A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: SYNERGY H
8465/1H

Higher Tier

Paper 1 Life and Environmental Sciences

Time allowed: 1 hour 45 minutes

MATERIALS
For this paper you must have:
- **a ruler**
- **a protractor**
- **a scientific calculator**
- **the periodic table (enclosed)**
- **the Physics Equations Sheet (enclosed).**

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

J U N 2 2 8 4 6 5 1 H 0 1

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INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Pencil should only be used for drawing.**
- **Answer ALL questions in the spaces provided. Do not write on blank pages.**
- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**
- **In all calculations, show clearly how you work out your answer.**

INFORMATION

- **The maximum mark for this paper is 100.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

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0 1

Ultraviolet, infrared and visible light are part of the electromagnetic spectrum.

0 1 . 1

Ultraviolet radiation and infrared radiation are emitted by some objects.

Give ONE use of ultraviolet radiation and ONE use of infrared radiation. [2 marks]

Ultraviolet radiation _____

_____

_____

Infrared radiation _____

_____

_____

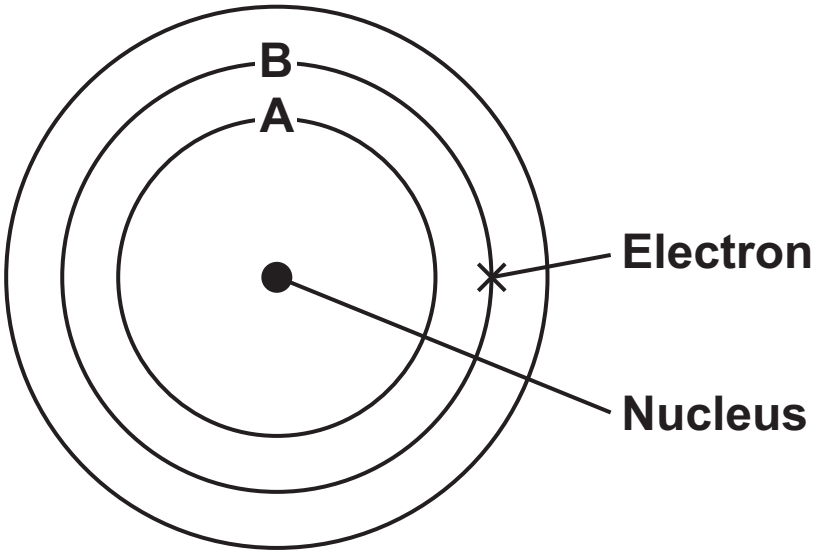
[Turn over]

0 1 . 2

Neon atoms can absorb electromagnetic radiation.

FIGURE 1 shows three of the energy levels around the nucleus of a neon atom.

FIGURE 1



The atom in FIGURE 1 has absorbed electromagnetic radiation.

What happens as an electron moves from energy level B to energy level A? [1 mark]

Tick (✓) ONE box.

- ☐ **Light is absorbed**
- ☐ **Light is emitted**
- ☐ **Light is reflected**

An electromagnetic wave has a speed of 300 000 000 m/s.

0 1 . 3

What is the speed of the wave in standard form? [1 mark]

Tick (✓) ONE box.

- ☐ **3.0×10^7 m/s**
- ☐ **3.0×10^8 m/s**
- ☐ **3.0×10^9 m/s**

[Turn over]

Use the Physics Equations Sheet to answer questions 01.4 and 01.5.

0 1 . 4

Write down the equation that links frequency (*f*), wavelength (*λ*) and wave speed (*v*). [1 mark]

0 1 . 5

The electromagnetic wave has a frequency of 750 000 Hz.

Calculate the wavelength of the electromagnetic wave.

Give the unit. [4 marks]

_____

_____

_____

_____

_____

_____

Wavelength = _____ Unit _____

9

[Turn over]

0 2

Students investigated the effect of different concentrations of salt solution on the mass of pieces of potato.

This is the method used.

