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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE (9–1)

Centre Number | Candidate Number

Tuesday 12 May 2020

Afternoon (Time: 2 hours) | Paper Reference **4BI1/1BR 4SD0/1BR**

Biology

Unit: 4BI1

Science (Double Award) 4SD0

Paper: 1BR

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- 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 ☒.

Information

- The total mark for this paper is 110.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Answer ALL questions.

1 Plant and animal cells have some features in common and some differences.

(a) (i) Which of these structures is not found in animal cells?

(1)

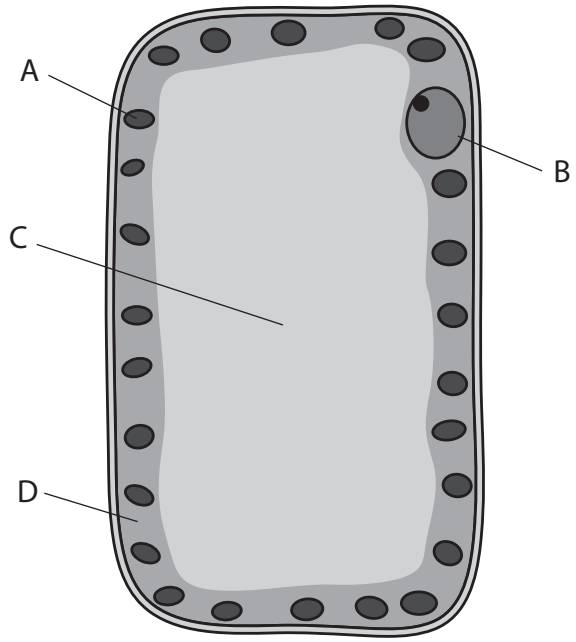
- ☒ **A** cell membrane
- ☒ **B** cell wall
- ☒ **C** mitochondrion
- ☒ **D** nucleus

(ii) Which of these substances is a carbohydrate stored in plant cells?

(1)

- ☒ **A** chlorophyll
- ☒ **B** glucose
- ☒ **C** glycogen
- ☒ **D** starch

(b) The diagram shows a leaf palisade mesophyll cell.



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(i) Describe the function of the parts labelled A, B, C and D.

(4)

A .....

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B .....

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C .....

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D .....

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(ii) Explain two ways that the structure of this palisade mesophyll cell is adapted for its function.

(2)

1 .....

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2 .....

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(Total for Question 1 = 8 marks)

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2 Bacteria are genetically modified to make human proteins.

(a) Which part of a bacterium is used in genetic modification?

(1)

☒ **A** cell wall

☒ **B** nucleoid

☒ **C** plasmid

☒ **D** RNA

(b) The passage describes the use of an industrial fermenter to grow genetically modified bacteria.

Complete the passage by writing a suitable word in each blank space.

(6)

The hormone called ..... is needed to control the blood glucose levels in humans.

Bacteria have been genetically modified to produce this hormone.

The fermenter is cleaned with ..... before adding a nutrient broth that contains the genetically modified bacteria.

This cleaning provides aseptic conditions that prevent ..... from other bacteria.

Paddles are used to ..... the contents.

A gas called ..... is bubbled into the fermenter.

The ..... is controlled by using a cooling jacket.

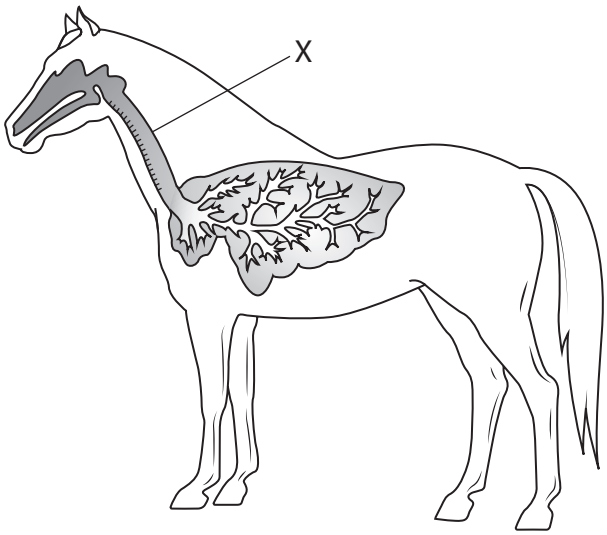
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3 The diagram shows the location of the lungs in a horse.



(a) (i) The part labelled X is the

(1)

- ☒ **A** bronchiole
- ☒ **B** bronchus
- ☒ **C** oesophagus
- ☒ **D** trachea

(ii) Which blood vessel transports blood to the horse's lungs?

