

FOR OFFICIAL USE



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National  
Qualifications  
2018

Mark

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**X740/76/01**

**Human Biology  
Section 1 — Answer Grid  
and Section 2**

TUESDAY, 15 MAY

1:00 PM – 3:30 PM



\* X 7 4 0 7 6 0 1 \*

Fill in these boxes and read what is printed below.

Full name of centre

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Town

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Forename(s)

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Surname

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Number of seat

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Date of birth

Day

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Month

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Year

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Scottish candidate number

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**Total marks — 100**

**SECTION 1 — 20 marks**

Attempt ALL questions.

Instructions for the completion of Section 1 are given on *page 02*.

**SECTION 2 — 80 marks**

Attempt ALL questions.

Question 13 contains a choice.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers and rough work is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting. Any rough work must be written in this booklet. You should score through your rough work when you have written your final copy.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.



\* X 7 4 0 7 6 0 1 0 1 \*

The questions for Section 1 are contained in the question paper X740/76/02.

Read these and record your answers on the answer grid on *page 03* opposite.

Use **blue** or **black** ink. Do NOT use gel pens or pencil.

1. The answer to each question is **either** A, B, C or D. Decide what your answer is, then fill in the appropriate bubble (see sample question below).
2. There is **only one correct** answer to each question.
3. Any rough working should be done on the additional space for answers and rough work at the end of this booklet.

### Sample Question

The digestive enzyme pepsin is most active in the

- A mouth
- B stomach
- C duodenum
- D pancreas.

The correct answer is **B** — stomach. The answer **B** bubble has been clearly filled in (see below).

A	B	C	D
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Changing an answer

If you decide to change your answer, cancel your first answer by putting a cross through it (see below) and fill in the answer you want. The answer below has been changed to **D**.

A	B	C	D
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

If you then decide to change back to an answer you have already scored out, put a tick (✓) to the **right** of the answer you want, as shown below:

A	B	C	D	or	A	B	C	D
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>		<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>



SECTION 1 — Answer Grid



	A	B	C	D
1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



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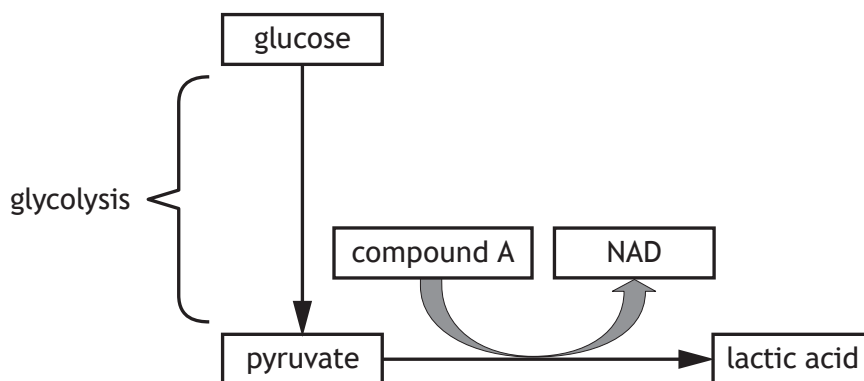
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SECTION 2 — 80 marks  
 Attempt ALL questions  
 Question 13 contains a choice

1. The diagram represents glycolysis and the metabolic pathway which synthesises lactic acid.

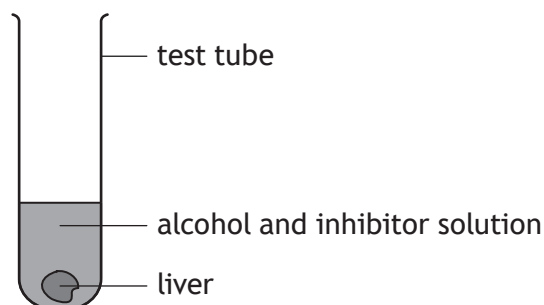


- (a) (i) State where glycolysis occurs within a cell. 1
- \_\_\_\_\_
- (ii) Describe what happens during the energy investment phase of glycolysis. 1
- \_\_\_\_\_
- \_\_\_\_\_
- (b) During lactic acid synthesis NAD is regenerated.
- (i) Name compound A. 1
- \_\_\_\_\_
- (ii) Explain the importance of the regeneration of NAD for glycolysis. 1
- \_\_\_\_\_
- \_\_\_\_\_
- (iii) State the reason why muscle cells produce lactic acid during vigorous exercise. 1
- \_\_\_\_\_
- \_\_\_\_\_



2. An investigation was carried out into the effect of inhibitor concentration on the activity of an enzyme which breaks down alcohol in liver cells.

