National
Qualifications
2017

X707/76/02

Biology
Section 1 — Questions

TUESDAY, 23 MAY
9:00 AM – 11:30 AM

Instructions for the completion of Section 1 are given on *Page 02* of your question and answer booklet X707/76/01.

Record your answers on the answer grid on *Page 03* of your question and answer booklet.

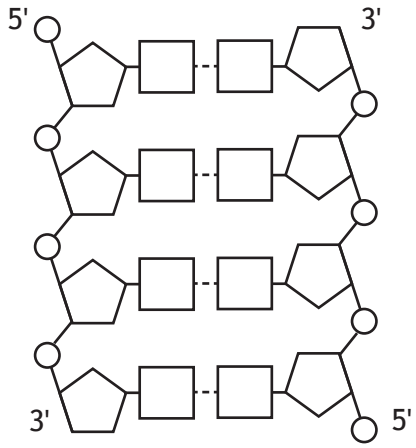
Before leaving the examination room you must give your question and answer booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

SECTION 1 — 20 marks

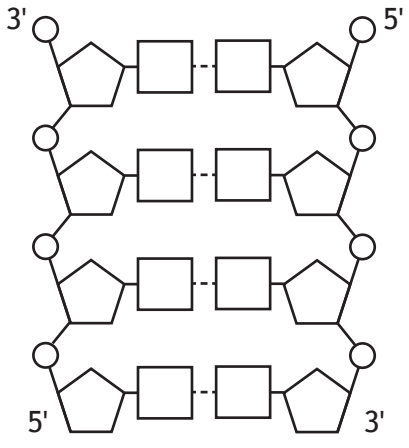
Attempt ALL questions

1. Which of the following diagrams shows the correct structure of DNA?

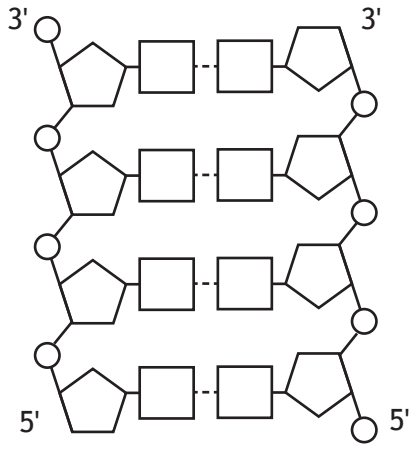
A



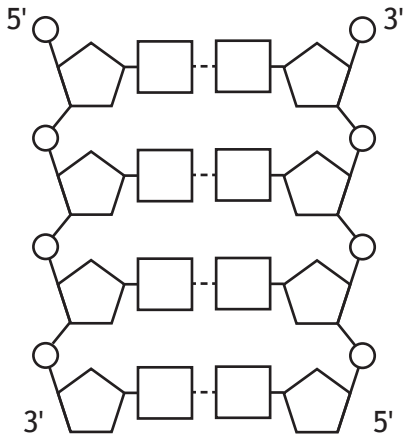
B



C



D



2. A section of double stranded DNA was found to have 60 guanine bases and 30 adenine bases.

What is the total number of deoxyribose sugars in this section?

A 30

B 90

C 180

D 270

3. The following terms describe different structures into which DNA can be organised within cells.

1 Linear chromosome

2 Circular chromosome

3 Circular plasmid

Which of these terms describe how DNA is organised within photosynthetic plant cells?

A 1 only

B 2 only

C 1 and 2 only

D 2 and 3 only

4. Which of the following molecules are required in the replication of the lagging strand of a DNA molecule?

A DNA polymerase and ligase only

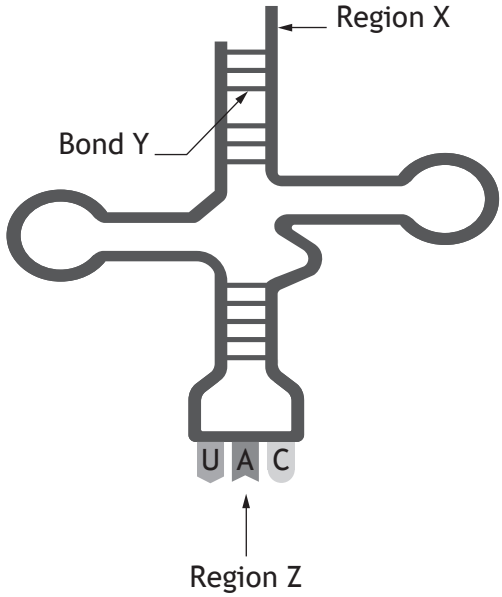
B DNA polymerase and primers only

C Ligase and primers only

D DNA polymerase, ligase and primers

[Turn over

5. The diagram shows a molecule of tRNA.



Which row in the table identifies Region X, Bond Y and Region Z?

