

8: Inheritance and evolution – Topic questions

Paper 4

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
3	2016	March	42
3	2016	June	41
3	2016	June	43

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at www.cambridgeinternational.org/support

- 3 Yeast is used in bread-making. It respire anaerobically, producing carbon dioxide.
- (a) Write the balanced chemical equation for anaerobic respiration of yeast in bread-making.

.....[2]

A baker wants to increase the rate of carbon dioxide production in the bread-making process. The baker trialled different concentrations of glucose solution in the bread dough. Fig. 3.1 shows the results.

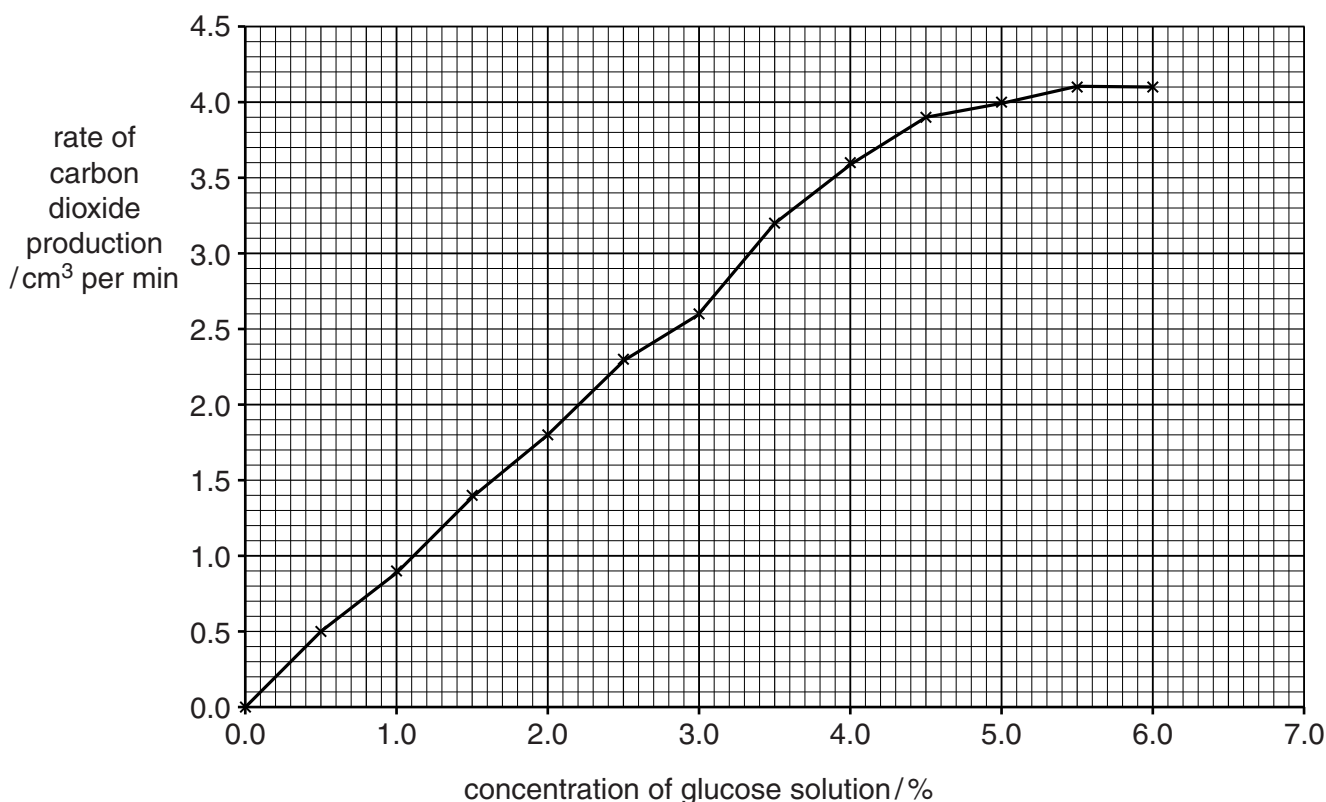


Fig. 3.1

- (b) (i) Predict the rate of carbon dioxide production if the concentration of the glucose solution was 7.0%.

..... cm³ per min [1]

- (ii) The baker carried out the trials at 30 °C. The trials were repeated at 20 °C. Draw a line on Fig. 3.1 to show the rate of carbon dioxide production at 20 °C. [2]

- (iii) The baker carried out another trial at 80 °C. No carbon dioxide was released.