Six test tubes were set up, each containing a piece of liver, alcohol and a different concentration of inhibitor, as shown in the diagram.



The test tubes were left for 30 minutes at 37 °C.

The final concentration of alcohol in each tube was then measured.

- (a) State **two** variables, not already mentioned, which should be kept constant to make this investigation valid. 2

1 \_\_\_\_\_

2 \_\_\_\_\_

- (b) The inhibitor used in this investigation was non-competitive.

Describe how a non-competitive inhibitor works. 1

\_\_\_\_\_

\_\_\_\_\_

- (c) The results of the investigation are shown in the table.

<i>Inhibitor concentration</i> (mM)	<i>Final alcohol concentration</i> (% of initial concentration)
0.5	20
1.5	28
2.5	60
3.5	96
4.5	100
5.5	100

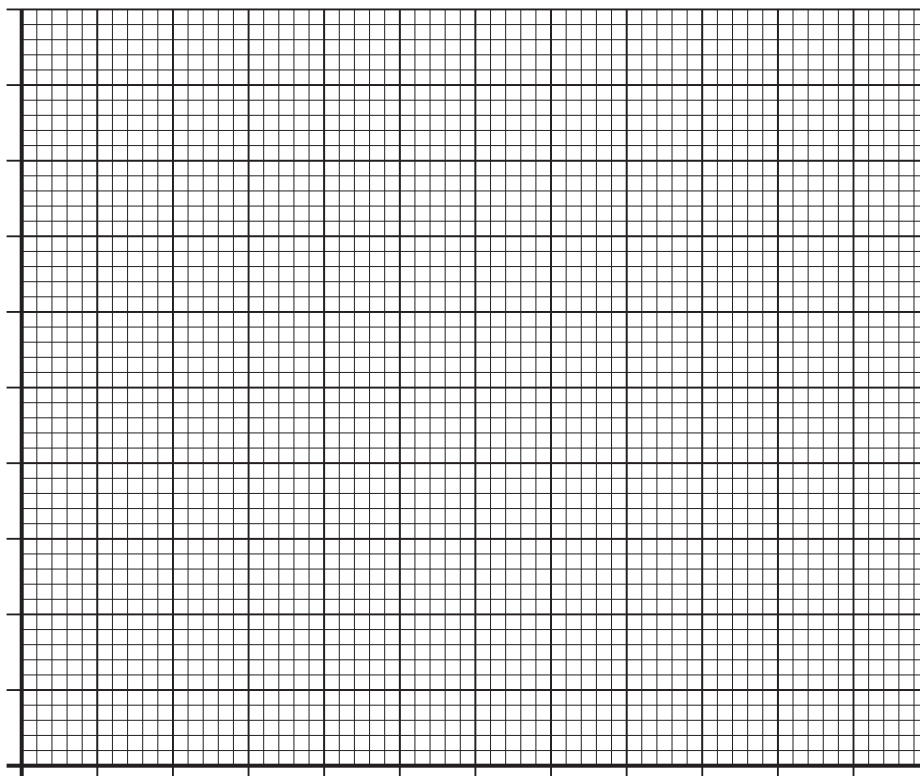


2. (c) (continued)

(i) Construct a line graph to show the data in the table.

2

(Additional graph paper, if required, can be found on *page 27*)



(ii) Use the data to describe the relationship between the concentration of inhibitor and enzyme activity.

2

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(d) A second experiment, using increasing concentrations of alcohol, was carried out to show that the inhibitor was non-competitive.

Six test tubes were set up, each containing a piece of liver, an inhibitor concentration of 4.5 mM and different concentrations of alcohol.

Suggest how the results would confirm that the inhibitor was non-competitive.

1

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3. Olfactory genes code for receptors in the nose that detect smells.

The base sequences from the same region of a rat olfactory gene and a human olfactory gene are shown.

Rat     ... ATACGATTGCATGCCGAT...  
 Human   ... ATACGATTGCATCCGAT...

The rat olfactory gene codes for a functional protein but the protein coded for by the human olfactory gene is non-functional.

