



National  
Qualifications  
2015

**X707/76/02**

**Biology  
Section 1—Questions**

WEDNESDAY, 13 MAY

1:00 PM – 3:30 PM

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

Record your answers on the answer grid on *Page three* 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.



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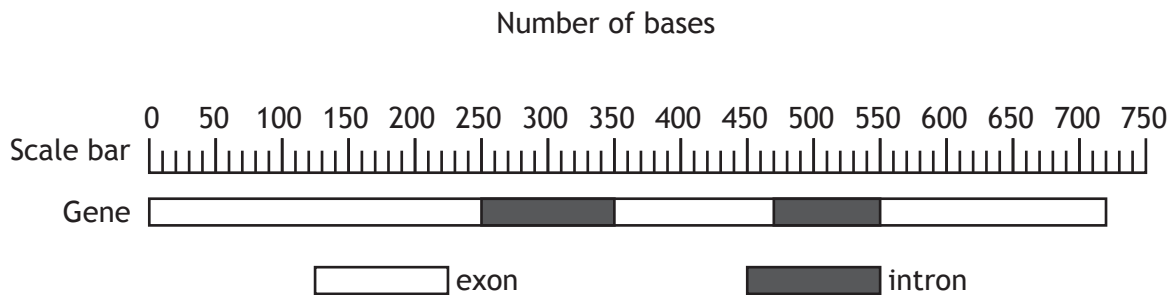
SECTION 1 — 20 marks

Attempt ALL questions

1. Which line in the table below shows features of the human genome?

	<i>Contains base sequences that regulate transcription</i>	<i>Contains base sequences transcribed to RNA but never translated</i>	<i>Contains base sequences from which primary transcripts are produced</i>
A	✗	✓	✗
B	✗	✗	✓
C	✓	✓	✗
D	✓	✓	✓

2. The diagram below shows a eukaryotic gene containing introns and exons and a scale bar representing the number of bases in the gene.



How many bases will there be in the mature mRNA formed from the primary transcript of this gene?

- A 180  
 B 540  
 C 560  
 D 720
3. Which of the following would **not** explain loss of genetic diversity in a population?
- A Inbreeding  
 B The founder effect  
 C The bottleneck effect  
 D No barriers to gene flow

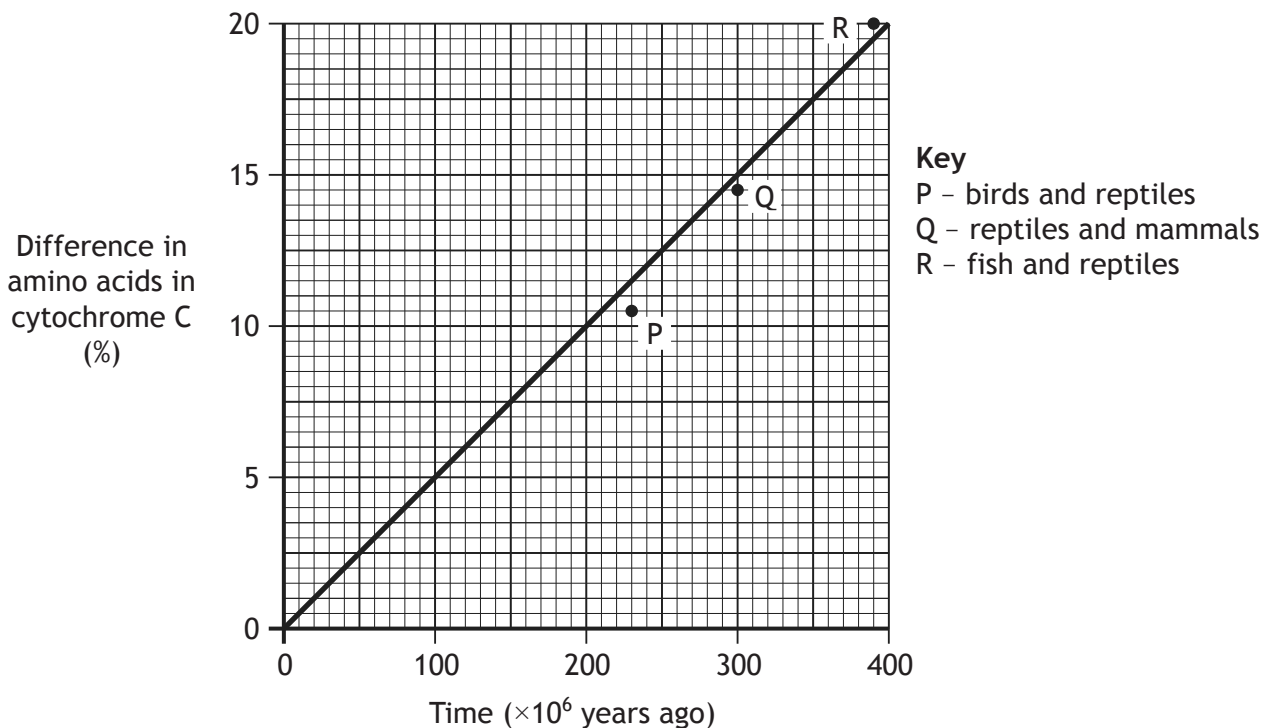
4. The following are events in the evolution of life on Earth.

