Cell Biology part 3 AQA Combined Science
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Name: _____

Class: _____

Date: _____

Time: **73 minutes**

Marks: **68 marks**

Comments:

Q1.

Bacteria can cause a variety of diseases in humans.

(a) What are **two** similarities between a bacterial cell and an animal cell?

Tick (✓) **two** boxes.

Both have a cell membrane.	☐
Both have a cell wall.	☐
Both have a nucleus.	☐
Both have cytoplasm.	☐
Both have plasmids.	☐

(2)

(b) Salmonella food poisoning is caused by bacteria in food.

Give **one** symptom of salmonella food poisoning.

Do **not** refer to vomiting or diarrhoea in your answer.

_____

_____

(1)

(c) What is the name of the first antibiotic developed?

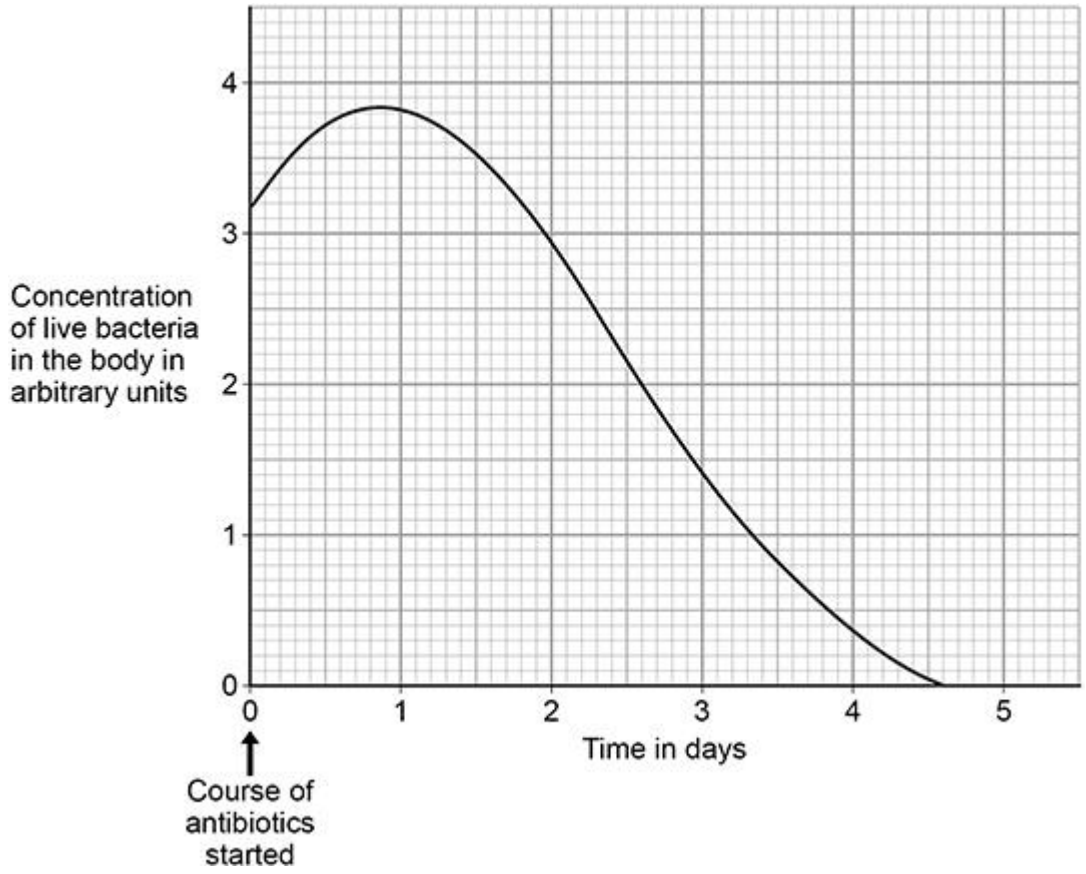
_____

(1)

A child with a severe bacterial infection was given a course of antibiotics.

Figure 1 shows how the concentration of live bacteria in the child's body changed when taking the course of antibiotics.

Figure 1



(d) The concentration of live bacteria in the body continued to increase after starting the course of antibiotics.

Suggest **one** reason why.

_____

_____

(1)

(e) After 3 days of taking the antibiotic:

- the child felt better
- there were still bacteria in the child's body.

Why did the child feel better?

Tick (✓) **one** box.

Bacteria had become immune to the antibiotic. ☐

The child had become resistant to the bacteria. ☐

There were fewer toxins in the body than at day 0 ☐

(1)

(f) Suggest why doctors do **not** give antibiotics to patients with minor infections.

