• Use BLACK ink or ball-point pen.
• Answer ALL questions.
• Answer the questions in the spaces provided – there may be more space than you need.

MATERIALS REQUIRED FOR EXAMINATION
Calculator, ruler

ITEMS INCLUDED WITH QUESTION PAPERS
Nil

INFORMATION FOR CANDIDATES
• The total mark for this paper is 60.
• The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.
• Questions labelled with an ASTERISK (*) are ones where the quality of your written communication will be assessed – you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.

ADVICE TO CANDIDATES
• Read each question carefully before you start to answer it.
• Keep an eye on the time.
• Try to answer every question.
• Check your answers if you have time at the end.
ANSWER ALL QUESTIONS.

Some questions must be answered with a cross in a box ✗. If you change your mind about an answer, put a line through the box ✗ and then mark your new answer with a cross ✔.

CELL TRANSPORT MECHANISMS

1 (a) Substances in the soil are taken up by plant root hair cells.

The diagram shows the direction of movement of two substances A and B across the cell membrane of a root hair cell.

(Question continues on next page)
(i) Name PROCESS X. (1 mark)
_________________________________________________________

(ii) Name PROCESS Y. (1 mark)
_________________________________________________________

(iii) Mineral ions are taken up by the root hair cells of plants.

Name the type of vessel that transports these mineral ions through the plant. (1 mark)
_________________________________________________________

(Question continues on next page)
(b) A student investigated osmosis in a courgette.

The photograph shows a courgette.

The student weighed pieces of courgette and placed them in five different concentrations of sugar solution.

After one hour she dried and reweighed the pieces of courgette.

She calculated the percentage change in mass.

The graph on page 6 shows the results of this investigation.

(Question continues on next page)
(i) Draw a line of best fit on the graph. (1 mark)

(ii) Use your line of best fit to estimate the concentration of sugar solution that would result in no change in mass. (1 mark)

estimate = _______________ moles per dm$^3$

(Question continues on next page)
(iii) Explain why there was an increase in the mass of the courgette in the sugar solution at 0·2 moles per dm$^3$. (3 marks)

(Questions continue on next page)
PRODUCING NEW STRAWBERRY PLANTS

2 Strawberry plants grow runners and new strawberry plants develop along the runners. The new plants are genetically identical to the parent plant.

The diagram shows the parent plant with new plants attached to runners.

(a) (i) Name the type of cell division that results in the production of these new plants. (1 mark)

__________________________________________________________________________

(Question continues on next page)
(ii) Farmers cut the runners and sell the new plants.

Suggest advantages of producing new strawberry plants in this way. (2 marks)

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(Question continues on next page)
(b) Some students extracted DNA from strawberries. The diagram shows the method used.

Stage 1
- Grind strawberry in soapy water

Stage 2
- Filter mixture into a boiling tube

Strawberry filtrate
slowly pour ice cold ethanol into the strawberry filtrate

remove DNA with a wire loop

(Question continues on next page)
Suggest the purpose of stages 1 and 3 in the DNA extraction. (2 marks)

stage 1  __________________________________________________________

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

stage 3  __________________________________________________________

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

(Question continues on next page)
(c) A short section of DNA from a strawberry is shown in the diagram.

(i) How many codons are shown in this section of DNA? (1 mark)

Put a cross (☒) in the box next to your answer.

☐ A 2
☐ B 3
☐ C 4
☐ D 12

(Question continues on next page)
(ii) This DNA is found in a structure within a cell of a strawberry plant.

On the diagram of a plant cell, draw and name the structure containing DNA. (2 marks)
PROBIOTIC BACTERIA

3 The digestive system is made up of a number of different organs.

(a) Define the term ORGAN. (1 mark)

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(b) (i) How many of the statements are correct?

- The low pH of the stomach kills bacteria.
- The low pH of the stomach provides optimum conditions for pepsin activity.
- The pH of the stomach is low so that acid digests protein.

Put a cross (☑) in the box next to your answer. (1 mark)

☐ A  none

☐ B  1

☐ C  2

☐ D  3

(Question continues on next page) (Turn over)
(ii) Complete the sentence by putting a cross (✓) in the box next to your answer.