State why no carbon dioxide was produced.

.....[1]

- (c) Name **one** other industrial process that uses yeast.

.....[1]

- (d) During the production of penicillin, large fermenters are used. Fig. 3.2 shows a fermenter.

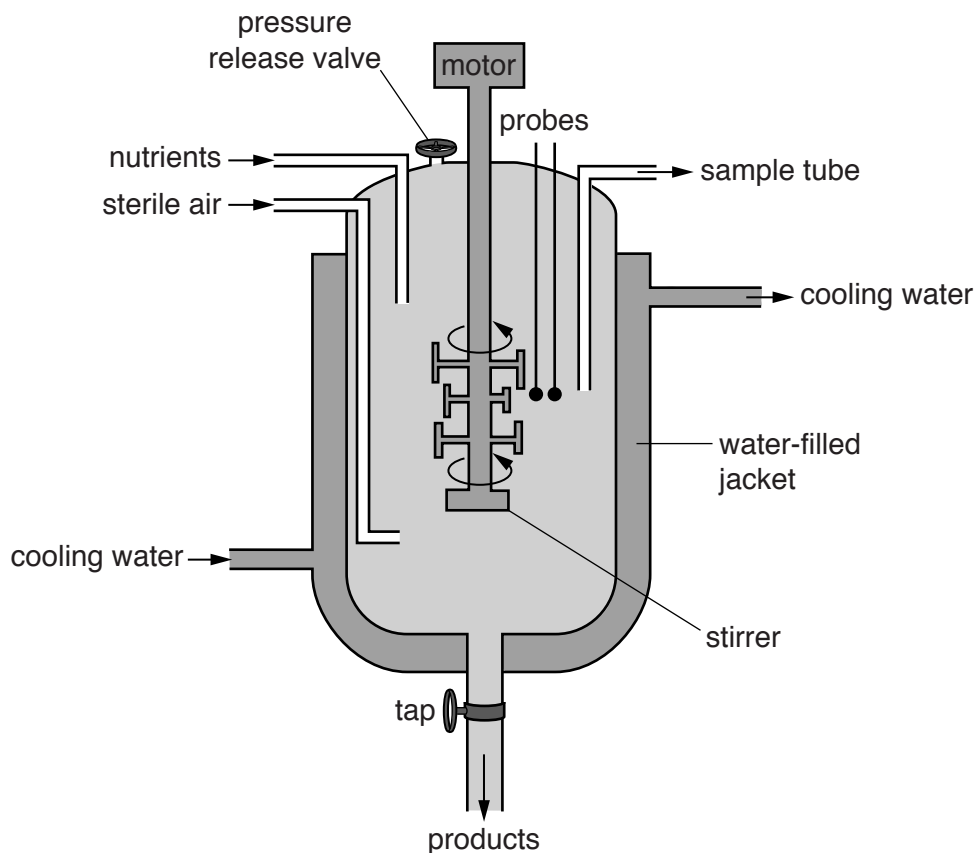


Fig. 3.2

- (i) Explain the functions of the following parts of the fermenter:

stirrer

.....

water-filled jacket

.....

probes

.....

[3]

- (ii) The air and nutrients that are added to the fermenter are sterile.

State why they must be sterile.

.....

.....

.....

[1]

[Total: 11]

- 3 Catalase is an enzyme that breaks down hydrogen peroxide inside cells. Red blood cells contain catalase.

Some dogs have an inherited condition in which catalase is not produced. This condition is known as acatalasia and it is caused by a mutation in the gene for catalase.

- (a) Define the terms *gene* and *gene mutation*.

gene.....

.....

gene mutation.....

.....

[2]

- (b) A geneticist was asked to investigate the inheritance of acatalasia in dogs.

The normal allele is represented by **B** and the mutant allele is represented by **b**.

The geneticist made the diagram in Fig. 3.1 to show the inheritance of acatalasia in a family of dogs. The shaded symbols indicate the dogs with acatalasia.