- (a) (i) Name the type of single gene mutation that has occurred to change the human base sequence. 1

\_\_\_\_\_

- (ii) Suggest why the changed sequence of bases in the human gene codes for a non-functional protein. 1

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

- (b) State the term which describes the comparison of human genome sequence data with the genomes of other species. 1

\_\_\_\_\_



3. (continued)

- (c) The table shows the number of functional olfactory genes identified in rats, humans and chickens.

<i>Animal</i>	<i>Number of functional olfactory genes</i>
rat	1200
human	400
chicken	80

- (i) Express, as a simple whole number ratio, the number of functional olfactory genes found in the animals.

1

*Space for calculation*

\_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_  
 rat                      human                      chicken

- (ii) Suggest what the number of functional olfactory genes indicates about the sense of smell of these animals.

1

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- (d) Describe **two** chromosome structure mutations and the overall consequence of these to the individual.

3

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\_\_\_\_\_

\_\_\_\_\_

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\_\_\_\_\_

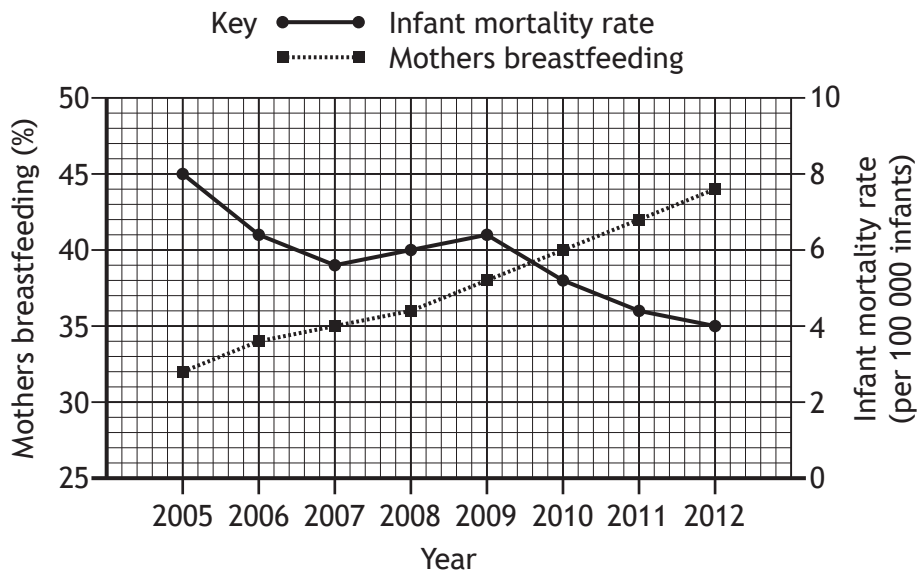
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4. The graph contains information about breastfeeding and infant mortality in a country between 2005 and 2012.



(a) (i) State the infant mortality rate when 35% of mothers were breastfeeding. 1

\_\_\_\_\_

(ii) Calculate the percentage decrease in the infant mortality rate between 2009 and 2012. 1

*Space for calculation*

\_\_\_\_\_ %

(iii) Predict the percentage of mothers who would be breastfeeding in 2013. 1

\_\_\_\_\_ %

(iv) Describe evidence from the graph which indicates that the increase in breastfeeding mothers cannot be the only reason for the decrease in infant mortality. 1

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



\* X 7 4 0 7 6 0 1 1 0 \*

4. (continued)

- (b) The table contains information from a Scottish survey comparing the incidence of diarrhoea in breastfed and bottle fed babies.

Feeding method	Age of baby (months)			
	0-3		4-6	
	Breast	Bottle	Breast	Bottle
Incidence of diarrhoea (%)	3.6	21.6	10.2	20.4

- (i) Calculate how many times greater the incidence of diarrhoea is when 0-3 month old babies are bottle fed rather than breastfed. 1

*Space for calculation*

\_\_\_\_\_ times greater

- (ii) Diarrhoea is a symptom of an intestinal infection.