	Region X	*Bond Y*	*Region Z*
A	amino acid attachment site	hydrogen	anticodon
B	anticodon	hydrogen	amino acid attachment site
C	amino acid attachment site	peptide	anticodon
D	anticodon	peptide	amino acid attachment site

6. New species have evolved when two populations have become

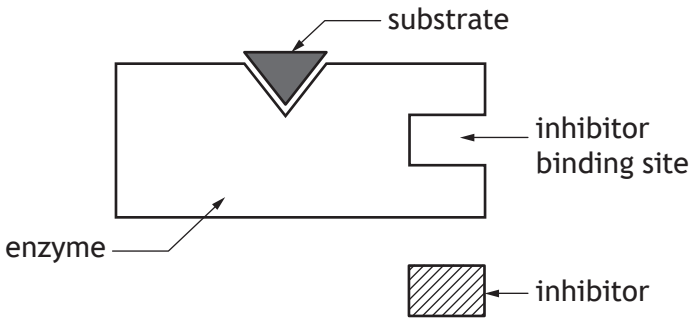
A isolated by a behavioural barrier

B unable to interbreed to produce fertile offspring

C very different due to directional selection

D very different due to disruptive selection.

7. The diagram shows an enzyme, its substrate and a substance which inhibits it.



The following statements describe some features of enzyme inhibition.

1 The inhibitor binds to the active site.

2 The effect of the inhibitor is reduced by increasing the substrate concentration.

3 The inhibitor is non-competitive.

Which of these statements apply to the inhibitor shown in the diagram?

A 1 only

B 3 only

C 1 and 2 only

D 2 and 3 only

[Turn over

8. An investigation was carried out to determine the effect of lead ion concentration on the activity of the enzyme amylase.

The results are shown in the table.

Lead ion concentration (mol l^{-1})	*Amylase activity* (% of control)
0·0 (control)	100
0·1	84
0·2	23
0·3	11
0·4	2
0·5	0

A conclusion that can be drawn from these results is that inhibition was

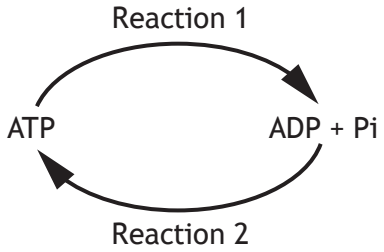
A highest at high lead ion concentrations

B highest at low lead ion concentrations

C lowest at lead ion concentration 0·5 mol l^{-1}

D highest at lead ion concentration 0·1 mol l^{-1}.

9. ATP is recycled to transfer energy within cells. The diagram shows two reactions involving ATP.

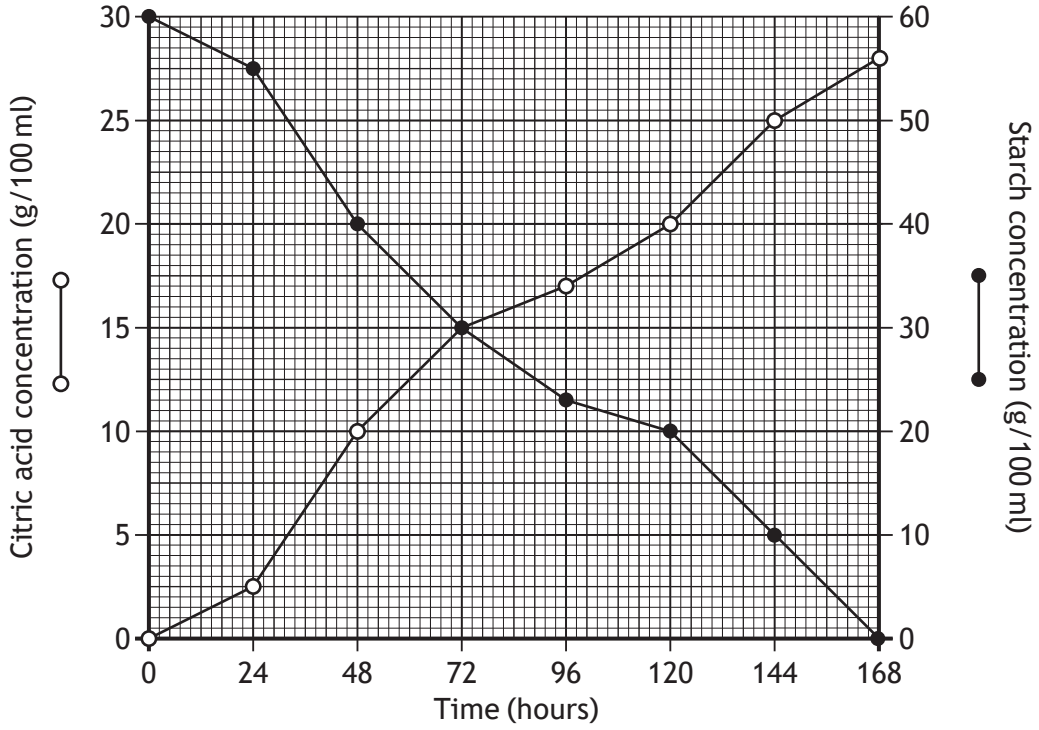


Which row in the table describes Reaction 1 and Reaction 2?