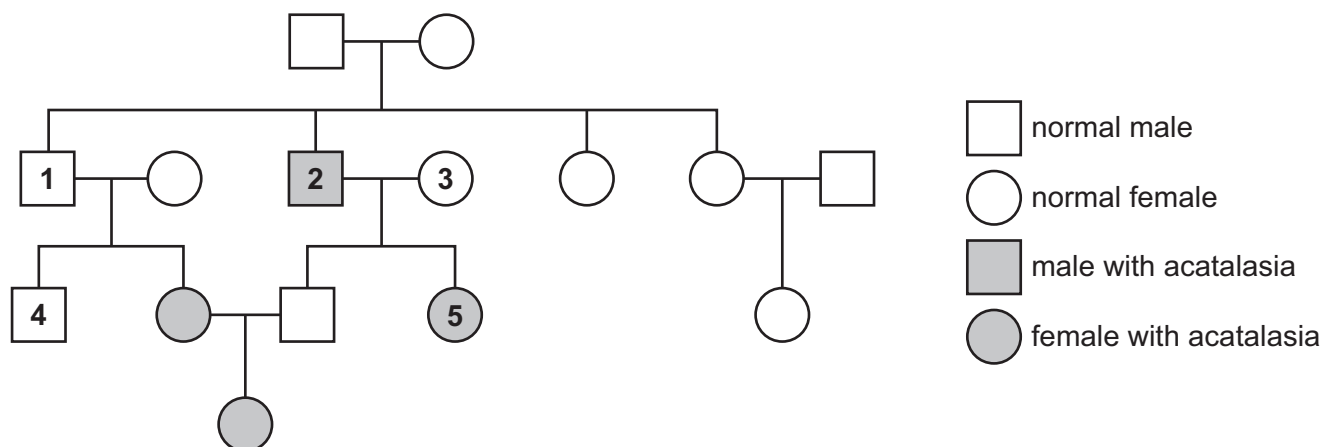


Fig. 3.1

- (i) State the genotypes of the dogs identified as **1**, **2** and **3** in Fig. 3.1.

1

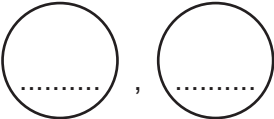
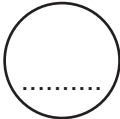
2

3

[3]

- (ii) The geneticist crossed dog 4 with dog 5. Approximately half of the offspring had acatalasia and half the offspring did not have acatalasia.

Complete the genetic diagram to show how this is possible.

	dog 4	dog 5
<i>parental phenotypes</i>	normal	has acatalasia
<i>parental genotypes</i>
<i>gametes</i>		
<i>Punnett square</i>		

offspring genotypes.....

offspring phenotypes..... [3]

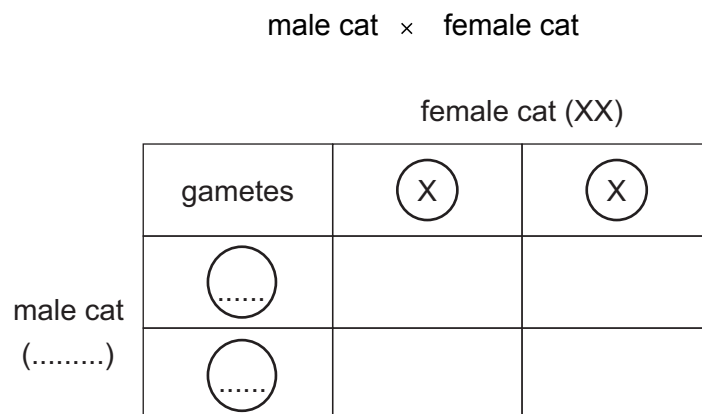
- (iii) State the name given to the type of cross that you have completed in (b)(ii).

..... [1]

[Total: 9]

- 3 (a) Sex in cats is determined in the same way as in humans.

Complete the diagram below to show how sex is determined in cats.



offspring ratio..... [3]

- (b) A scientist investigated the inheritance of fur colour in cats.

The gene for coat colour is located on the X chromosome. The gene has two alleles:

- **B** black
- **b** orange.

The X chromosome with the allele for black is represented by X^B .

The X chromosome with the allele for orange is X^b .

A female cat can be a mixture of these colours, described as calico.

Fig. 3.1 shows the inheritance of this condition in a family of cats.