1. **Cut three pieces of potato, each with a mass of 2.00 g.**

2. **Place the pieces of potato into a salt solution with a concentration of 0.2 mol/dm^3.**

3. **After 30 minutes, measure the mass of each piece of potato.**

4. **Calculate the change in mass.**

5. **Repeat steps 1 to 4 for five other concentrations of salt solution.**

TABLE 1 shows the results.

TABLE 1

Concentration of salt solution in mol/dm^3	Change in mass in g			Mean change in mass in g
0.2	0.31	0.34	0.25	0.30
0.4	−0.07	−0.08	−0.13	−0.09
0.6	−0.18	−0.13	−0.11	−0.14
0.8	−0.24	−0.19	−0.17	−0.20
1.0	−0.22	−0.30	−0.32	−0.28
1.2	−0.26	−0.35	−0.32	X

[Turn over]

0 2 . 1

Give TWO control variables the students should have used in the investigation.

Do NOT refer to mass or time in your answer. [2 marks]

1 _____

_____

_____

2 _____

_____

_____

0 2 . 2

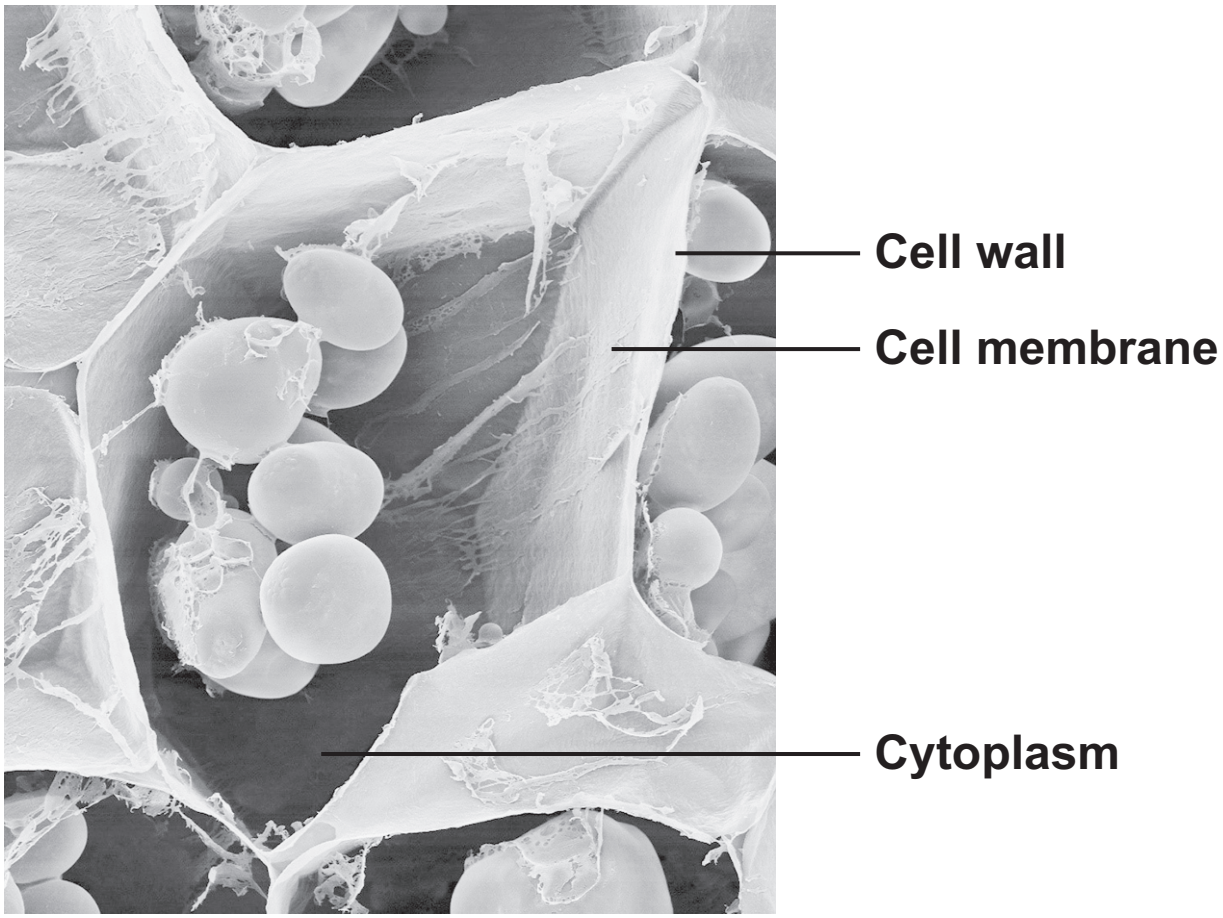
Calculate value X in TABLE 1, on page 11. [3 marks]