(1)

- ☒ **A** aorta
- ☒ **B** pulmonary artery
- ☒ **C** pulmonary vein
- ☒ **D** vena cava

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(iii) Which row of the table describes what happens when the horse breathes in?

(1)

	Diaphragm	External intercostal muscles
☒ **A**	contract	contract
☒ **B**	contract	relax
☒ **C**	relax	contract
☒ **D**	relax	relax

(b) The table shows the percentage of total blood flow in different body parts of a horse at rest and when running.

Body part	Percentage of total blood flow (%)	
	at rest	when running
leg muscle	15	82
intestine	30	3

Comment on the changes in the percentage of total blood flow in these body parts.

(4)

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(c) The horse breathes faster and deeper when running.

Explain why the horse continues to breathe faster and deeper for a period of time after it has stopped running.

(2)

(Total for Question 3 = 9 marks)

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4 The plants in a woodland are eaten by mice and caterpillars.

The mice also eat the caterpillars.

The mice are eaten by birds called owls.

(a) Draw a food web showing these feeding relationships.

(2)

(b) Give the term that describes the trophic level of a caterpillar.

(1)

(c) The woodland covered a total area of 5 km^2.

A scientist investigates the number of mice and owls in the woodland.

He counts the number of mice and owls on the same summer day each year for five years.

The table shows the scientist's results.

Year	Number of mice per km^2	Number of owls in entire woodland
1	2×10^3	10
2	2×10^3	12
3	3×10^3	12
4	5×10^3	16
5	1×10^3	14

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(i) Calculate the number of mice in the total area of woodland in year 3.

(2)

number of mice = ...

(ii) Suggest why there were more mice in year 4 than in the other years.

(3)

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(iii) Suggest why the number of owls was fairly constant each year.

(2)

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(iv) Suggest a method you would use to estimate the number of mice in the woodland.

(3)

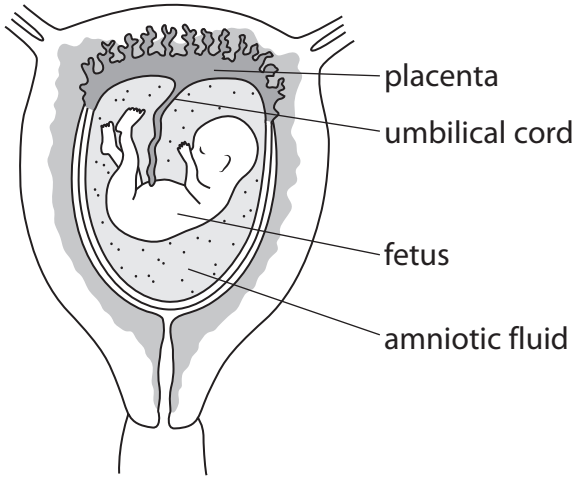
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5 The diagram shows a fetus in the uterus of a woman.



The umbilical cord transports blood from the placenta to the fetus.

This blood contains molecules from the mother that are needed by the developing fetus.

(a) (i) Explain how some of these molecules allow active transport to occur in cells of the fetus.

(3)

(ii) Explain how one type of molecule from the mother helps to protect the fetus from infection.

(2)

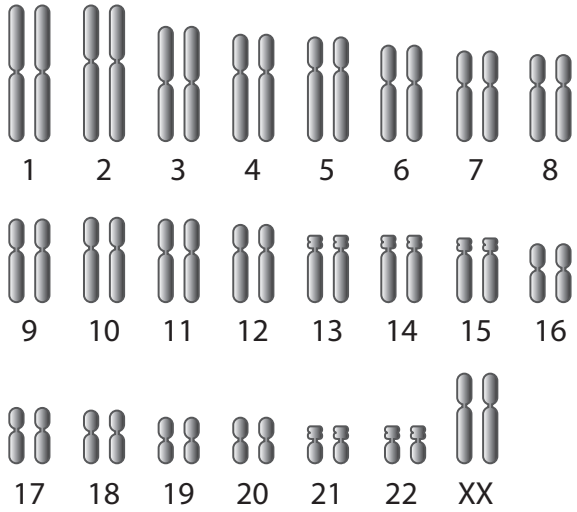
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(b) The amniotic fluid contains cells from the fetus.

It is possible to look at chromosomes in these cells.

A diagram of the chromosomes is called a karyotype.

The diagram shows the karyotype of a fetus cell.



Give two conclusions you can make from this karyotype.

(2)

1 .....

.....

2 .....

.....

(c) Doctors recommend that pregnant women obtain more of some dietary components than women who are not pregnant.

The table shows the recommended percentage increase of some dietary components in the diet of a woman who is pregnant compared to a woman who is not pregnant.