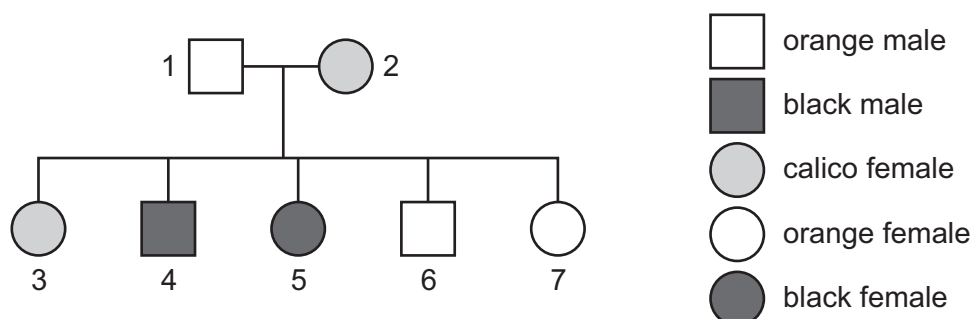


Fig. 3.1

(i) State the genotypes of cats 1, 4, and 5 in Fig. 3.1.

cat 1

cat 4

cat 5 [3]

(ii) Coat colour in cats is an example of discontinuous variation.

Explain why coat colour is an example of discontinuous variation.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 9]

Abbreviations used in the Mark Scheme:

;	separates marking points
/	alternatives
I	ignore
R	reject
A	accept (for answers correctly cued by the question, or guidance for examiners)
AW	alternative wording (where responses vary more than usual)
AVP	any valid point
ecf	credit a correct statement / calculation that follows a previous wrong response
ora	or reverse argument
()	the word / phrase in brackets is not required, but sets the context
<u>underline</u>	actual word given must be used by candidate (grammatical variants excepted)
max	indicates the maximum number of marks that can be given

Question	Answer	Marks
3 (a)	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$;	[2]
3 (b) (i)	4.1 (cm ³ per min) ;	[1]
3 (b) (ii)	a single line below the original curve on the graph and following the same shape ; line starts at origin ;	[2]
3 (b) (iii)	enzymes denatured / yeast died ;	[max 1]
3 (c)	(named) alcohol production ; producing biofuels / ethanol ; production of yeast extract ; GM yeast ;	[max 1]
3 (d) (i)	stirrer keeps microorganism suspended / prevent it from sinking ; enables microorganisms to always have access to nutrients ; maintain even temperature ; to create uniform / even / homogenous mixture ; to form pellets of fungus / avoid mat formation ; water-filled jacket reduces heat energy / temperature ; maintains, a constant / suitable / optimum, temperature ; probes monitor / detect / measure, temperature / pH / gas concentration / pressure / nutrients ;	[4]

Question	Answer	Marks													
3 (d) (ii)	prevent contamination ;	[1]													
[Total: 11]															
3 (a)	gene a length of DNA that codes for a protein ; gene mutation a change in base sequence of DNA ;	[2]													
3 (b) (i)	1 Bb ; 2 bb ; 3 Bb ;	[3]													
3 (b) (ii)	<table><tr><td colspan="2" rowspan="2"></td><th colspan="2">male gametes</th></tr><tr><th>B</th><th>b</th></tr><tr><th rowspan="2">female gametes</th><th>b</th><td>Bb</td><td>bb</td></tr><tr><th>(b)</th><td>(Bb)</td><td>(bb)</td></tr></table> offspring genotypes Bb and bb ; A heterozygous and homozygous recessive offspring phenotypes normal / carrier and acatalasia ;			male gametes		B	b	female gametes	b	Bb	bb	(b)	(Bb)	(bb)	[3]
				male gametes											
		B	b												
female gametes	b	Bb	bb												
	(b)	(Bb)	(bb)												
5 (b) (iii)	test (cross)	[1]													
[Total: 9]															
3 (a)	<table><tr><th>gametes</th><th>X</th><th>X</th></tr><tr><th>X</th><td>XX</td><td>XX</td></tr><tr><th>$\text{Y} ;$</th><td>XY</td><td>XY ;</td></tr></table> offspring ratio = 1:1 / 50:50 / 50% male, 50% female / 2:2 ;	gametes	X	X	X	XX	XX	$\text{Y} ;$	XY	XY ;	[3]				
gametes	X	X													
X	XX	XX													
$\text{Y} ;$	XY	XY ;													
3 (b) (i)	cat 1 $\text{X}^{\text{b}}\text{Y}$; cat 4 $\text{X}^{\text{B}}\text{Y}$; cat 5 $\text{X}^{\text{B}}\text{X}^{\text{B}}$;	[3]													
3 (b) (ii)	distinct, phenotypes / coat colours / categories ; no (continuous) range of colour / AW ; controlled by genes ; not affected by the, environment / AW / named example ;	[3]													
[Total: 9]															