X = _____ g

[Turn over]

FIGURE 2 shows a potato cell.

FIGURE 2



0 2 . 3

Explain why the mass of the pieces of potato increased in the 0.2 mol/dm^3 salt solution.

You should refer to the cell parts labelled in FIGURE 2.
[6 marks]

0 2 . 4

The image in FIGURE 2 was made using an electron microscope and NOT a light microscope.

Give ONE piece of evidence to support this. [1 mark]

0 2 . 5

The potato cell in FIGURE 2 contains starch grains.

A starch grain on a different image had a diameter of 1.2 cm.

The starch grain had a real diameter of 0.008 mm.

Calculate the magnification of the image. [3 marks]

_____

_____

_____

_____

Magnification = × _____

[Turn over]

Starch is digested in the gut.

0 2 . 6

Why is digestion of starch needed? [1 mark]

Tick (✓) ONE box.

- ☐ Starch is a carbohydrate.
- ☐ Starch molecules are insoluble.
- ☐ Starch molecules are small.

0 2 . 7

Describe the process of starch digestion. [2 marks]

_____

_____

_____

_____

_____

_____

18

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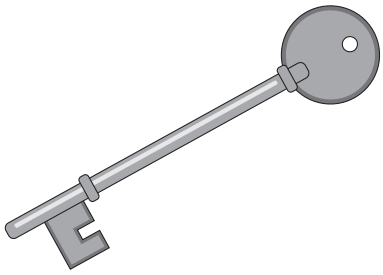
[Turn over]

0 3

Keys are usually made from metal.

FIGURE 3 shows a metal key.

FIGURE 3



0 3 . 1

Describe a method to determine the density of the metal the key is made from.

You should include the measuring instruments you would use.

Use the Physics Equations Sheet. [4 marks]

[Turn over]

0 3 . 2

A manufacturer of keys buys metal as small solid cubes.

A solid metal cube has a density of 2.70×10^3 kg/m^3.

The cube has a mass of 0.0216 kg.

Calculate the surface area of the cube.

Use the Physics Equations Sheet. [5 marks]