Suggest why there is a greater incidence of diarrhoea in bottle fed babies. 1

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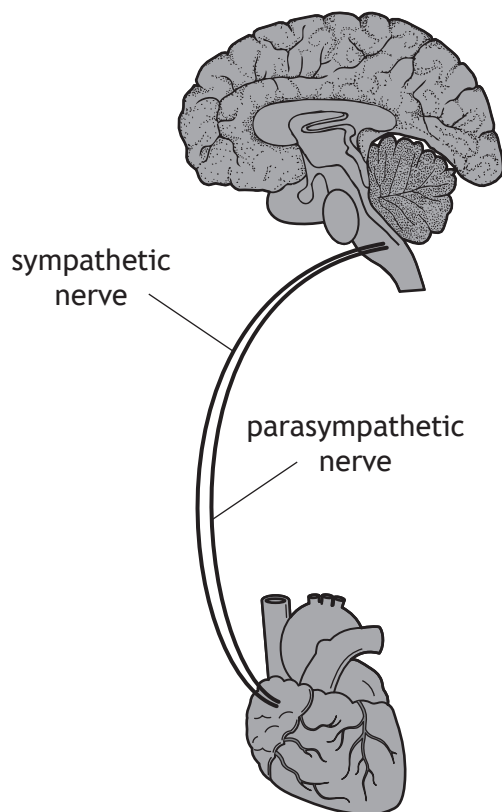


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[Turn over



5. The diagram represents part of the autonomic nervous system which links the brain to the heart.



- (a) Name the parts of the brain and heart which are linked by the nerves shown in the diagram. 2

Brain \_\_\_\_\_

Heart \_\_\_\_\_

- (b) Explain how the sympathetic and parasympathetic nerves control heart rate. 2

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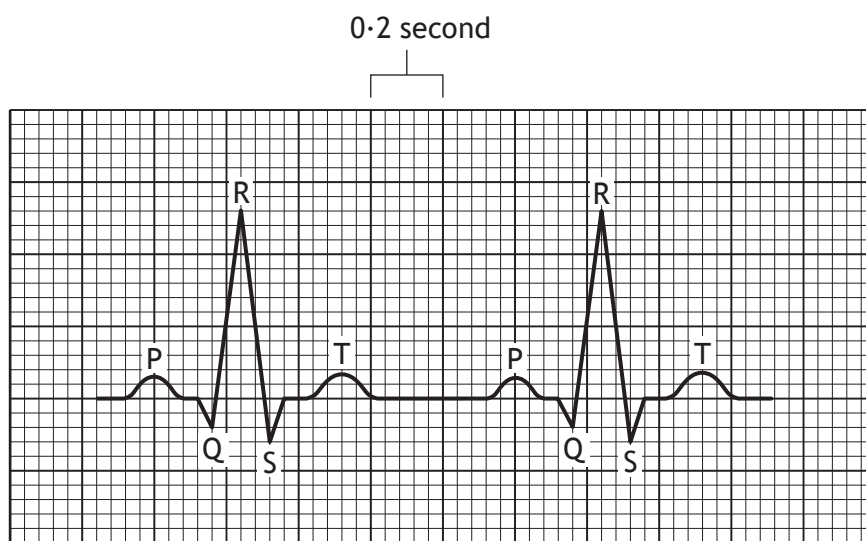


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5. (continued)

(c) The diagram shows an electrocardiogram (ECG) of an individual's heart.



(i) Use the diagram to calculate the individual's heart rate.

1

*Space for calculation*

\_\_\_\_\_ beats/min

(ii) Describe what happens in the heart between points Q and S.

1

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[Turn over



6. The table shows the number of males in different age groups with raised cholesterol levels in Scotland between 2004 and 2013.

Age group (years)	Number of males with raised cholesterol levels (per 1000)									
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Under 15	1	1	0	1	0	0	0	2	0	1
15–44	33	33	31	29	21	21	22	16	18	14
45–64	236	232	217	209	132	139	134	137	125	128
Over 64	274	316	295	274	167	166	164	167	171	167

(a) Calculate which age group had the greatest percentage decrease in the number of males with raised cholesterol levels between 2004 and 2013. 1

*Space for calculation*

\_\_\_\_\_ years

(b) (i) Name a type of drug that is used to control cholesterol levels. 1

\_\_\_\_\_

(ii) Use the data in the table to identify the year in which this type of drug became widely available. 1

\_\_\_\_\_

(c) State **one** role of cholesterol in the body. 1

\_\_\_\_\_

\_\_\_\_\_



7. An office worker and an Olympic swimmer were found to have the same BMI. They each weighed 105 kg and were 1.85 m in height.

(a) (i) Calculate their BMI.

1

*Space for calculation*

(ii) Suggest why, after calculating their BMI, a health professional advised only the office worker to lose weight.

1

(b) The office worker developed Type 2 diabetes.

Explain why this condition causes the blood glucose concentration to remain high.