Component	Percentage increase of some dietary components in the diet of a woman who is pregnant compared to a woman who is not pregnant (%)
Energy in kJ	10
Calcium in g	71
Iron in mg	50
Protein in g	14
Vitamin D in μg	300

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(i) Explain why a woman who is pregnant requires more of each of the dietary components listed in the table.

(4)

(ii) The actual mass of additional iron needed by the pregnant woman was 9.0 mg per day.

Calculate the actual total mass of iron needed by the pregnant woman.

(3)

mass = ... mg per day

(Total for Question 5 = 14 marks)

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6 Lichens are organisms that grow well on stone walls in unpolluted air.

Lichens grow less well in polluted air.

Car exhaust fumes contain sulfur dioxide that pollutes air.

A scientist investigates the effect of pollution by cars in a city.

This is her method.

- measure the percentage area of a stone wall in the city centre covered by lichen
- repeat this measurement at different distances from the city centre

The table shows her results.

Distance from city centre in km	Percentage area covered by lichen (%)
0	0
2	6
4	20
6	30
8	50
10	64
12	70

(a) Explain the results shown in the table.

(2)

(b) Describe a method to measure the percentage of a stone wall covered by lichen.

(3)

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(c) Adding water to a powder called sodium metabisulphite will release sulfur dioxide gas.

Devise a laboratory investigation to find out the effect of sulfur dioxide gas on the heat released by germinating seeds.

Include experimental details in your answer and write in full sentences.

(6)

(Total for Question 6 = 11 marks)

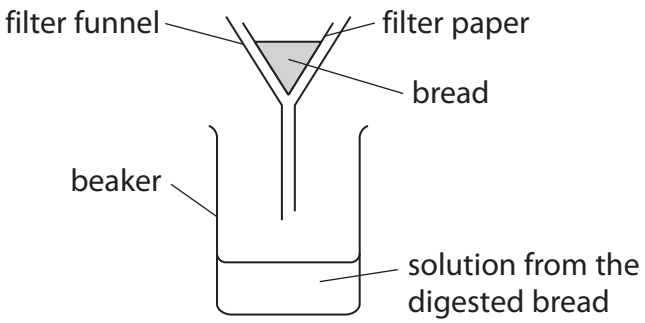
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7 Bread contains starch.

A student investigates how temperature affects the digestion of bread.

This is the apparatus he uses in his method.



This is the student's method.

- add amylase to a sample of bread
- put this bread in the filter funnel
- pour water onto the bread
- do a Benedict's test on the solution from the digested bread that collects in the beaker
- repeat the method at different temperatures

(a) Explain the results of Benedict's test if the amylase digests the starch.

(2)

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(b) The student's method lacks detail.

Rewrite the method so that the student could make a valid conclusion about the effect of temperature on amylase.

(4)

(c) The student predicted that the rate of digestion of starch would keep increasing as temperature increased.

Comment on this prediction.

(4)

(Total for Question 7 = 10 marks)

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8 An electronic cigarette (e-cigarette) has been invented.

E-cigarettes are held in the hand like normal cigarettes. Instead of burning tobacco, e-cigarettes heat a liquid that contains nicotine and flavourings to produce a vapour that is inhaled.

Scientists carried out an investigation to see how the smoking habits of students changed between 2011 and 2016.

Each year they determined the percentage of students who used e-cigarettes and the percentage of students who smoked normal cigarettes during the year.

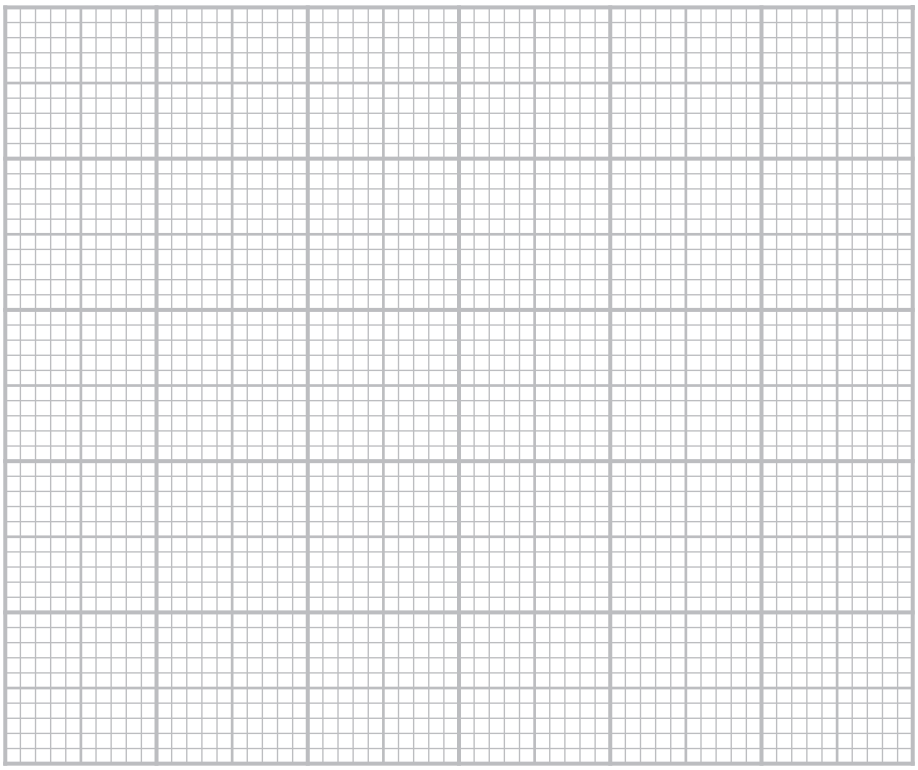
The results are shown in the table.