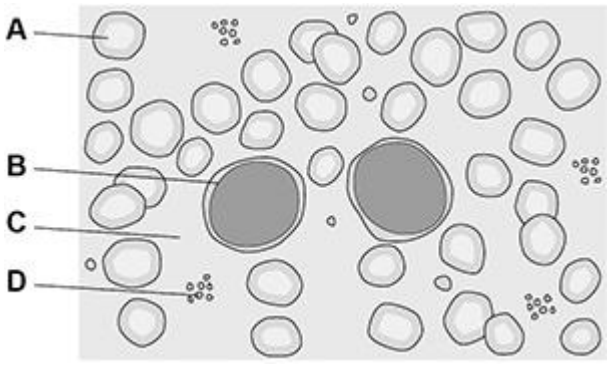
_____

_____

(1)

Figure 2 shows blood viewed using a microscope.

Figure 2



Blood viewed using a microscope © jarun011 / iStock

(g) A vaccine will stimulate the production of antibodies.

Which part of the blood in **Figure 2** produces antibodies?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(h) Which part of the blood in **Figure 2** starts the clotting process?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(Total 9 marks)

Q2.

This question is about cell division.

(a) Write the biological structures from the box in the correct order of size.

cell	**chromosome**	**gene**	**nucleus**

Smallest

↓

Largest

_____

_____

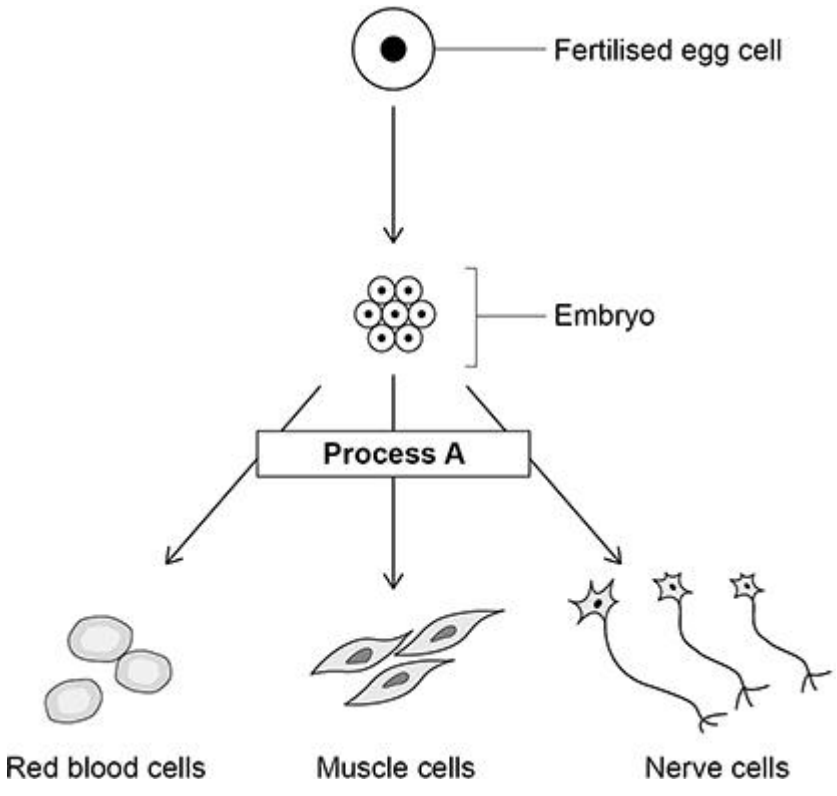
_____

_____

(1)

Figure 1 shows how a fertilised egg cell can produce specialised cells.

Figure 1



(b) Name **Process A**.

_____

(1)

(c) How many cell divisions are needed to form a 16-cell embryo from the original fertilised egg cell?

_____

_____

Number of cell divisions = _____

(1)

(d) In humans a fertilised egg cell contains 23 pairs of chromosomes.