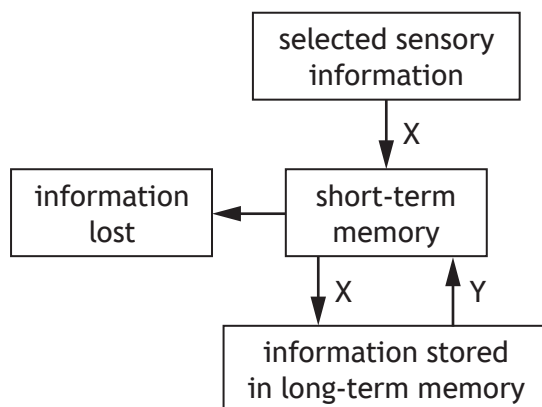
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8. (a) The diagram represents the flow of information through memory.



(i) Name process X. 1

\_\_\_\_\_

(ii) Explain why information can be lost by displacement from short-term memory. 1

\_\_\_\_\_  
 \_\_\_\_\_

(iii) Rehearsal increases the chance of information being transferred from short-term to long-term memory. Describe **one** other way that information can be transferred from short-term to long-term memory. 1

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

(iv) Y represents the retrieval of information from long-term memory. Describe how contextual cues aid the retrieval of information. 1

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

(b) State where semantic memories are stored in the brain. 1

\_\_\_\_\_



9. (a) The photograph shows cars parked in a street.



The judgement of distance depends on visual cues.

Explain how the following visual cues allow a person to judge how far away each car is from them in the street.

(i) Size \_\_\_\_\_ 1

\_\_\_\_\_

\_\_\_\_\_

(ii) Superimposition \_\_\_\_\_ 1

\_\_\_\_\_

\_\_\_\_\_

(b) State the term used for the ability of the brain to judge the distance of an object based on the different images received by each eye. 1

\_\_\_\_\_

[Turn over



9. (continued)

MARKS  
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(c) Students carried out the following experiment on the judgement of distance.

- 1 One student raised their right arm and closed both eyes.
- 2 A coin was randomly placed on the bench in front of them.
- 3 The student opened both eyes and immediately lowered their arm trying to touch the coin with their index finger.
- 4 The distance between the coin and the spot where the index finger landed was measured.
- 5 Steps 1–4 were repeated, firstly **only** opening the left eye and secondly **only** opening the right eye.
- 6 Then steps 1–5 were repeated another nine times.

The results are shown in the table.

Attempt	Distance between coin and spot where finger landed (mm)		
	both eyes open	left eye open	right eye open
1	2	4	12
2	2	6	15
3	1	6	16
4	1	8	14
5	1	9	13
6	0	5	14
7	0	4	17
8	1	10	18
9	0	7	
10	1	8	15
Average	0.9	6.7	15.0

(i) Calculate the missing distance for attempt 9.

1

*Space for calculation*

\_\_\_\_\_ mm



## 9. (c) (continued)

- (ii) Suggest a reason why the coin was randomly placed for each attempt.

1

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- (iii) The results of the experiment show that two eyes are more accurate than one for judging distance.

State another conclusion which can be drawn from the results.

1

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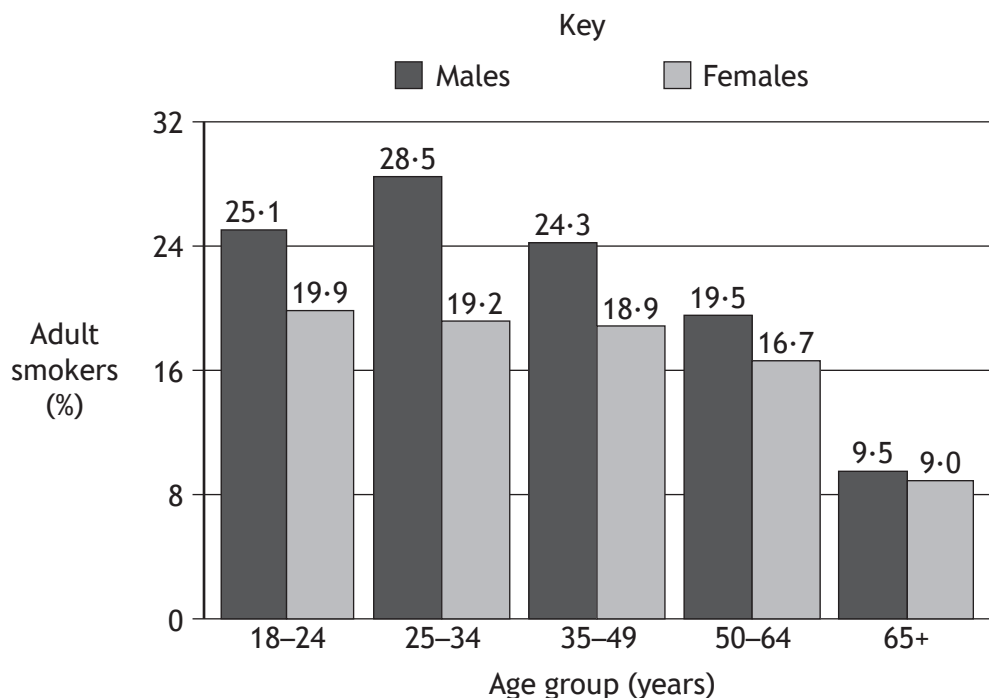
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\* X 7 4 0 7 6 0 1 1 9 \*

