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EDEXCEL COMBINED SCIENCE BIOLOGY: QUESTIONS BY TOPIC

Genetics (3)

Combined Science Biology (Foundation) Topic 3

4 questions · 40 marks · Mark schemes included

Pearson Edexcel Combined Science (9-1) Biology 1SC0, Foundation Tier, June 2018 - June 2025

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 info@guidemygrades.com

 Piccadilly Business Centre, Unit C, Aldow Enterprise Park
Blackett Street, Manchester, M12 6AE

HOW TO USE THIS BOOKLET

Questions run from the lowest mark tariff to the highest, so similar questions sit together.

Click any row below to jump straight to that question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme.

Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

QUESTION	SOURCE	MARKS	PAGE
1. Q2	Paper 1 November 2021	8	4
2. Q3 <i>also Topic 1</i>	Paper 1 November 2021	9	8
3. Q5	Paper 1 June 2023	11	12
4. Q4	Paper 1 June 2023	12	16



QUESTIONS

4 questions · 40 marks · lowest tariff first



8-MARK QUESTIONS

1 question in this booklet



2 (a) Sickle cell disease is a recessive genetic disorder in humans.

(i) Two parents are heterozygous for sickle cell disease.

Complete the Punnett square to show the possible genotypes of their children.

(1)

	D	d
D		
d		

(ii) State the percentage probability that their children could have sickle cell disease.

(1)

percentage probability = ... %

(iii) A father with the genotype dd and a mother with the genotype DD plan to have several children.

Explain why none of their children will have sickle cell disease.

(2)

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(b) Figure 2 shows some information about two types of cattle.

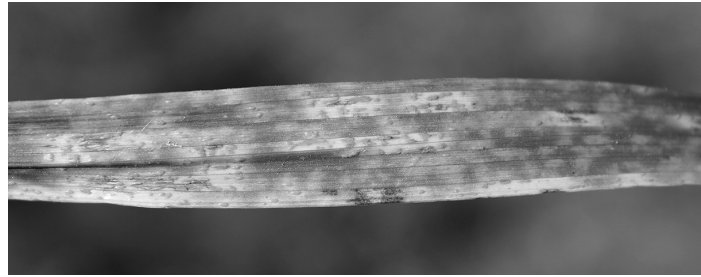
type of cattle	survival in high temperatures	meat quality
Brahman	good	poor
Shorthorn	poor	good

Figure 2

Describe how these types of cattle could be selectively bred to produce cattle that can survive high temperatures and have good meat quality.

(2)

(c) Figure 3 shows the leaf of a wheat plant with a fungal disease.



(Source: © Kazakov Maksim/Shutterstock)

Figure 3

Give **two** benefits of breeding wheat plants that are resistant to fungal disease.

(2)

1

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2

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(Total for Question 2 = 8 marks)

9-MARK QUESTIONS

1 question in this booklet



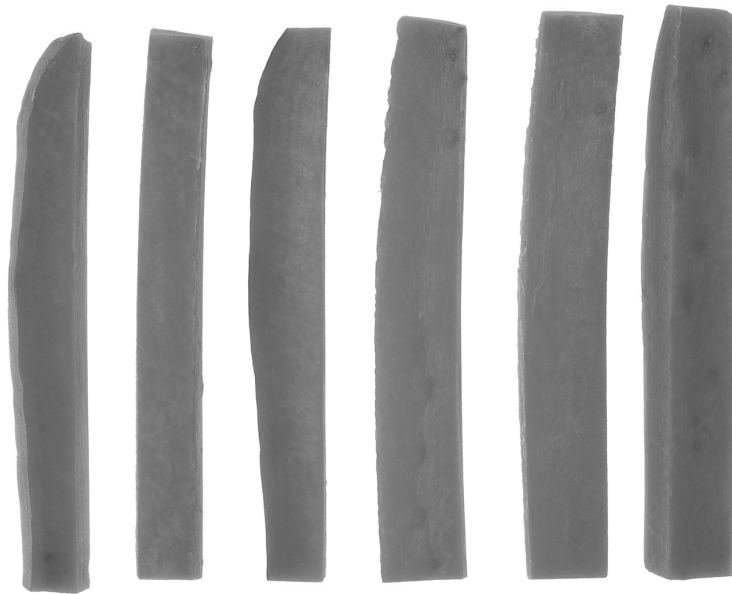
3 (a) Carrots have different physical characteristics such as colour.