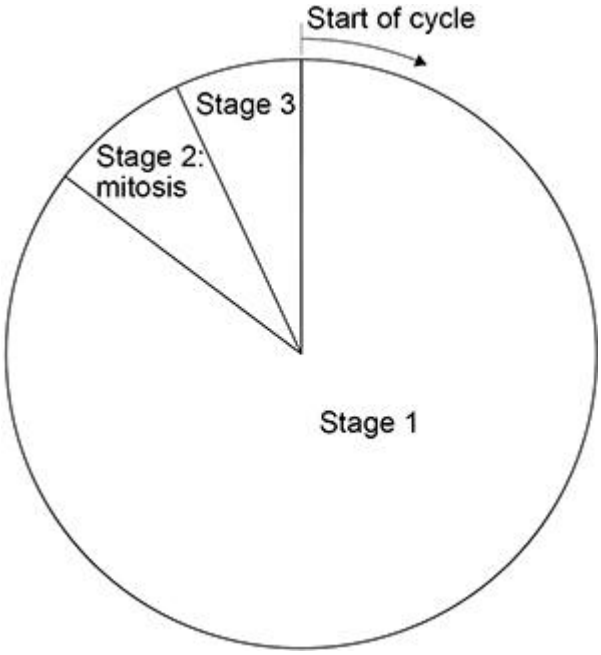
How many chromosomes will there be in each of the embryo cells?

_____

(1)

(e) **Figure 2** represents a cell cycle for a human embryonic cell.

Figure 2



Describe **one** change in the cell that occurs during **each** of the stages of the cell cycle.

Stage
1 _____

_____

Stage
2 _____

_____

Stage
3 _____

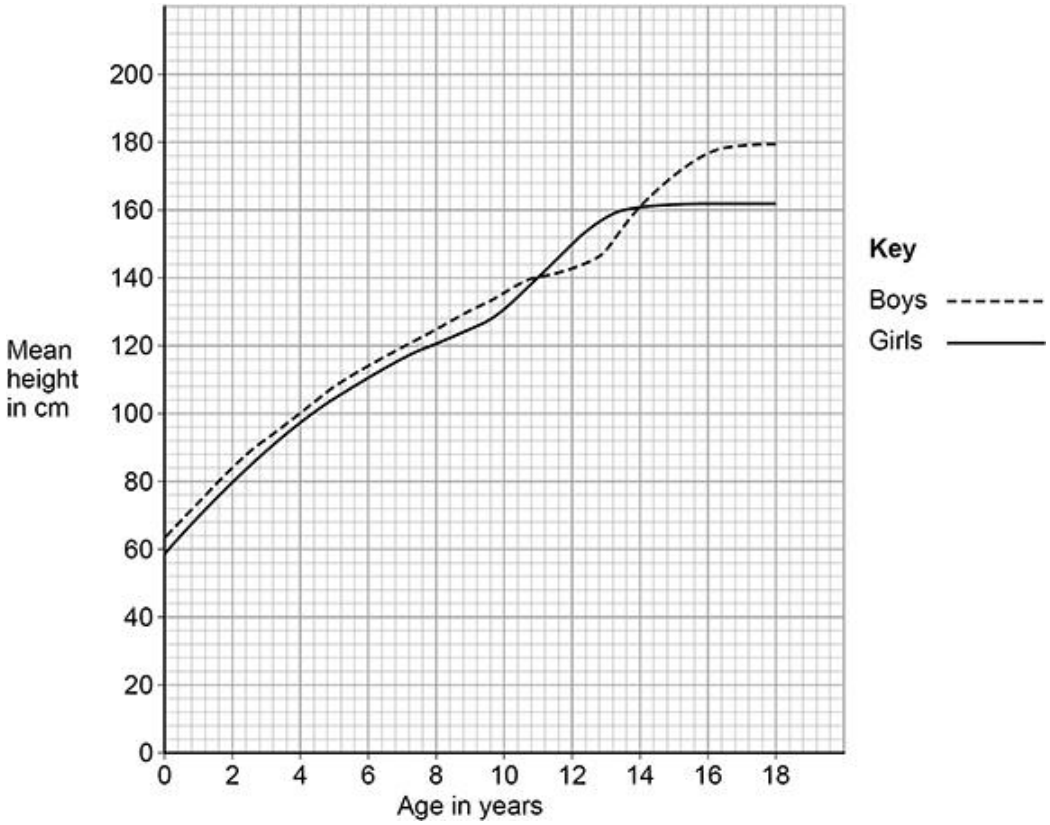
_____

(3)

Cell division is important in the growth of multicellular organisms.

(f) **Figure 3** shows the mean height of boys and of girls from birth to age 18 years.

Figure 3



Compare the growth of boys with the growth of girls.

Use data from **Figure 3** in your answer.

(6)

(g) Give **one** way that cell division by mitosis is important in **fully grown** animals.

_____

_____

(1)

(Total 14 marks)

Q3.