_____

_____

_____

_____

Surface area = _____ m^2

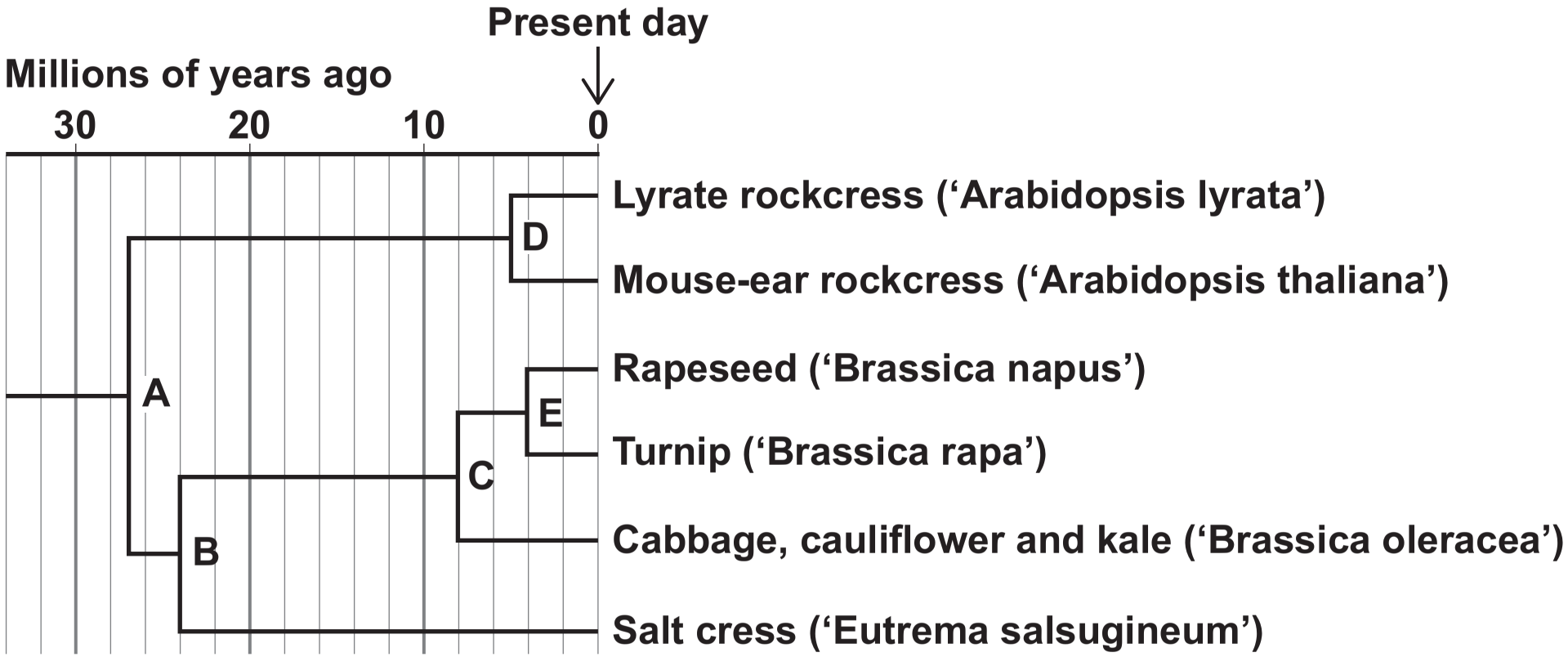
9

[Turn over]

0 4

FIGURE 4 shows the evolution of some plants.

FIGURE 4



A, B, C, D and E show when one species evolved into two species.

Use FIGURE 4 to answer Questions 04.1 to 04.3.

0 4 . 1

Give the genus name of salt cress. [1 mark]

_____

_____

0 4 . 2

Cabbage, cauliflower and kale are all varieties of one species, 'Brassica oleracea'.

How many years ago did rapeseed evolve to become a different species from cabbage, cauliflower and kale? [1 mark]

_____ **million years ago**

[Turn over]

0 4 . 3

Give the BINOMIAL names of TWO species that evolved 5 million years ago. [1 mark]

1 _____

_____

2 _____

_____

0 4 . 4

Rapeseed is grown to produce oil for cooking.

Describe how a sample of rapeseed oil could be tested to show it contains lipid. [2 marks]

Test _____

_____

_____

Positive result for lipid _____

_____

0 4 . 5

It has taken thousands of years for farmers to produce the different varieties of 'Brassica oleracea'.

Describe how farmers have been able to produce the different varieties of 'Brassica oleracea'. [3 marks]

0 4 . 6

Describe how scientists can prove that cabbage and cauliflower plants are the same species.

Do NOT refer to DNA analysis in your answer. [2 marks]

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[Turn over]

Scientists investigated the genomes of three varieties of 'Brassica oleracea'.