Which genetic term describes the physical characteristics of a carrot?

(1)

- ☒ A genotype
- ☒ B monohybrid
- ☒ C phenotype
- ☒ D heterozygous

(b) Figure 4 shows some carrot sticks.



(Source: © rukxstockphoto/Shutterstock)

Figure 4

A student chose three carrot sticks and weighed each one.

The carrot sticks were placed in 50 cm³ of distilled water.

After two hours the student weighed each carrot stick again.

Figure 5 shows the results for these carrot sticks P, Q and R.

carrot stick	mass at the start in grams	mass after two hours in grams	change in mass in grams
P	4.0	4.9	0.9
Q	4.2	5.0	0.8
R	4.1	5.0	0.9

Figure 5

- (i) Give **one** reason why the student used three carrot sticks instead of just one carrot stick.

(1)

.....

.....

- (ii) Give **two** ways that this method could be improved.

(2)

1

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2

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- (iii) Calculate the percentage change in mass of carrot stick **Q**.

(3)

Use the equation

$$\text{percentage change} = \frac{\text{change in mass}}{\text{mass at the start}} \times 100$$

Give your answer to 2 significant figures.

percentage change = ... %



(iv) Explain the change in mass of the carrot sticks.

(2)

(Total for Question 3 = 9 marks)



11-MARK QUESTIONS

1 question in this booklet



5 (a) Apple trees show genetic variation.

(i) State **one** possible cause of genetic variation in apple trees.

(1)

(ii) The colour of an apple is an observable characteristic.

Which is the term for an observable characteristic?

(1)

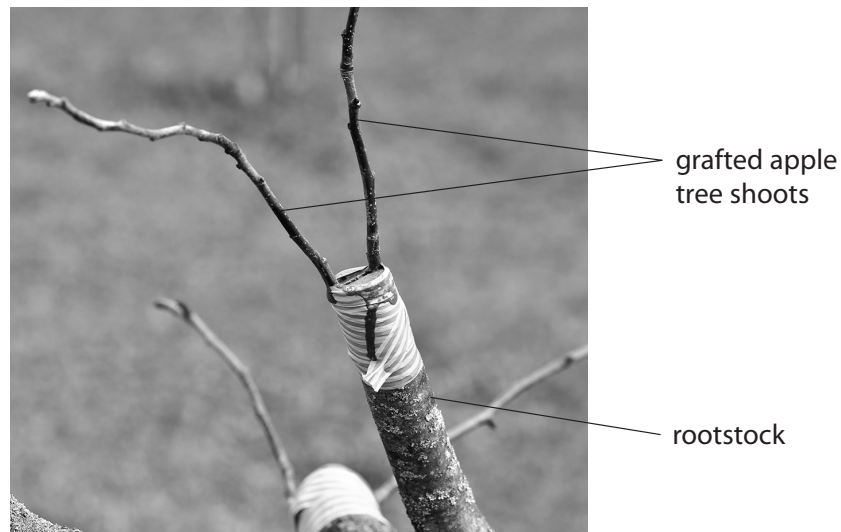
- ☐ A gene
- ☐ B genotype
- ☐ C heterozygous
- ☐ D phenotype

(b) Name the type of reproduction that produces genetically identical organisms.

(1)

(c) Grafting is a technique used to grow some varieties of apple tree.

Figure 9 shows apple tree shoots grafted on to a rootstock.



(Source: © ATTILA Barsan/Shutterstock)

Figure 9

Grafting can be used to produce apple trees that are genetically identical.

Give **one** advantage and **one** disadvantage of growing genetically identical apple trees.

(2)

advantage

disadvantage

(d) As apples ripen, enzymes convert starch into sugars.

Devise a method to find the optimum pH of an enzyme that breaks down starch.