10. The graph shows the percentage of adult smokers in different age groups in the UK in 2011.



(a) (i) Describe **two** trends shown in the graph.

2

1 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(ii) Apart from individuals giving up smoking, suggest a reason for the difference in the percentage of 25-34 year olds and 65+ year olds smoking.

1

\_\_\_\_\_

\_\_\_\_\_



10. (continued)

(b) Smokers can become addicted to the nicotine in tobacco.

Nicotine acts as an agonist of acetylcholine causing an increase in the levels of dopamine.

(i) Describe how nicotine acts as an agonist at a synapse.

1

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(ii) Describe how dopamine reinforces smoking behaviour.

1

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(iii) Describe how repeated exposure to nicotine can lead to nicotine tolerance by desensitisation.

1

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(c) Explain why anti-smoking campaigns often feature a celebrity.

1

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(d) In 2011 there were 36 980 cases of lung cancer in the UK linked to smoking. This was 86% of all lung cancer cases in the UK in 2011.

Calculate the total number of lung cancer cases in the UK in 2011.

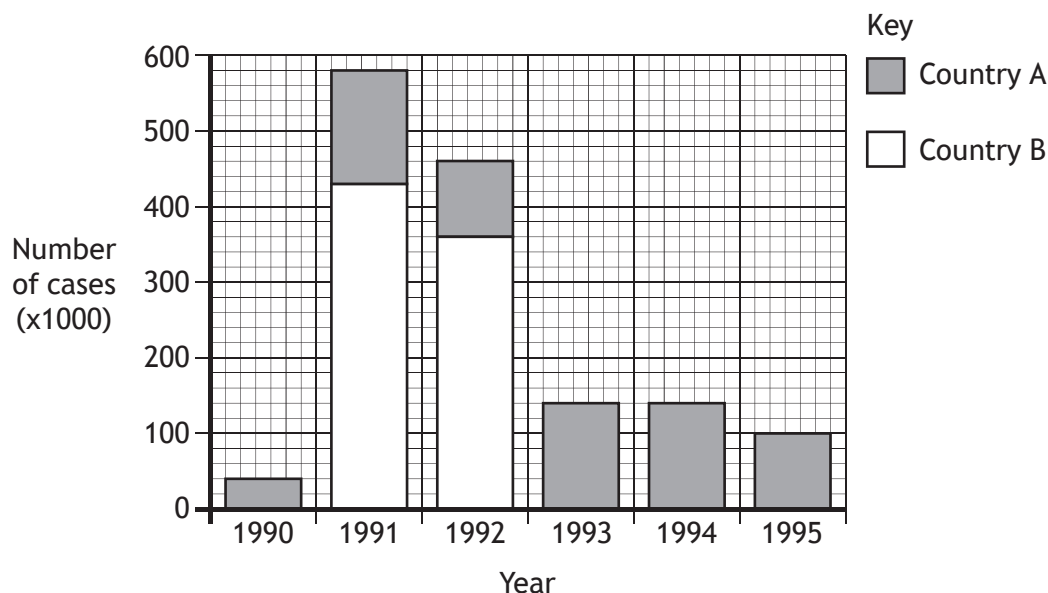
1

*Space for calculation*

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11. The graph compares the number of cases of a water-borne disease in two countries between 1990 and 1995.