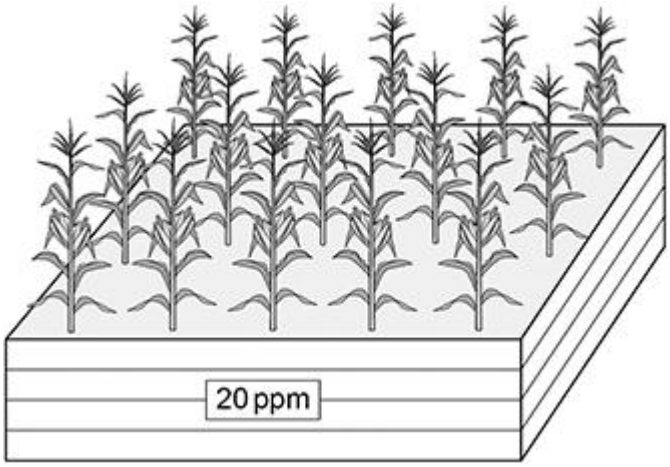
Scientists investigated the effect of soil nitrate ion concentration on the yield of corn.

This is the method used.

1. Corn plants were grown in a large box of soil.
2. The soil nitrate ion concentration in the box was kept at 0 parts per million (ppm).
3. All the corn from each plant in the box was removed and weighed.
4. The mean mass of corn per plant was calculated.
5. Steps 1 to 4 were repeated for boxes containing soil with different concentrations of nitrate ions.

Figure 1 shows the corn plants in the box with a 20 ppm soil nitrate ion concentration.

Figure 1



(a) Give **two** variables the scientists should have controlled in this investigation.

1 _____

_____

2 _____

_____

(2)

The scientists carried out a valid investigation.

The table below shows the scientists' results.

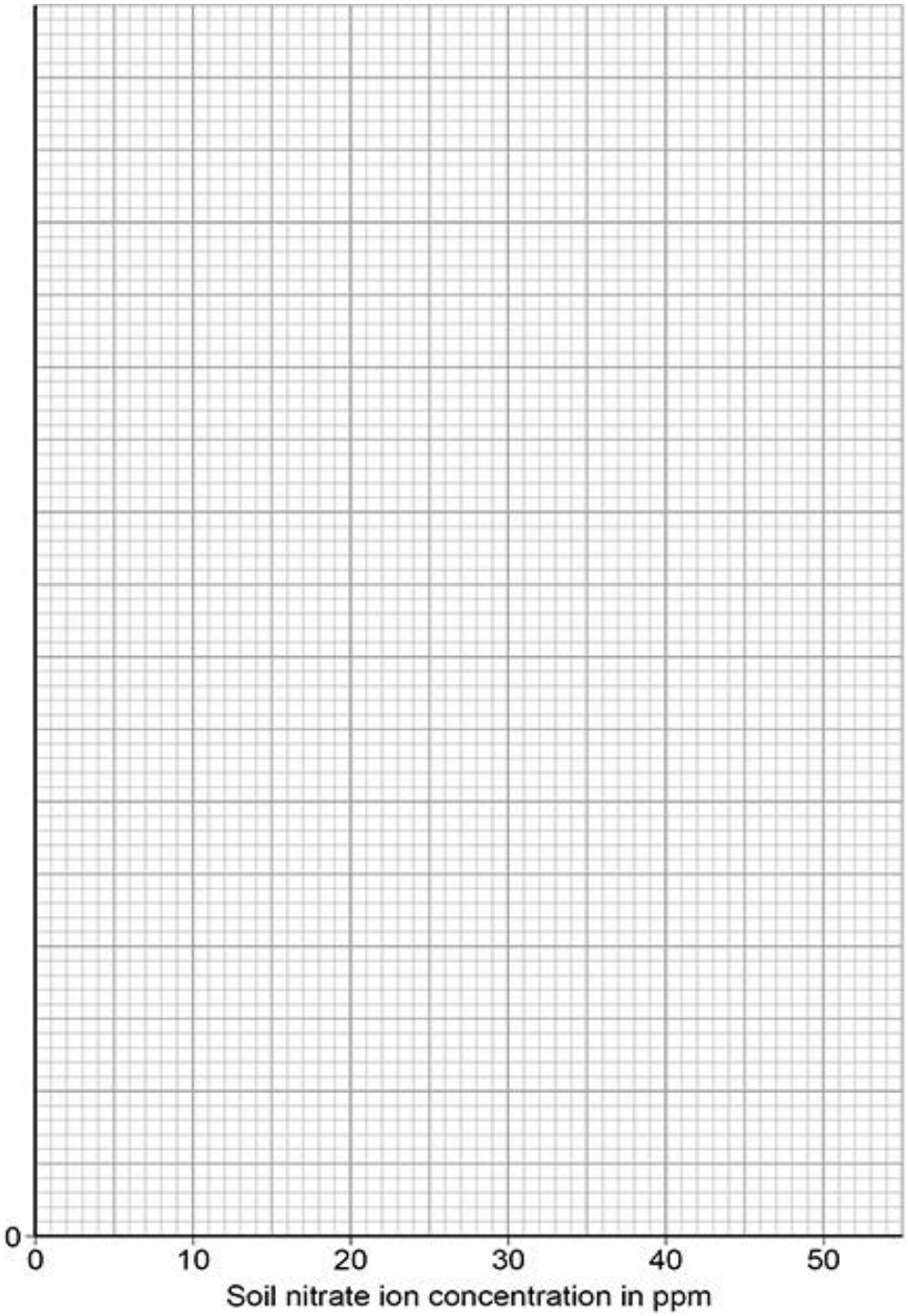
Soil nitrate ion concentration in ppm	**Mean mass of corn per plant in grams**
0	122
10	190
20	256
30	268
40	240
50	184