You may use standard laboratory equipment and the solutions listed in the box.

starch solution enzyme solution iodine solution
a range of pH solutions

(4)

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(e) The optimum pH of an enzyme is pH 6.

Explain why this enzyme would not work at pH 10.

(2)

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(Total for Question 5 = 11 marks)



12-MARK QUESTIONS

1 question in this booklet



4 Figure 8 shows some characteristics of pea plants.

flower colour	seed shape
purple	round
white	wrinkled

Figure 8

The allele for purple flowers is dominant to the allele for white flowers.

(a) Which term describes the allele for white flowers?

(1)

- ☐ **A** heterozygous
- ☐ **B** homozygous
- ☐ **C** gamete
- ☐ **D** recessive

(b) A scientist crossed a pea plant that produced round seeds (Rr) with a pea plant that produced wrinkled seeds (rr).

(i) Complete the Punnett square.

(2)

		wrinkled seeds	
round seeds	R		
	r		

(ii) State the percentage of the offspring that will produce round seeds.

(1)

percentage = ...%



(c) The scientist crossed **two** purple flowering pea plants.

The offspring were:

- 133 plants with purple flowers
 - 46 plants with white flowers
- (i) Calculate the ratio of offspring with purple flowers to offspring with white flowers.

Give your answer to the nearest whole number.

(2)

ratio:1

- (ii) Explain why it was possible for this cross to produce some offspring with white flowers.

(2)

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(d) The cells in pea plants are diploid.

These cells have 14 chromosomes.

- (i) Explain why pea plant gametes have only seven chromosomes.

(2)

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.....



(ii) Describe what happens at fertilisation.

(2)

(Total for Question 4 = 12 marks)



MARK SCHEMES

official Pearson Edexcel mark schemes



Question Number	Answer	Mark									
2(a)(i)	<table border="1"> <tr> <td></td><td>D</td><td>d</td></tr> <tr> <td>D</td><td>DD</td><td>Dd</td></tr> <tr> <td>d</td><td>Dd</td><td>dd</td></tr> </table> Accept dD for Dd		D	d	D	DD	Dd	d	Dd	dd	(1) AO3 2a
	D	d									
D	DD	Dd									
d	Dd	dd									

Question Number	Answer	Mark
2(a)(ii)	25 (%)	(1) AO3 2b

Question Number	Answer	Additional guidance	Mark
2(a)(iii)	An explanation including: - all the children will have the genotype Dd / will be heterozygous (1) - but to have sickle cell disease the children must have {the genotype dd / two recessive alleles} (1)	accept children will always inherit a dominant allele / D from their mother accept a correctly completed Punnett square for this marking point	(2) AO2 1

Question Number	Answer	Mark
3(a)	C phenotype The only correct answer is C <i>A is not correct because genotype does not describe the physical characteristics</i> <i>B is not correct because monohybrid does not describe the physical characteristics</i> <i>D is not correct because heterozygous does not describe the physical characteristics</i>	(1) AO1 1

Question Number	Answer	Additional guidance	Mark
3(b)(i)	Any one from: - a single result could be anomalous (1) - to calculate a mean (1)	accept to see if the results are the same / similar ignore references to increasing accuracy	(1) AO1 2

Question Number	Answer	Additional guidance	Mark
3(b)(ii)	Any two from: • measure the length / width of the carrot sticks (1) • cut sticks from the same carrot / same part of carrot (1) • use the same variety of carrot (1) • (surface) dry the carrot sticks before weighing (1)	accept other valid ways of improving this method, e.g. using more than three carrot sticks (1)	(2) A03 3b

Question Number	Answer	Additional guidance	Mark
3(b)(iii)	substitution $(0.8 \div 4.2) \times 100$ (1) evaluation 19.048 (1) 2 significant figures 19 (%)	full marks for correct answer without any working accept 19.0476 / 19.05 (2) award one mark for rounding an incorrectly calculated answer to 2 significant figures	(3) A02 1

Question Number	Answer	Mark
3(b)(iv)	An explanation linking any two from: • the carrot sticks gained mass (1) • because water moved into the carrot (cells) (1) • by osmosis / description of osmosis (1)	(2) AO3 2a 2b