- 1 Animals appear
- 2 Vertebrates appear
- 3 Land plants appear

In which order are these events thought to have occurred?

- A 1 2 3
- B 1 3 2
- C 3 1 2
- D 3 2 1

5. The graph below shows a molecular clock which compares the amino acid sequences in the protein cytochrome C in various vertebrate groups.

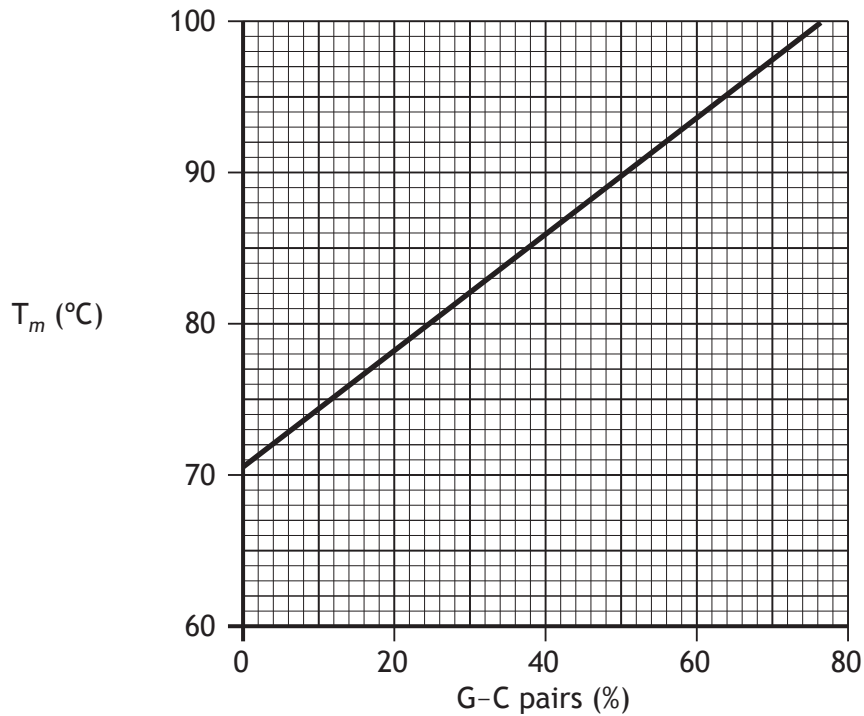


From the information in the graph, which vertebrate groups shared a common ancestor most recently?

- A Fish and reptiles
- B Birds and mammals
- C Reptiles and mammals
- D Birds and reptiles

[Turn over

6. The melting temperature of a molecule of DNA ( $T_m$ ) is the temperature at which half of its base pairs separate.  $T_m$  is proportional to the percentage of the guanine to cytosine (G-C) base pairs in the molecule as shown on the graph below.



The numbers of base pairs present in a DNA molecule are shown in the table below.

<i>Number of base pairs present</i>	
<b>A-T</b>	<b>G-C</b>
<b>1200</b>	<b>800</b>

What is  $T_m$  for this molecule?

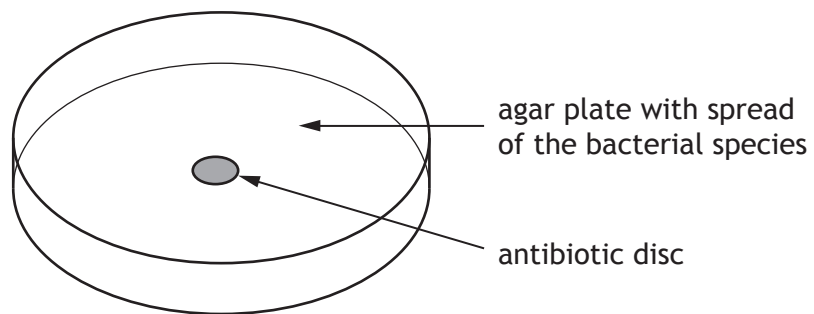
- A 78 °C
- B 86 °C
- C 94 °C
- D 96 °C

7. The following are molecules that can be broken down into substrates for respiration.

- 1 starch
- 2 protein
- 3 fat

Which molecules can be broken down into products which can be converted directly into intermediates of the citric acid cycle?

