indicates the maximum number of marks that can be given

Question	Answer	Marks																																	
1 (a)	<table border="1"> <thead> <tr> <th>function</th><th>letter on Fig. 1.1</th><th>name</th></tr> </thead> <tbody> <tr> <td>structure that separates oxygenated and deoxygenated blood</td><td>F</td><td>septum ;</td></tr> <tr> <td>structure that prevents backflow of blood from ventricle to atrium</td><td>D</td><td>bicuspid / mitral / atrioventricular, <u>valve</u> ;</td></tr> <tr> <td>blood vessel that carries oxygenated blood</td><td>A</td><td>aorta</td></tr> <tr> <td>blood vessel that carries deoxygenated blood</td><td>B</td><td>pulmonary artery</td></tr> <tr> <td></td><td>H</td><td>vena cava ;</td></tr> <tr> <td>structure that prevents backflow of blood from pulmonary artery to right ventricle</td><td>K</td><td>semilunar <u>valve</u> ;</td></tr> <tr> <td>chamber of the heart that contains oxygenated blood</td><td>C</td><td>left atrium</td></tr> <tr> <td></td><td>E</td><td>left ventricle ;</td></tr> <tr> <td>chamber of the heart that pumps deoxygenated blood</td><td>J</td><td>right atrium</td></tr> <tr> <td></td><td>G</td><td>right ventricle ;</td></tr> </tbody> </table>	function	letter on Fig. 1.1	name	structure that separates oxygenated and deoxygenated blood	F	septum ;	structure that prevents backflow of blood from ventricle to atrium	D	bicuspid / mitral / atrioventricular, <u>valve</u> ;	blood vessel that carries oxygenated blood	A	aorta	blood vessel that carries deoxygenated blood	B	pulmonary artery		H	vena cava ;	structure that prevents backflow of blood from pulmonary artery to right ventricle	K	semilunar <u>valve</u> ;	chamber of the heart that contains oxygenated blood	C	left atrium		E	left ventricle ;	chamber of the heart that pumps deoxygenated blood	J	right atrium		G	right ventricle ;	[6]
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1 (b) (i)	<p>pulse rate increases and remains constant ;</p> <p>immediate / sudden / steep / rapid / AW, increase in pulse rate ;</p> <p>increases from 44–48 bpm to 164–170 bpm ;</p> <p>maximum / 164–170 bpm, at, 4 min(utes) / 2 min(utes) after race starts ;</p>	[max 3]																																	

Question	Answer	Marks																								
1 (b) (ii)	adrenaline stimulates increase in, heart / pulse, rate ; increase in blood, carbon dioxide (concentration) / acidity, detected ; nerves stimulate heart to beat faster ; ref to muscle contraction / AW ; muscles require more energy / muscles are doing more work ; (rate of aerobic) respiration increases ; increase demand for, oxygen / glucose ; ref to removal of, carbon dioxide / lactic acid / heat ; more, blood / carbon dioxide, to lungs (per unit time) ; more, blood / oxygen / glucose, to muscles ; AVP ; e.g. ref to ATP / vasodilation in muscles	[max 4]																								
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1 (b)	keeps, airways / trachea / bronchi, open ; allows (free flow of) air into (the lungs) ; allows flexibility / can breathe even when, bent / swallowing / AW ; AVP ;	[max 2]																								
1 (c) (i)	(aerobic) respiration	[1]																								
1 (c) (ii)	rate (of breathing) increases	[1]																								
1 (c) (iii)	stimulus (is CO <sub>2</sub> ) ; A acidic / pH, of blood decreases ; (CO <sub>2</sub> / pH) detected by the brain ; by a receptor ; ref to (named) neurone in context ; brain sends impulses to, (intercostal) muscles / diaphragm / effectors ; (intercostal) muscles / diaphragm / effectors, contract more (frequently) ; negative feedback / homeostasis ; reflex / automatic / involuntary ;	[max 3]																								
[Total: 13]																										

Question	Answer	Marks
5 (a)	4.92 / 4.93;	[1]
5 (b)	(platelets) promote / involved in, clotting; fibrinogen changes to fibrin; soluble to insoluble; fibrin forms a mesh; traps blood cells; prevents loss of blood / stops bleeding; prevents entry of pathogens; AVP;	[4]
5 (c)	secrete / produce / release, antibodies;	[1]
5 (d)	active immunity; ref to memory, cells / lymphocytes; memory cells produced in first infection;	[2]
5 (e) (i)	decrease, steep / in short period of time / in two months / AW, to 500 cells per mm <sup>3</sup> ; increase to 650 – 670 cells per mm <sup>3</sup> ; gradual / AW, decrease until 10 years; to 40 cells per mm <sup>3</sup> at 10 years;	[3]
5 (e) (ii)	no / reduced, (active) immune response; reduced production of antibodies; vulnerable to, infections / (opportunistic) disease / TB / cancers / pneumonia / AW; AIDS; weight loss / death / reduce life span;	[3]
[Total: 14]		