(b) Complete **Figure 2**.

You should:

- label the *y*-axis
- use a suitable scale for the *y*-axis
- plot the data from the table above
- draw a line of best fit.

Figure 2



(4)

The table above is repeated below.

Soil nitrate ion concentration in ppm	Mean mass of corn per plant in grams
0	122
10	190
20	256
30	268
40	240
50	184

(c) Describe the relationship between soil nitrate ion concentration and the mean mass of corn per plant.

Use data from the table above in your answer.

(2)

(d) Farmers add nitrate fertiliser to fields where they grow corn.

Nitrate fertilisers are expensive.

Evaluate the economic and environmental implications of adding fertiliser to soil in nitrate ion concentrations ranging from 0 to 50 ppm

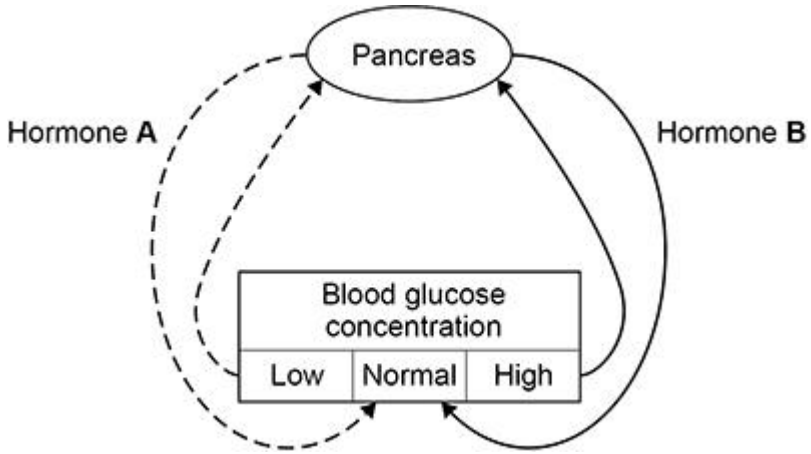
(4)

(Total 12 marks)

Q4.

Blood glucose concentration in the human body needs to be kept within the normal range.

The figure below shows that two hormones control blood glucose concentration.



(a) Name the type of hormonal control shown in the figure above.

_____

(1)

(b) Name hormones **A** and **B** in the figure above.

A _____

B _____

(1)

(c) Explain how the two hormones in the figure above keep the blood glucose concentration within the normal range for 3 hours after a meal.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

Female reproductive hormones are used to treat infertility in women.

(d) Follicle Stimulating Hormone (FSH) and then Luteinising Hormone (LH) can be injected into a woman to help her become pregnant by sexual intercourse.

Explain how injecting FSH and then LH will help a woman to become pregnant.

(3)

(e) In some women the injections of FSH and LH are the first steps for In Vitro Fertilisation (IVF).

Describe the remaining steps in IVF.

(4)

(f) There are two different processes of cell division in humans.

Describe **three** differences between cell division to form sperm cells compared with cell division to form liver cells.

1

2

3

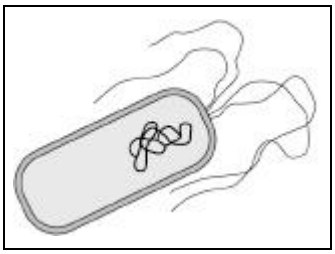
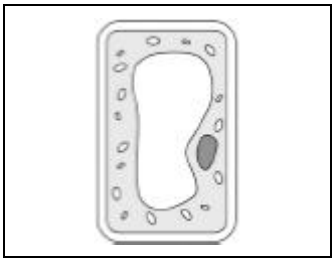
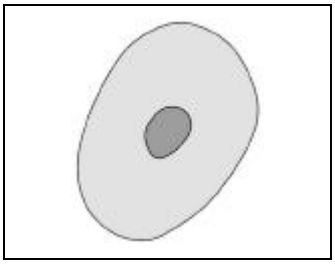
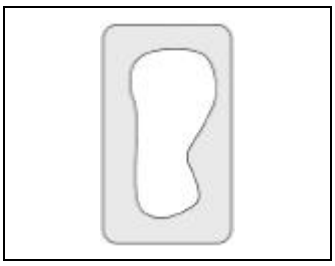
(3)

(Total 18 marks)

Q5.