0 4 . 7

What is meant by 'genome'? [1 mark]

_____

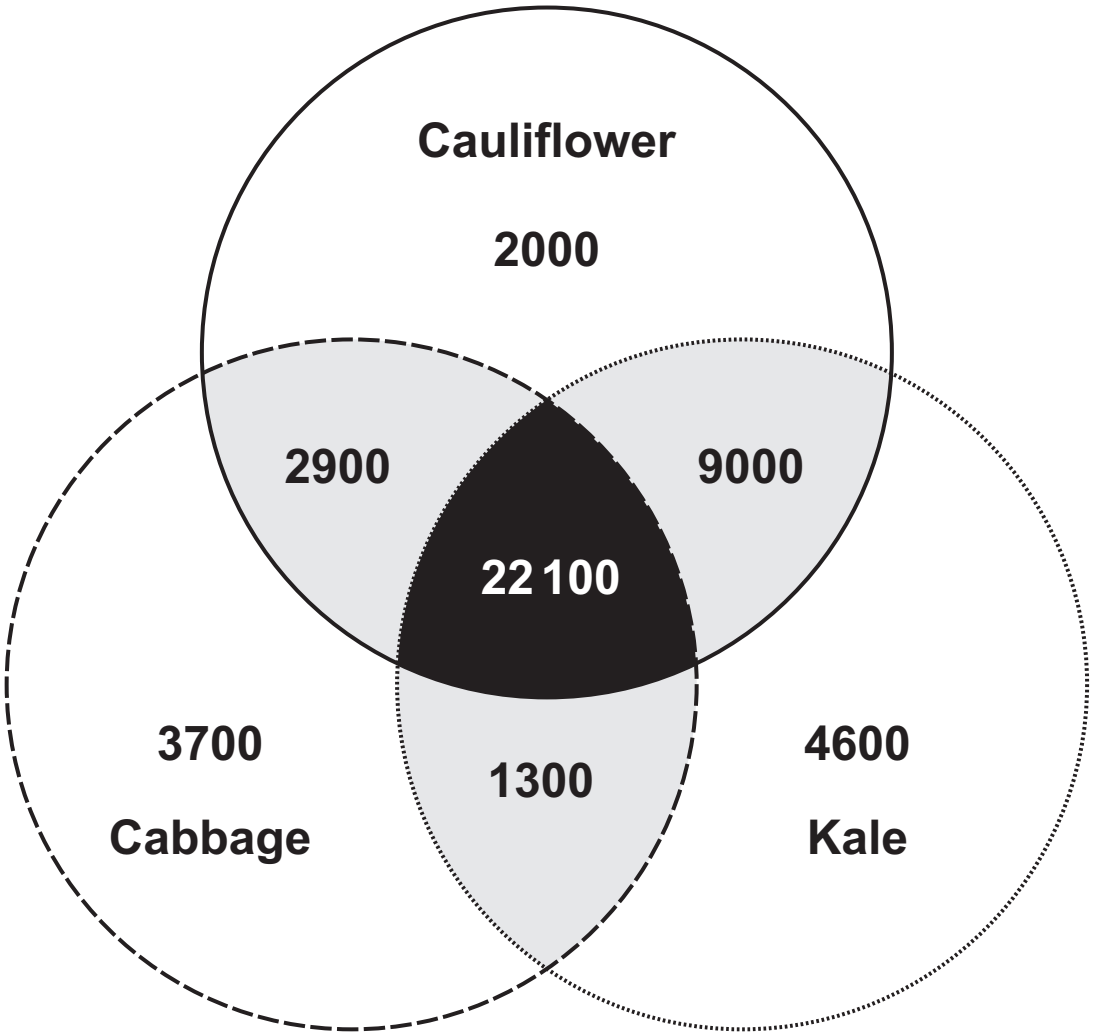
_____

_____

FIGURE 5, on page 31, shows the number of genes in 'Brassica oleracea' that are:

- **found only in each variety**
- **found in two of the varieties**
- **found in all three of the varieties.**

FIGURE 5



KEY

- Genes found only in each variety
- Genes found in two of the varieties
- Genes found in all three of the varieties

[Turn over]

0 4 . 8

How does FIGURE 5 show that cauliflower and kale are more closely related than cauliflower and cabbage?
[1 mark]

_____

_____

_____

0 4 . 9

Calculate the percentage of the total number of genes in cauliflower that are in kale, but NOT in cabbage.
[2 marks]

_____

_____

_____

_____

_____

_____

Percentage = _____ %

14

0 5

The atomic model has changed over time.