- A 1 only
  - B 1 and 3 only
  - C 2 and 3 only
  - D 1, 2 and 3
8. The effect of an antibiotic on a bacterial species was tested by spreading a culture of each of the bacterial species on agar plates and adding a disc of absorbent paper soaked in the antibiotic, as shown in the diagram below.



The plate was incubated for 24 hours at 30 °C and the growth examined.

Which of the following would be a suitable control for this experiment?

Repeat the experiment exactly but

- A with no bacteria
  - B incubate at human body temperature
  - C use a disc with no antibiotic
  - D use a disc with a different antibiotic.
9. Mitochondria are small membrane-bound compartments present in eukaryotic cells.
- One advantage to a mammalian muscle cell of having many small mitochondria is that they provide a
- A small surface area to volume ratio to increase the uptake of oxygen
  - B large surface area to volume ratio to increase the uptake of oxygen
  - C large surface area to volume ratio to decrease the uptake of carbon dioxide
  - D small surface area to volume ratio to decrease the uptake of carbon dioxide.

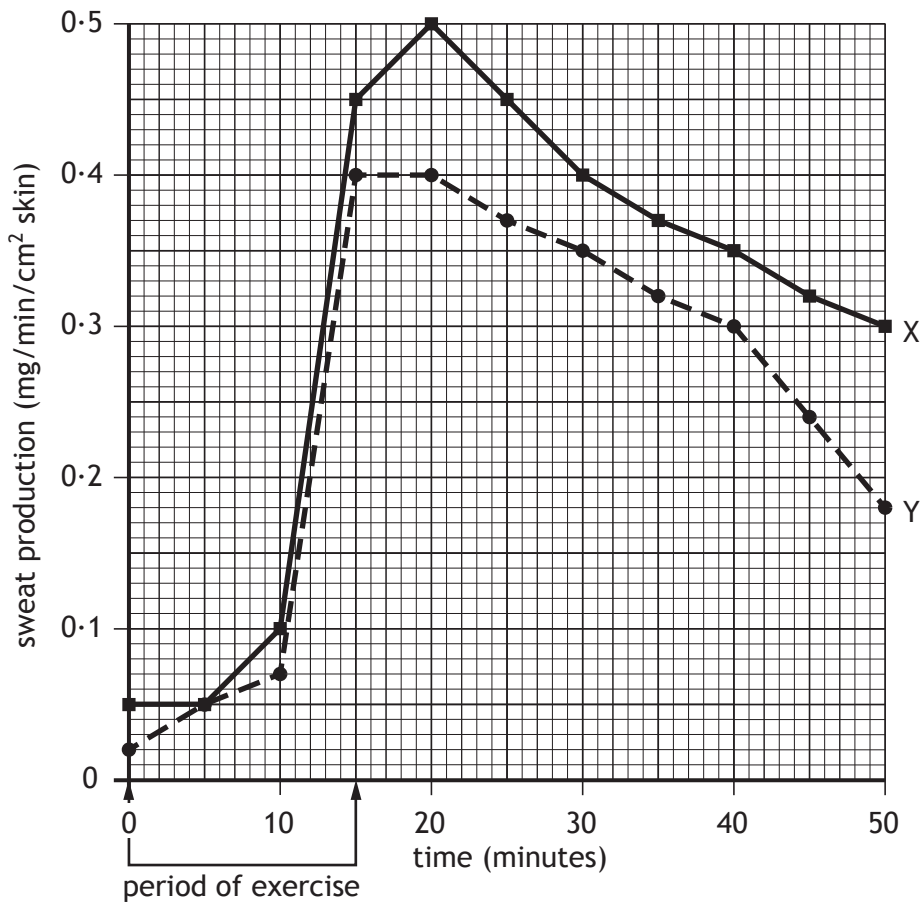
10. When salmon migrate from freshwater into seawater, changes in concentration of their surroundings are detected and the activity of the ion pumps in the salmon gills increases. The activity of the ion pumps decrease when the salmon migrate back to freshwater.

Which line in the table below shows the description of the salmon and the control of its ion pumps?

	<i>Description of salmon</i>	<i>Control of ion pumps</i>
A	conformer	by negative feedback
B	conformer	behavioural
C	regulator	by negative feedback
D	regulator	behavioural

11. The rate of sweat production of two individuals, X and Y, was measured during and after a period of exercise.

The results are shown in the graph below.



Which of the following conclusions can be drawn from the graph?

- A The rate of sweat production of individual X is always greater than individual Y.
- B Individuals X and Y both reach their maximum sweat production at 20 minutes.
- C Individual X starts increasing sweat production sooner than individual Y.
- D The greatest difference in sweat production by individuals X and Y is at 50 minutes.