Protein is broken down to form

(1 mark)

☐ A amino acids
☐ B fatty acids
☐ C glucose
☐ D glycerol

(Question continues on next page)
(c) Explain how the structure of villi allows efficient absorption of the soluble products of protein digestion. (4 marks)
(d) Probiotic bacteria are thought to be beneficial to health. Probiotic bacteria can be consumed in chocolate and milk.

The graph shows the percentage survival of probiotic bacteria in the stomach.
(i) The total number of live bacteria in the chocolate was five million.

Calculate the number of live bacteria from the chocolate that survived in the stomach. (2 marks)

answer = __________________

(ii) Suggest a reason for the survival differences of probiotic bacteria in chocolate compared with probiotic bacteria in milk. (1 mark)

_________________________________________________________

_________________________________________________________

_________________________________________________________

(Total 10 marks) Q3

(Questions continue on next page) (Turn over)
FITNESS TRAINING

4 The volume of blood that the heart pumps with every beat is known as the stroke volume. Stroke volume can be used to indicate fitness level.

The table gives information about the stroke volume, heart rate and cardiac output of an athlete at rest and during exercise.

<table>
<thead>
<tr>
<th>ATHLETE</th>
<th>STROKE VOLUME / dm³</th>
<th>HEART RATE / BEATS PER MINUTE</th>
<th>CARDIAC OUTPUT / dm³ min⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>at rest</td>
<td>0·1</td>
<td>53</td>
<td>5·3</td>
</tr>
<tr>
<td>during exercise</td>
<td>182</td>
<td>30·4</td>
<td></td>
</tr>
</tbody>
</table>

(a) Calculate the stroke volume of the athlete during exercise. (2 marks)

answer = _________________dm³

(Question continues on next page)
(b) Explain why it is important that the cardiac output of the athlete increases during exercise. (3 marks)

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

__________________________________________________________________________________________

(Problem continues on next page)
(c) Describe how the circulatory system transports substances around the body. (2 marks)

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(Question continues on next page)
(d) The diagrams below show a healthy heart and a heart with a condition known as hypertrophic cardiomyopathy (HCM).

A symptom of HCM is that contraction of the heart muscle is more difficult.

Suggest the effects HCM may have on an athlete during competitive sport. (2 marks)
(e) Some athletes, such as sprinters, use energy from anaerobic respiration.

Complete the sentence by putting a cross (□) in the box next to your answer.

Anaerobic respiration produces

□ A carbon dioxide
□ B glucose
□ C lactic acid
□ D oxygen

(1 mark)

(Total 10 marks)
In May 2011, the Food Standards Agency stated that meat and milk produced from cloned animals should be allowed to go on sale to the public.

(a) (i) Describe the risks associated with cloning mammals. (3 marks)
*(ii) A cloned animal contains genetic information that is identical to its parent.

Describe the stages in the production of a cloned mammal. (6 marks)

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

(Continue your answer on next page)
(b) (i) Fertilisation takes place during sexual reproduction to produce genetically different offspring.

Complete the sentence by putting a cross (√) in the box next to your answer.

Fertilisation occurs when

(1 mark)

☐ A diploid gametes combine to produce a diploid zygote

☐ B diploid gametes combine to produce a haploid zygote

☐ C haploid gametes combine to produce a diploid zygote

☐ D haploid gametes combine to produce a haploid zygote

(Question continues on next page)
(ii) Genetically different organisms contain different DNA codes that produce different proteins.

Describe the process that takes place in the nucleus during the first stage of protein synthesis. (2 marks)

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

(Total 12 marks)  Q5

(Questions continue on next page)
CELLS

6 There are many different types of cell in the human body.

(a) Complete the sentence by putting a cross (✓) in the box next to your answer.

An embryonic stem cell can

(1 mark)

☐ A differentiate into any type of cell
☐ B differentiate into only one type of cell
☐ C only be obtained from embryos
☐ D only produce haploid cells

(b) Describe how the structure of a red blood cell is related to its function. (3 marks)

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(Continue your answer on next page)
(c) Describe the function of platelets. (2 marks)
*(d) Mitosis and meiosis are types of cell division.

Compare these two types of cell division. (6 marks)

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

(Continue your answer on next page)