Cells are the building blocks of life.

(a) Draw **one** line from each type of organism to the diagram of one of its cells.

Type of organism	Diagram of one cell
Animal	
Bacterium	
Plant	
	

(3)

(b) Cells contain structures. These structures have different functions.

Draw **one** line from each function to the correct structure.

Function	Structure
Contains genetic information	Cell membrane
Controls what enters and leaves a cell	Cell wall
Where photosynthesis happens	Chloroplast
	Nucleus

(3)

(c) Chemicals are produced in cells.

Complete the sentences.

Choose answers from the box.

cellulose	**DNA**	**glycogen**	**starch**	**urea**

A chemical excreted by animals is _____.

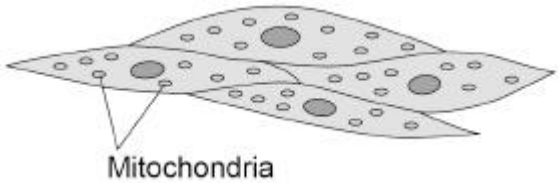
A chemical stored in animal cells is_____.

A chemical stored in plant cells is _____.

A chemical that strengthens plant cell walls is _____.

(4)

The figure below shows a diagram of muscle cells.



(d) Give **one** function of muscle cells.

_____

_____

(1)

(e) Explain how muscle cells are adapted for their function.

Use the figure above.

_____

_____

_____

_____

(2)

(f) One muscle cell was 0.05 mm wide.

When viewed using a microscope the image of the muscle cell was 2 mm wide.

Calculate the magnification used to view the cell.

Use the equation:

$$\text{magnification} = \frac{\text{width of image}}{\text{width of real cell}}$$

_____

_____

_____

Magnification = × _____

(2)

(Total 15 marks)

Q1.

(a) both have a cell membrane

1

both have cytoplasm

1

(b) any **one** from:

- fever
  - *allow high temperature*
  - *allow sweating / chills*
- abdominal / stomach cramps
  - *ignore vomiting / sickness / diarrhoea*
  - *ignore feel unwell unqualified*
  - *ignore rashes*

1

(c) penicillin

allow phonetic spelling

1

(d) any **one** from:

- only a few bacteria killed so live bacteria continued to reproduce
  - *allow bacteria reproducing when course started*
- time delay before antibiotic reached bacteria
  - *allow takes time (for antibiotic) to travel through the body*
- time delay before antibiotic could kill bacteria
  - *allow takes time (for antibiotic) to work*

1

(e) there were fewer toxins in the body than at day 0

1

(f) to reduce / prevent resistant strains / bacteria developing

ignore references to bacteria becoming immune

or

to reduce / prevent antibiotic resistance (in bacteria)

allow because they will get better without taking any antibiotics

ignore body will fight the infection unqualified

allow some infections are caused by viruses

allow because they have been told not to by NHS / NICE

1

(g) B

1

(h) D

1

[9]

Q2.

(a) gene

chromosome

nucleus

cell

must be in this order

1

(b) differentiation

ignore specialisation

1

(c) 4

allow 15

1

(d) 46

allow 23 pairs (of chromosomes)

1

(e) **Stage 1** any **one** from:

- (cell) growth
- increase in number of sub-cellular structures

  allow increase in number of organelles / ribosomes / mitochondria

- DNA replicates

  allow genetic material for DNA

  allow DNA doubles / duplicates

- chromosomes double / duplicate / replicate

1

Stage 2 any **one** from:

ignore mitosis occurs

- (one set of) chromosomes is pulled to each end of cell

  allow chromosomes line up across the centre of the cell

  allow chromosomes move to opposite ends of the cell

- two nuclei form

  allow nucleus divides / splits (into two)

1

Stage 3 any **one** from:

- cytoplasm / membrane divides

  allow cytokinesis

- two identical cells formed

1

(f) **Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.

4–6

Level 1: Relevant features are identified and differences noted.