0 5 . 1

Alpha particles have been used to investigate the atomic model.

Describe the structure of an alpha particle. [1 mark]

_____

_____

_____

[Turn over]

0 5 . 2

An atom has a radius of 0.182 nm.

1 m = 1 000 000 000 nm

What is the radius of the atom in metres? [1 mark]

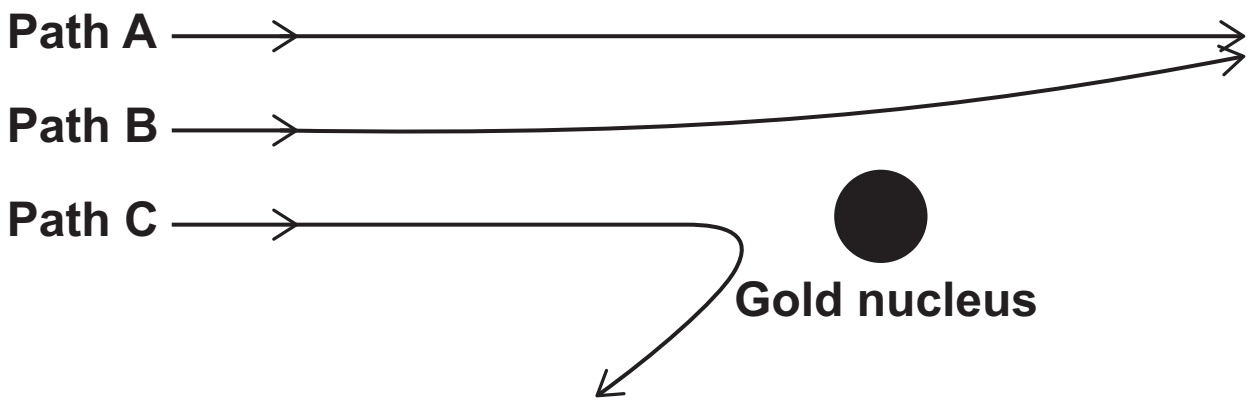
Tick (✓) ONE box.

- ☐ 1.82×10^{9} m
- ☐ 1.82×10^{10} m
- ☐ 1.82×10^{-9} m
- ☐ 1.82×10^{-10} m

Alpha particles from a source were directed at thin gold foil.

FIGURE 6 shows some of the paths the alpha particles followed.

FIGURE 6



During one experiment the number of alpha particles following different paths was recorded.

TABLE 2 shows the number of alpha particles that followed paths A, B and C.

TABLE 2

PATH	Number of alpha particles
A	8 289 864
B	7 920
C	198

0 5 . 3

Determine the simplest ratio of alpha particles following paths A, B and C. [2 marks]

_____

_____

_____

_____

_____

Simplest ratio of A : B : C =

_____ : _____ : 1

0 5 . 4

Explain how the results provide evidence for the nuclear model of the atom.

Use FIGURE 6 and TABLE 2 on page 35. [4 marks]

An atom of boron can be represented as $^{11}_{5}B$

An atom of carbon can be represented as $^{12}_{6}C$

0 5 . 5

Compare the number of sub-atomic particles in the atom of boron and in the atom of carbon. [2 marks]

0 5 . 6

Boron and carbon both have isotopes.

What does 'isotope' mean? [1 mark]

11

0 6

Organisms have been genetically modified (GM) for many reasons.

0 6 . 1

What has been genetically modified to produce a hormone that reduces blood glucose concentration? [1 mark]

Tick (✓) ONE box.

- ☐ **Algae**
- ☐ **Bacteria**
- ☐ **Viruses**

[Turn over]

Scientists are researching the production of GM pigs.

Organs from GM pigs could be transplanted into humans.