(Total for question 3 = 9 marks)



Question number	Answer	Additional guidance	Mark
5(a)(i)	mutation / sexual reproduction / different combinations of alleles can occur	accept genetic modification	(1) AO2 1

Question number	Answer	Mark
5(a)(ii)	D phenotype The only correct answer is D <i>A is not correct because gene is not the correct term for an observable characteristic</i> <i>B is not correct because genotype is not the correct term for an observable characteristic</i> <i>C is not correct because heterozygous is not the correct term for an observable characteristic</i>	(1) AO1 1

Question number	Answer	Additional guidance	Mark
5(b)	asexual (reproduction)	ignore mitosis reject meiosis accept cloning / binary fission	(1) AO1 1

Question number	Answer	Additional guidance	Mark
5(c)	One from advantages: • (fruit) will have desired qualities (1) • can be produced faster (1) AND One from disadvantages: • susceptible to a disease (1) • can't survive an environmental change (1) • reduced gene pool (1)	ignore genetically identical / no variation for advantages and disadvantages accept examples of characteristics e.g. all tasty / same taste ignore higher yield accept inherited/genetic diseases accept can't survive a selection pressure	(2) AO2 1

Question number	Answer	Additional guidance	Mark
5(d)	A method including four from: • mix starch, enzyme and pH (solution) (1) • use iodine (to test for starch) (1) • (with iodine solution) blue-black means starch is present / {orange / brown} means no starch present (1) • control of one variable e.g. concentration, volume, temperature (1) • repeat using different pH solutions (1)	all three solutions are required accept add iodine to a spotting tile ignore blue ignore amount unless a measurement is given	(4) A03 3a

Question Number	Answer	Additional guidance	Mark
5(e)	An explanation linking two from: • enzyme denatures (1) • which changes the shape of the active site (1) • so {the enzyme cannot bind to its substrate / active site no longer complementary / no enzyme-substrate complexes form} (1)	accept enzyme changes shape accept substrate {no longer fits /is no longer complementary} accept starch for substrate	(2) A02 1

(Total for question 5 = 11 marks)



Question Number	Answer	Mark
4(a)	D recessive The only correct answer is D <i>A is not correct because the term that describes the allele for white flowers is not heterozygous</i> <i>B is not correct because the term that describes the allele for white flowers is not homozygous</i> <i>C is not correct because the term that describes the allele for white flowers is not gamete</i>	(1) AO1 1

Question Number	Answer	Mark									
4(b)(i)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td><td>r</td><td>r</td></tr> <tr> <td>R</td><td>Rr</td><td>Rr</td></tr> <tr> <td>r</td><td>rr</td><td>rr</td></tr> </table> • gametes (r r) (1) • genotypes of offspring (1)		r	r	R	Rr	Rr	r	rr	rr	(2) AO2 2ab
	r	r									
R	Rr	Rr									
r	rr	rr									

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	50 (%)	ecf from Punnett square	(1) A03 2a

Question Number	Answer	Additional guidance	Mark
4(c)(i)	$(133 \div 46) = 2.89 / 2.9$ (1) Rounded to the whole number 3 (:1)	award full marks for correct answer without working	(2) A03 2a

Question Number	Answer	Mark
4(c)(ii)	An explanation linking - both parents are heterozygous / Pp / each parent has an allele for white flowers (1) (so) some offspring have {two recessive alleles / pp} / are homozygous recessive (1)	(2) A02 2

Question Number	Answer	Additional guidance	Mark
4(d)(i)	An answer including two from - gametes are produced by meiosis (1) (meiosis) {halves the number of chromosomes / produces haploid gametes} / gametes have one of each pair of chromosomes (1)	accept when gametes fuse diploid cells / cells with 14 chromosomes are produced (1)	(2) AO1 1

Question Number	Answer	Mark
4(d)(ii)	Any two from: (male and female) gametes fuse (1) (forming a) zygote (1) (forming a) diploid cell (1)	(2) AO1 1

(Total for question 4 = 12 marks)