[Turn over

12. The table below shows the results of pharmacogenetic tests on a drug designed to treat a liver infection in a group of patients.

		<i>Number of patients</i>	
		beneficial effect on patient	no beneficial effect on patient
<i>Number of patients</i>	toxic side-effects	30	15
	no side-effects	60	45

What percentage of the patients gained benefit from the drug but showed toxic side-effects?

- A 20
  - B 25
  - C 30
  - D 90
13. The statements below give information on three different bacterial species.
- 1 *Psychrobacter adeliensis* is found in Antarctica. It has been isolated from coastal ice and grows well at low temperatures.
  - 2 *Thermophilus aquaticus* lives in hot springs and generates ATP by removal of high energy electrons from inorganic molecules.
  - 3 *Escherichia coli* has enzymes with an optimal temperature of 37°C. Most strains of this species are harmless and live in animal intestines although some strains can be harmful to the host animal.

From this information, which of these bacterial species can be classified as extremophile?

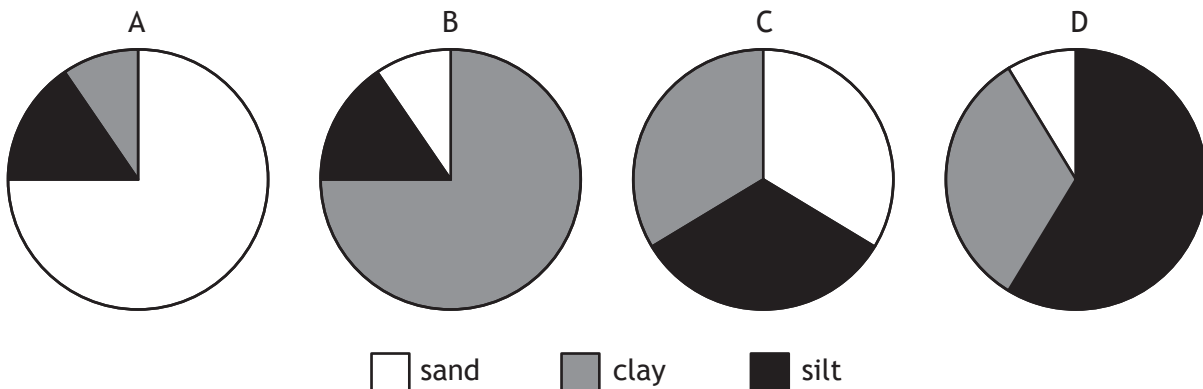
- A 1 and 2 only
- B 1 and 3 only
- C 2 only
- D 3 only

14. Which of the following results in a transfer of electrons down the electron transport chains during the light dependent reactions of photosynthesis?
- A NADP is converted to NADPH
  - B Water is split by photolysis
  - C ATP is synthesised
  - D Pigment molecules absorb energy
15. When quantifying plant productivity, the economic yield is the
- A total biomass produced
  - B biomass of desired product
  - C increase in biomass due to photosynthesis
  - D rate of biomass production per hectare.
16. Soil type is dependent on the composition of its components which in turn affects the productivity of plants growing in it.

The table below shows the percentage of each component present in four different soils.

<i>Soil type</i>	<i>Component (%)</i>		
	clay	silt	sand
sandy clay loam	20–30	0–30	50–80
clay loam	20–35	20–60	20–50
sandy silt loam	0–20	40–80	20–50
silty clay loam	20–35	45–80	0–20

Which of the following charts represents a clay loam?



17. The table below shows the number of beet armyworm larvae found in plots of cotton plants.

Some plots were treated with insecticide on 27 June and 1 August and other plots left untreated.

Sampling date		Number of beet armyworm larvae	
		Treated plots	Untreated plots
July	8	3	3
	15	33	2
	22	22	17
	29	42	10
August	5	120	8
	12	160	10

Which of the following is the most likely explanation for the differences between the treated and untreated plots?

- A The insecticide kills a predator of the larvae
  - B The larvae are resistant to the insecticide
  - C The beet armyworm breeds in July
  - D The larvae have a short lifecycle
18. In primates such as chimpanzees, parental care
- A occurs over a short time period
  - B provides time for learning complex social behaviour
  - C increases the parent's social status within their group
  - D involves appeasement behaviour within a group.
19. Altruistic behaviour between closely related animals
- A reduces competition between individuals in the population
  - B increases the survival chances of the donor animal
  - C increases the frequency of shared genes in the next generation
  - D reduces unnecessary aggression and conflict in social groups.

20. A species that plays a role vital for the survival of many other species in an ecosystem is called
- A a keystone species
  - B a native species
  - C an invasive species
  - D a dominant species.

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

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