	Reaction 1	*Reaction 2*
A	catabolic and energy released	anabolic and energy required
B	anabolic and energy released	catabolic and energy required
C	catabolic and energy required	anabolic and energy released
D	anabolic and energy required	catabolic and energy released

10. The fungus *Aspergillus niger* is grown in large fermenters to produce citric acid using starch as a substrate.

The graph shows the changes in the citric acid and starch concentrations in a fermenter over 168 hours.



The citric acid concentration equals the starch concentration at

A 0 hours

B 48 hours

C 72 hours

D 120 hours.

[Turn over

11. The following list describes changes which take place during temperature regulation in mammals.

1 Vasodilation

2 Vasoconstriction

3 Contraction of hair erector muscles

4 Relaxation of hair erector muscles

Which of these changes takes place in response to a decrease in body temperature?

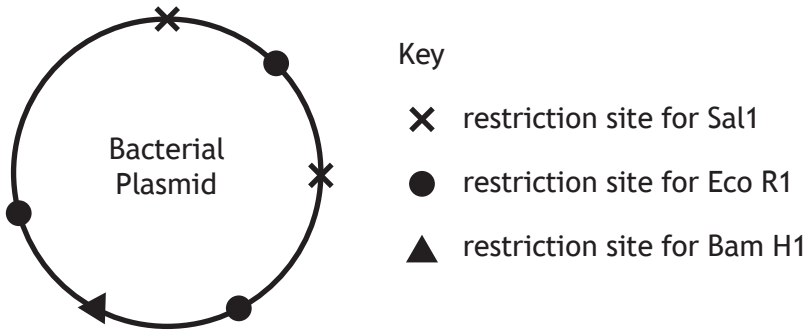
A 1 and 3 only

B 1 and 4 only

C 2 and 3 only

D 2 and 4 only

12. The diagram shows a bacterial plasmid with restriction sites for three different restriction endonucleases, Sal1, Eco R1 and Bam H1.



Which row in the table identifies the number of fragments produced if the plasmid was cut with the combinations of restriction endonucleases shown?

	Combination	
	Sal1 and Bam H1	*Sal1 and Eco R1*
A	3	4
B	3	5
C	4	4
D	4	5

13. Inbreeding depression is a result of

A an increase in heterozygotes
B a genetically variable population
C crossbreeding for improved characteristics
D an accumulation of recessive deleterious alleles.

14. Livestock production generates less food per unit area of land than crop production because

A energy is gained between trophic levels of the food chain
B livestock production degrades natural resources
C energy is lost between trophic levels of the food chain
D it is easier to grow crops than raise livestock in difficult habitats.

15. The table shows optimum, maximum and minimum temperatures for the growth of some crop plants.

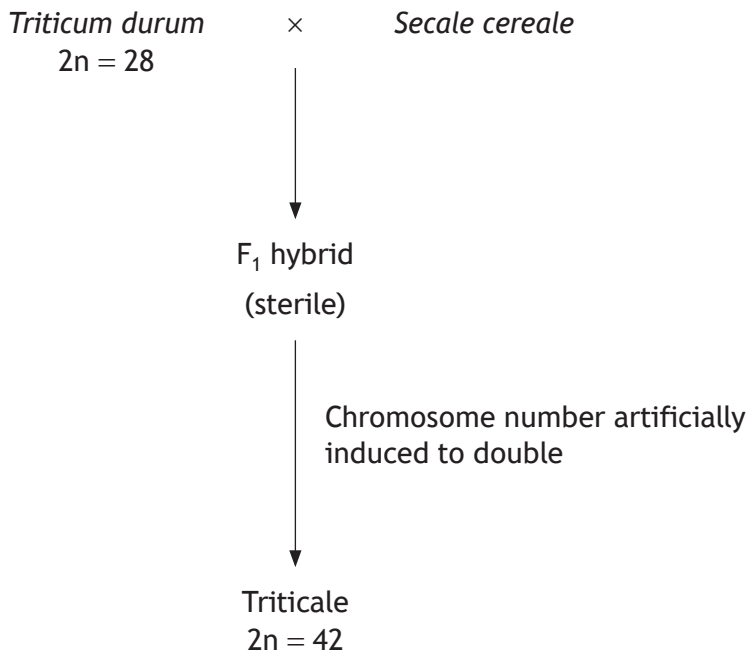
	Temperature (°C)		
Crop	*Optimum*	*Maximum*	*Minimum*
Maize	22–26	32–34	20–22
Wheat	20–25	36–38	5–7
Rice	30–33	37–40	18–22
Potato	15–20	28–34	12–14
Soyabean	25–28	37–40	10–14

Which of the following predictions is supported by the evidence in the table?