(a) (i) Describe how the graph demonstrates that the pattern of the disease was epidemic in country B. 1

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(ii) State the term which describes the pattern of disease in country A. 1

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(iii) Suggest how the pattern of this disease in country A would differ if the disease was sporadic. 1

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## 11. (continued)

(b) In 1996, a programme of immunisation against this disease was started in country B. Herd immunity was established once 85% of the population was immunised.

(i) Explain why this level of immunisation protected the whole population.

1

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(ii) State **one** reason why it is difficult to immunise 100% of a population against a disease.

1

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[Turn over



\* X 7 4 0 7 6 0 1 2 3 \*

12. The non-specific immune system provides resistance to infection by physical, chemical and cellular means.

(a) (i) Name the type of cell which forms a physical barrier in the skin. 1

\_\_\_\_\_

(ii) In addition to forming a physical barrier, state another way in which these cells resist infection. 1

\_\_\_\_\_  
\_\_\_\_\_

(b) Mast cells initiate the inflammatory response.

Name the chemical which they release and explain how it increases the supply of fluid into the infected tissue. 2

Chemical \_\_\_\_\_

Explanation \_\_\_\_\_

\_\_\_\_\_

(c) (i) The cellular aspect of the non-specific response is provided by two types of white blood cell.

Complete the table by describing how these cells destroy pathogens. 2

<i>Type of cell</i>	<i>How cell destroys pathogens</i>
Phagocyte	
NK cell	

(ii) State how phagocytes and NK cells stimulate the specific immune response. 1

\_\_\_\_\_  
\_\_\_\_\_



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13. Answer either A or B in the space below.

Labelled diagrams may be used where appropriate.

A Give an account of hormonal control of puberty and sperm production in males.

8

OR

B Give an account of treatments for male and female infertility.

8



\* X 7 4 0 7 6 0 1 2 5 \*

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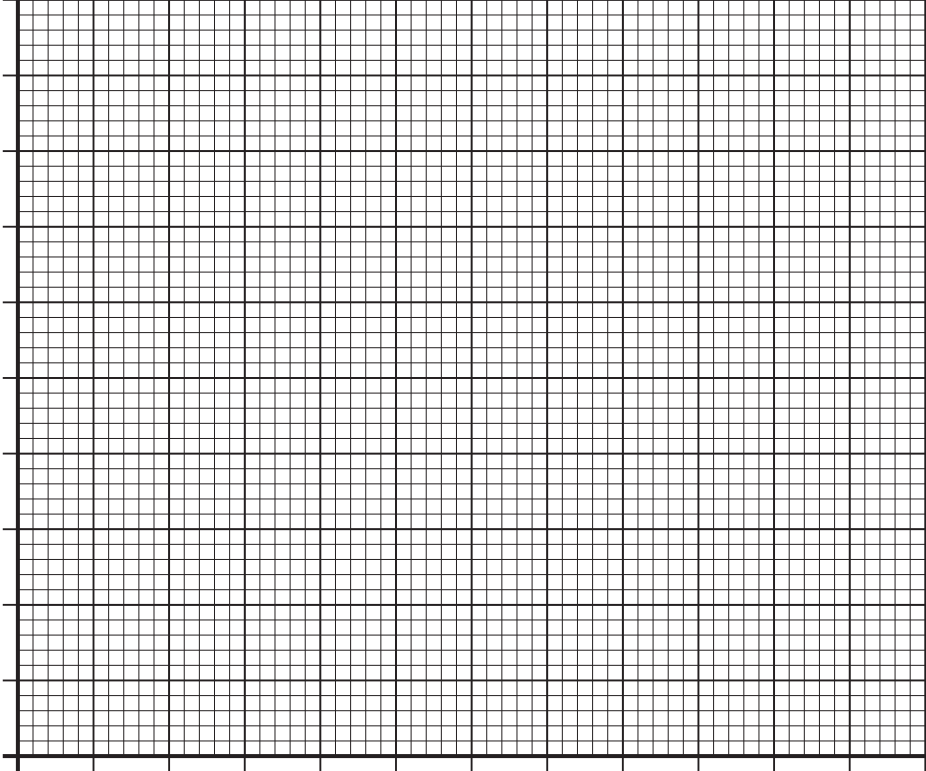
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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional graph paper for Question 2 (c)(i)



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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK



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ACKNOWLEDGEMENTS

Question 9(a) – Tupungato/Shutterstock.com



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