0 6 . 2

What is ONE advantage of using organs from GM pigs instead of using organs from human donors? [1 mark]

0 6 . 3

Describe how a human gene could be used to genetically modify a pig embryo. [2 marks]

Farmers produce cotton from cotton plants.

FIGURE 7 shows a cotton plant.

FIGURE 7

Insects feed on cotton plants.

Cotton plants have been genetically modified to produce a pesticide that kills insects.

[Turn over]

0 6 . 4

Give ONE advantage to a farmer of growing cotton plants that are able to kill insects. [1 mark]

_____

_____

_____

Bollworms are insects that eat cotton plants.

Most bollworms are killed if they eat the GM cotton.

Some bollworms have a gene that allows the bollworm to eat GM cotton and survive.

- **The allele for being killed by eating GM cotton is dominant.**
- **The allele for being able to eat GM cotton and survive is recessive.**

0 6 . 5

Two bollworms mate. Both bollworms would be killed by eating GM cotton.

80 offspring are produced.

Some offspring are able to eat GM cotton and survive.

Predict how many of the 80 offspring are likely to be able to eat GM cotton and survive.

You should:

- **draw a Punnett square diagram**
- **identify the genotypes of the two parent bollworms**
- **identify the phenotype of each offspring genotype**
- **use the symbols: B = dominant allele**
  b = recessive allele

[5 marks]

Predicted number of offspring that will be able to eat GM cotton and survive = _____

[Turn over]

0 6 . 6

The allele in bollworms for being able to eat GM cotton and survive is recessive.

A bollworm may evolve that has a new dominant allele that allows the bollworm to eat GM cotton and survive.

Explain how a NEW DOMINANT ALLELE emerging would cause a greater problem than the recessive allele that already exists. [4 marks]

0 7

This question is about health.

0 7 . 1

Some pathogens cause food poisoning.

Explain how the stomach is adapted to prevent food poisoning. [2 marks]

0 7 . 2

Different types of disease may interact.

Suggest ONE type of disease that may be triggered by infection with human papillomavirus (HPV). [1 mark]

Chlamydia, HIV and HPV are sexually transmitted diseases (STDs).

0 7 . 3

Chlamydia is caused by the same type of microorganism as gonorrhoea.

Suggest how chlamydia infections are treated. [1 mark]

_____

_____

0 7 . 4

One symptom of chlamydia infection is damage of the uterus lining.

Which TWO hormones are involved in maintaining the uterus lining? [2 marks]