Year	Percentage of students	
	using e-cigarettes	smoking normal cigarettes
2011	1.5	15.8
2012	2.8	14.0
2013	4.5	12.7
2014	13.4	9.5
2015	16.0	9.3
2016	11.3	8.0

(a) Plot a line graph to show how the percentage of students who used e-cigarettes and the percentage of students who smoked normal cigarettes changed between 2011 and 2016.

Join the points with straight lines.

(6)



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(b) Describe the changes in the percentages of students smoking cigarettes and using e-cigarettes between 2011 and 2016.

(2)

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(c) The scientists interviewed 60 000 students each year during the period of the investigation.

Calculate the change in the number of students who were smoking normal cigarettes from 2011 to 2016.

(2)

number of students = ...

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(d) Some people are promoting e-cigarettes as a healthier alternative to smoking normal cigarettes.

(i) Suggest why using e-cigarettes may be thought to be less harmful than smoking normal cigarettes.

(4)

(ii) Suggest why many doctors are concerned about promoting the use of e-cigarettes to young people.

(2)

(Total for Question 8 = 16 marks)

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9 Cleft chin is a phenotype believed to be controlled by a single gene that has two alleles.

The dominant allele, N, codes for cleft chin and the recessive, n, allele codes for the absence of the cleft chin.

(a) With reference to the example of cleft chin, state what is meant by the following terms

(i) phenotype

(1)

.....

(ii) gene

(1)

.....

(iii) allele.

(1)

.....

(b) A woman with a cleft chin has a child with a man who also has a cleft chin.

The child does not have a cleft chin.

(i) Use a genetic diagram to show the genotypes of the parents, the gametes they can produce and all the possible genotypes and phenotypes of their children.

(4)

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(ii) The parents then have a second child. Calculate the probability that this child will be female and not have a cleft chin.

(2)

probability = ...

(iii) Sometimes a cleft chin does not develop even if the individual inherits the dominant allele.

Suggest what might cause this.

(1)

.....

.....

(c) Most inherited conditions are not controlled by a single gene, but by many genes.

Describe how a scientist could distinguish between a genetic condition in rats controlled by a single gene and one controlled by many genes.

(3)

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(Total for Question 9 = 13 marks)

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10 Farmers may add chemical fertilisers to their soil.

(a) Explain how chemical fertilisers can increase crop yield.

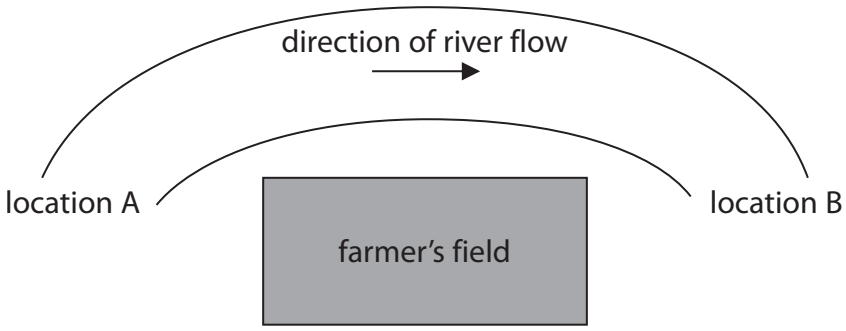
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(b) These fertilisers may leak into rivers.

A scientist measures the oxygen content of water in two different locations of the same river during the month of April.



In location A he finds that the mean dissolved oxygen was 6 mg per litre and at location B he finds that the mean dissolved oxygen was 3 mg per litre.

He concludes that the use of fertiliser in the field has affected the oxygen content of the river.

Discuss his conclusion.

(4)

(c) Some farmers use alternative substances to chemical fertilisers.

Suggest one alternative substance that a farmer may use.

(1)

(Total for Question 10 = 9 marks)

TOTAL FOR PAPER = 110 MARKS

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