1–3

No relevant content

0

Indicative content

General comparisons:

- boys height at birth (slightly) greater than girls height
- boys are (slightly) taller than girls up to age 11
- correct height comparisons eg boys are approximately 4 / 5 cm taller than girls up to age 11
- girls and boys are the same height at age 11
- girls are taller than boys between age 11 and age 14
- girls and boys are the same height at age 14
- boys are taller than girls above age 14
- correct height comparisons eg boys are 5 to 18 cm taller than girls above age 14
- boys (eventually) grow taller than girls
- boys carry on growing for a longer time than girls
- girls stop growing age 13 / 14 / 15 **and** boys stop growing age 17 / 18

Rate comparisons:

- rate of growth similar up to age 10 / 11
- girls grow faster than boys between 10 / 11 and 14

  allow girls have a greater increase in height between 11 and 14
- growth spurt occurs at a younger age in girls
- growth spurt starts age 10 / 11 in girls **and** age 13 / 14 in boys
- increased rate of growth in girls aged 10 to 13 /14 **and** in boys aged 13 to 17 / 18

Key points for Level 2 are correct reference to 0-11 year period, 11-14 period and after age 14, with at least one correct reference to rate of growth or use of correct values of height and age to illustrate rate.

(g) repair of tissues

allow repair of organs

ignore repair of cells

or

replacement of cells

allow replacement of tissues

ignore replacement of organs

ignore growth

1

[14]

Q3.

(a) any **two** from:

- light (intensity)
- water
- temperature
- mass / volume of soil

allow size of box

allow depth of soil

- soil type **or** (soil) pH
- other mineral content of the soil

ignore fertiliser

- number of plants (in a box)

allow planting density

- starting mass / height / age of corn
- type / variety of corn

allow species of corn

- harvested at the same time

allow harvested when mature

2

*do **not** accept nitrate ion concentration*

(b) suitable scale **and** axis labelled (mean <u>mass</u> (of corn) per plant in <u>grams / g</u>)

1

all points plotted correctly

allow a tolerance of ± ½ a small square

*allow **1** mark for 4 or 5 correct plots*

2

suitable line of best fit

ignore line extended beyond 50ppm

ignore line joined point to point with straight lines

1

*max **3** marks for bar chart*

(c) as (soil) nitrate / concentration increases, (mean) mass (of corn)

increases **and** then decreases

1

with a maximum (mean mass of corn) at 30 (ppm)

*allow a maximum consistent with graph in part **(b)***

1

*if no other mark awarded, allow **1** mark for (mean mass of corn) increases to 30 (ppm) **or** (mean mass of corn) decreases above 30 (ppm)*

(d) any **four** from:
(economic)

- increasing nitrate / ion (concentration) up to 30 ppm will give high(er) yield / income / sales

  ignore mass for this marking point only

- greater than 30 ppm will decrease yield / mass / income / sales **and** therefore waste money / fertiliser

  *allow greater than 30 ppm, the yield / mass / income / sales / will not increase (as much) **and** therefore waste money / fertiliser*

- any increase in yield / mass / income / sales must be balanced with cost (of fertiliser)

  *allow profit / benefit will depend on yield / mass / income / sales **and** cost (of fertiliser)*

- quantity to add will depend on original nitrate (ion concentration) of soil

(environmental)

- (when it rains) fertiliser / nitrate will enter rivers / lakes / sea / ocean causing pollution

  allow fertiliser / nitrate run-off causes pollution

  allow eutrophication or description of eutrophication

  allow description of effect of fertiliser / nitrate pollution eg health impact of fertiliser in drinking water

  allow environmental implication of (significant) energy use in fertiliser production / transport

4

*max **3** marks if no reference to environmental implication*

[12]

Q4.

(a) negative feedback (control)

ignore homeostasis

1

(b) A = glucagon
B = insulin

both required in correct order

correct or phonetic spelling only

1

(c) **Indirect marking**

view with (b)

(when blood glucose concentration is high after a meal) insulin / B is secreted (by the pancreas) causing glucose to enter cells

1

(glucose is) converted to glycogen in the liver / muscle (cells for storage)

1

(this causes) blood glucose concentration to return to normal so insulin / B secretion slows / stops / decreases

1

when blood glucose concentration is low glucagon / A is secreted (by the pancreas)

1

(which causes) breakdown of glycogen in the liver (into glucose)

allow (which causes) breakdown of glycogen in the muscle (cells)

1

(this causes) blood glucose concentration to return to normal so glucagon / A secretion slows / stops / decreases

1

(d) FSH causes (several) ova / eggs to mature (in the ovary)

allow singular ovum / egg

allow follicle for ovary

1

(then) LH causes ovulation
or
LH causes release of the ova / eggs

allow singular ovum / egg

1

so more eggs / ova present therefore higher probability / chance of fertilisation
or
so more eggs / ova present therefore higher probability / chance of sperm fusing with an egg