A Maize will grow at lower temperatures than soyabean.
B Rice will grow at higher temperatures than soyabean.
C Rice will grow in a narrower range of temperatures than maize.
D Wheat will grow in a wider range of temperatures than potato.

[Turn over

16. Triticale is a hybrid cereal species which was produced by crossing *Triticum durum* (a species of wheat) with *Secale cereale* (a species of rye) as shown in the diagram.



What was the diploid (2n) number of chromosomes in *Secale cereale*?

A 7

B 14

C 21

D 28

17. The following statements describe symbiotic relationships between organisms.

1 Mistletoe plants absorb nutrients from apple trees on which they grow.

2 Egyptian Plover birds clean the teeth of Nile crocodiles and feed on the debris they remove.

3 Tapeworms live in the small intestine of pigs and absorb some of their nutrients.

Which of these relationships can be described as parasitic?

A 2 only

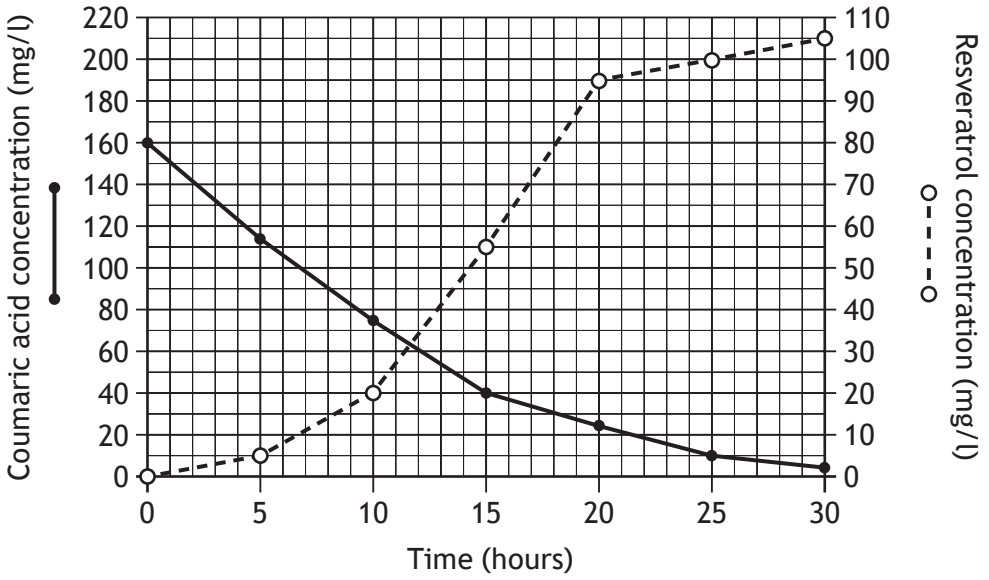
B 3 only

C 1 and 2 only

D 1 and 3 only

18. Resveratrol is a substance which may reduce the risk of heart disease. Using recombinant DNA technology, *E. coli* bacteria have been modified so that they now produce resveratrol when grown in a medium containing coumaric acid.

The graph shows concentrations of resveratrol and coumaric acid in the medium over a 30 hour period.



The simplest whole number ratio of the concentration of resveratrol to coumaric acid after 25 hours is

A 1 : 2

B 1 : 40

C 10 : 1

D 20 : 1.

19. Which row in the table identifies how the bottleneck effect and habitat corridors may change genetic diversity of a population?

	Change in genetic diversity	
	Bottleneck effect	*Habitat corridors*
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

[Turn over

20. Some species of social insect are of economic importance to humans by providing ecosystem services.

Which of the following are examples of ecosystem services?

1 Braconid wasps parasitising hornworms which are a pest of tomatoes.

2 Bumblebees pollinating an orchard of apple trees.

3 Worker termites caring for the queen and her offspring.

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

[END OF SECTION 1. NOW ATTEMPT THE QUESTIONS IN SECTION 2 OF YOUR QUESTION AND ANSWER BOOKLET.]