1 _____

_____

2 _____

_____

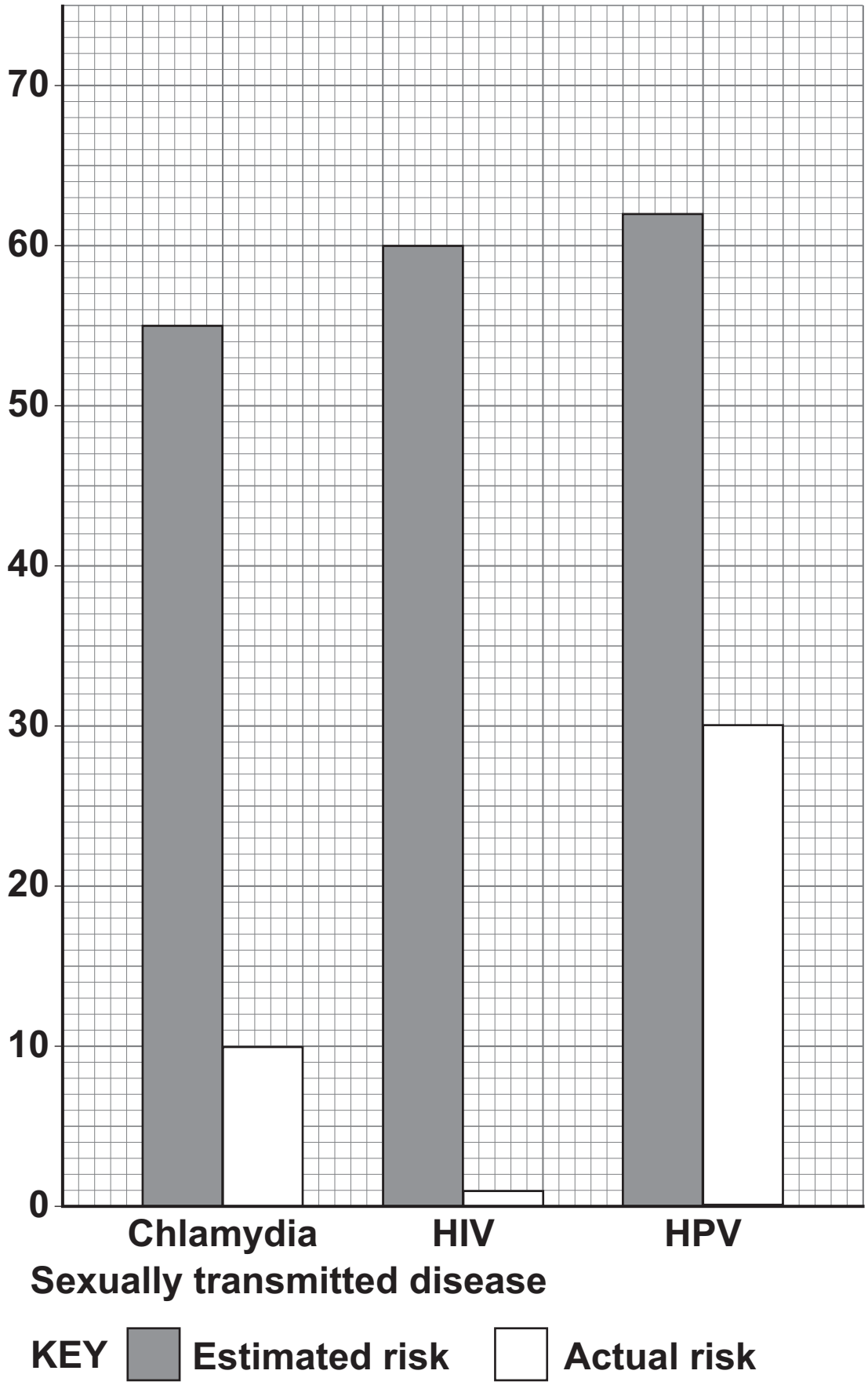
Students were asked to estimate the percentage risk of a person becoming infected with different STDs.

The estimate was compared to the actual percentage risk of infection.

FIGURE 8, on page 48, shows the results.

[Turn over]

FIGURE 8


Percentage (%) risk of becoming infected
70
60
50
40
30
20
10
0
Chlamydia
HIV
HPV
Sexually transmitted disease
KEY
Estimated risk
Actual risk

0 7 . 5

Why is the data in FIGURE 8 plotted as a bar chart and NOT as a line graph? [1 mark]

0 7 . 6

The difference between the estimated risk and the actual risk is NOT the same for each STD.

Suggest TWO reasons why. [2 marks]

1

2

[Turn over]

0 7 . 7

Explain how only some types of contraception reduce the spread of STDs. [2 marks]

0 7 . 8

Explain why patients with late-stage HIV infection or AIDS are likely to become very ill from other infections. [4 marks]

15

[Turn over]

0 8

It is important to keep our feet healthy.

0 8 . 1

FIGURE 9 shows a doctor testing a reflex action of a patient.

FIGURE 9

When the doctor touches the patient's foot with a blunt rod, the patient's toes curl.

Describe the pathway of this reflex action. [6 marks]

0 8 . 2

Sometimes runners tie their shoelaces too tightly.

Tight shoes can cause muscle pain part-way through a long run.

Explain why the muscle pain starts part-way through the run. [4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

10

END OF QUESTIONS

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Additional page, if required.
Write the question numbers in the left-hand margin.

Additional page, if required.
Write the question numbers in the left-hand margin.

Additional page, if required.
Write the question numbers in the left-hand margin.

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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
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TOTAL	