1

(e) collection of (mature) egg(s) from the ovary

allow follicle for ovary

1

(which are) fertilised (in the laboratory)

*do **not** accept if in fallopian tube*

allow egg and sperm fuse

1

develop into embryo(s) (in the laboratory)

allow develop / divide into small balls of cells (in the laboratory)

*do **not** accept foetus*

1

embryo(s) inserted into uterus / womb

1

(f) any **three** from:

- meiosis for sperm cells **and** mitosis for liver cells
- two cell divisions to form sperm **and** one cell division to form liver (cells)
- four genetically different sperm cells **and** two genetically identical liver cells

  *allow four genetically different cells formed from meiosis **and** two genetically identical cells formed from mitosis*
- sperm cells have 23 chromosomes **and** liver cells have 46 chromosomes

  *allow sperm cells have 23 chromosomes **and** liver cells have 23 pairs of chromosomes*

  allow haploid (sperm) and diploid (liver cells)

  ignore reproduction

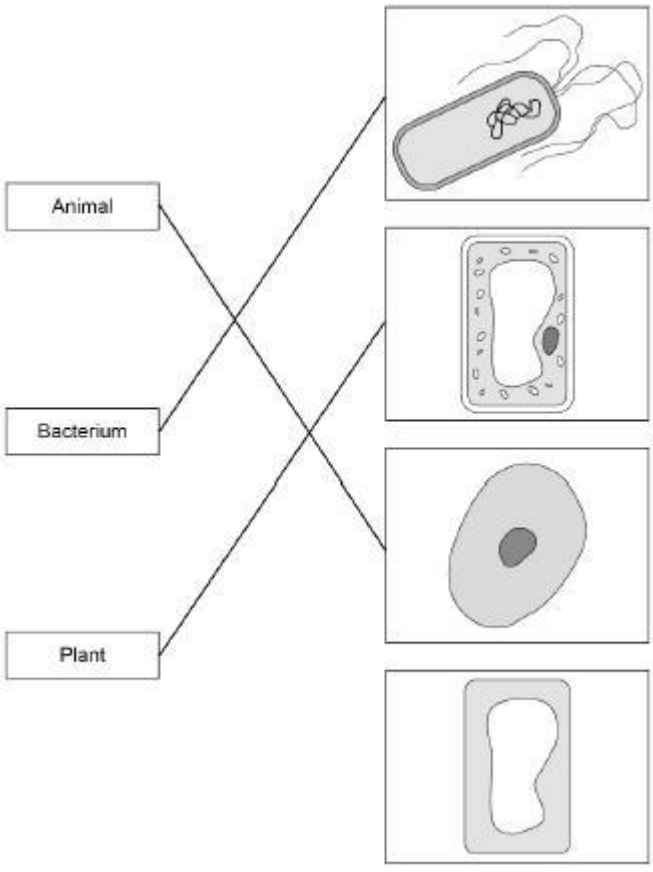
  *max **2** marks if reference to sperm cells dividing*

3

[18]

Q5.

(a)

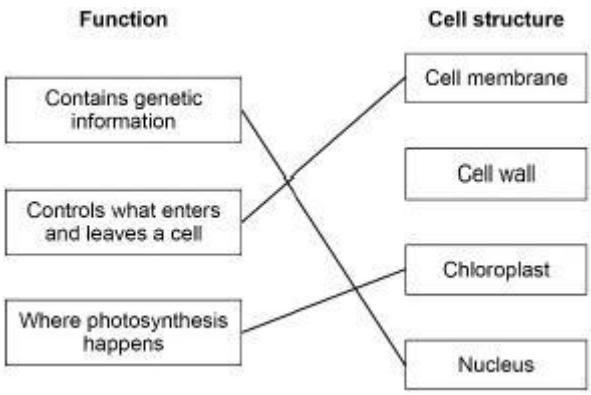


do **not** accept more than one line from a box on the left

1
1

1

(b)



do **not** accept more than one line from a box on the left

1
1
1

(c) urea

must be in this order

1

glycogen

1

starch

1

cellulose

1

(d) any **one** from:

- (to cause) movement
- to contract / shorten

allow example of movement

ignore to relax / expand

ignore references to strength / energy / power

1

(e) (many) mitochondria

1

to transfer / release (a lot of) energy

allow (mitochondria) for respiration

*do **not** accept to produce / make / create energy*

ignore reference to the shape / strength of the cells

1

(f) $\frac{2}{0.05}$

1

(×) 40

*do **not** accept if a unit is given*

1

[15]