

The Origin and Evolution of Life

Question Paper

Level	Pre U
Subject	Biology
Exam Board	Cambridge International Examinations
Topic	The Origin and Evolution of Life
Booklet	Question Paper

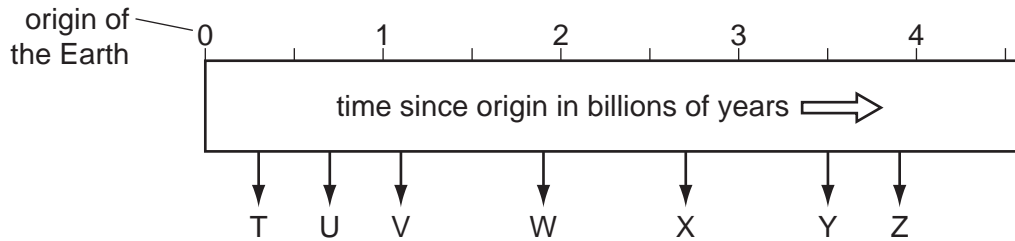
Time Allowed: 27 minutes

Score: /22

Percentage: /100

- 1 The Earth is thought to be about 4.6 billion years old.

The diagram includes a time-line which shows some of the stages in the evolution of life on Earth.



Which row shows the correct time sequence of these events?

	first evidence of life developing on Earth	first evidence of prokaryotes on Earth	first evidence of eukaryotes on Earth
A	T	W	Y
B	U	X	Y
C	U	V	W
D	V	X	Z

- 2 A key feature of most multicellular organisms is the ability to differentiate and produce specialised cells.

Which row best describes the ability of **zygotic cells** to differentiate?

	totipotent	pluripotent	multipotent
A	✓	✓	✓
B	✓	x	✓
C	✓	x	x
D	x	✓	✓

key

✓ = ability

x = no ability

- 3 Conservation of larger areas is considered more worthwhile than smaller ones but sometimes small areas have advantages for some species.

Why do smaller areas sometimes have advantages for some species?

- A fewer predators present
- B less complex food webs
- C less intra-specific competition
- D smaller edge effects

- 4 The effects of some features possessed by various organisms are listed below.

- 1 advantageous mutations may not be passed on
- 2 allows division of labour between cells
- 3 allows greater control of the internal environment
- 4 enables cells to become specialised
- 5 reduces need for coordination within the organism

Which are advantages shared by multicellular organisms?

- A 1, 2 and 3 only
- B 2, 3 and 4 only
- C 3, 4 and 5 only
- D 1, 2, 3, 4 and 5

- 5 The ratio of stable carbon isotopes ^{12}C and ^{13}C in sedimentary rocks can be used as evidence for the origins of life.

Which statement is correct?

- A A high ratio of ^{13}C to ^{12}C suggests that life may have begun 3.9 million years ago.
- B A high ratio of ^{13}C to ^{12}C suggests that life may have begun 4.6 billion years ago.
- C A high ratio of ^{12}C to ^{13}C suggests that life may have begun 3.9 billion years ago.
- D A high ratio of ^{12}C to ^{13}C suggests that life may have begun 4.6 million years ago.

- 6 In the SLOSS debate, some conservationists argued that several smaller reserves were better than one large reserve.

What advantages could they put forward to support their argument?

- 1 A whole species is less likely to be wiped out by a single event.
- 2 This is good for species with a high area requirement.
- 3 The edges are smaller in relation to the total area.
- 4 Diseases are less likely to spread between populations of the same species.

A 1 and 4 only **B** 2 and 3 only **C** 2 and 4 only **D** 3 only

- 7 How many condensation reactions have occurred during the formation of a single chain of three nucleotides from phosphate, deoxyribose and bases?

A 2 **B** 5 **C** 6 **D** 8

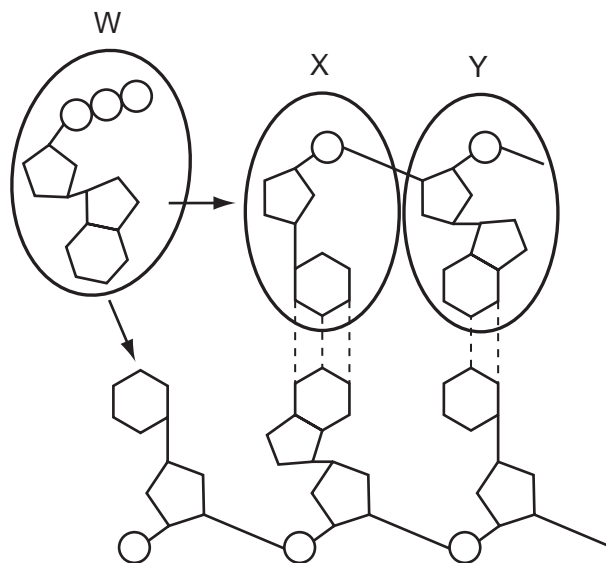
- 8 The statements below are about bonds found in biological molecules.

- 1 They are formed by condensation.
- 2 Oxygen is part of the bond.
- 3 ATP is hydrolysed to form the bonds.
- 4 The bonds contain potential energy.

Which statements are correct for the bonds in the primary structure of proteins?

A 1, 3 and 4 only **B** 3 and 4 only **C** 1 and 2 only **D** 1, 2, 3 and 4

9 The diagram shows the synthesis of a polynucleotide. Molecule W is a nucleotide triphosphate.



Which statements are correct?

- 1 The base in W could be the purine, adenine
- 2 The base in Y is the purine, guanine
- 3 The base in X is the pyrimidine, cytosine
- 4 The base in X could be the pyrimidine, uracil

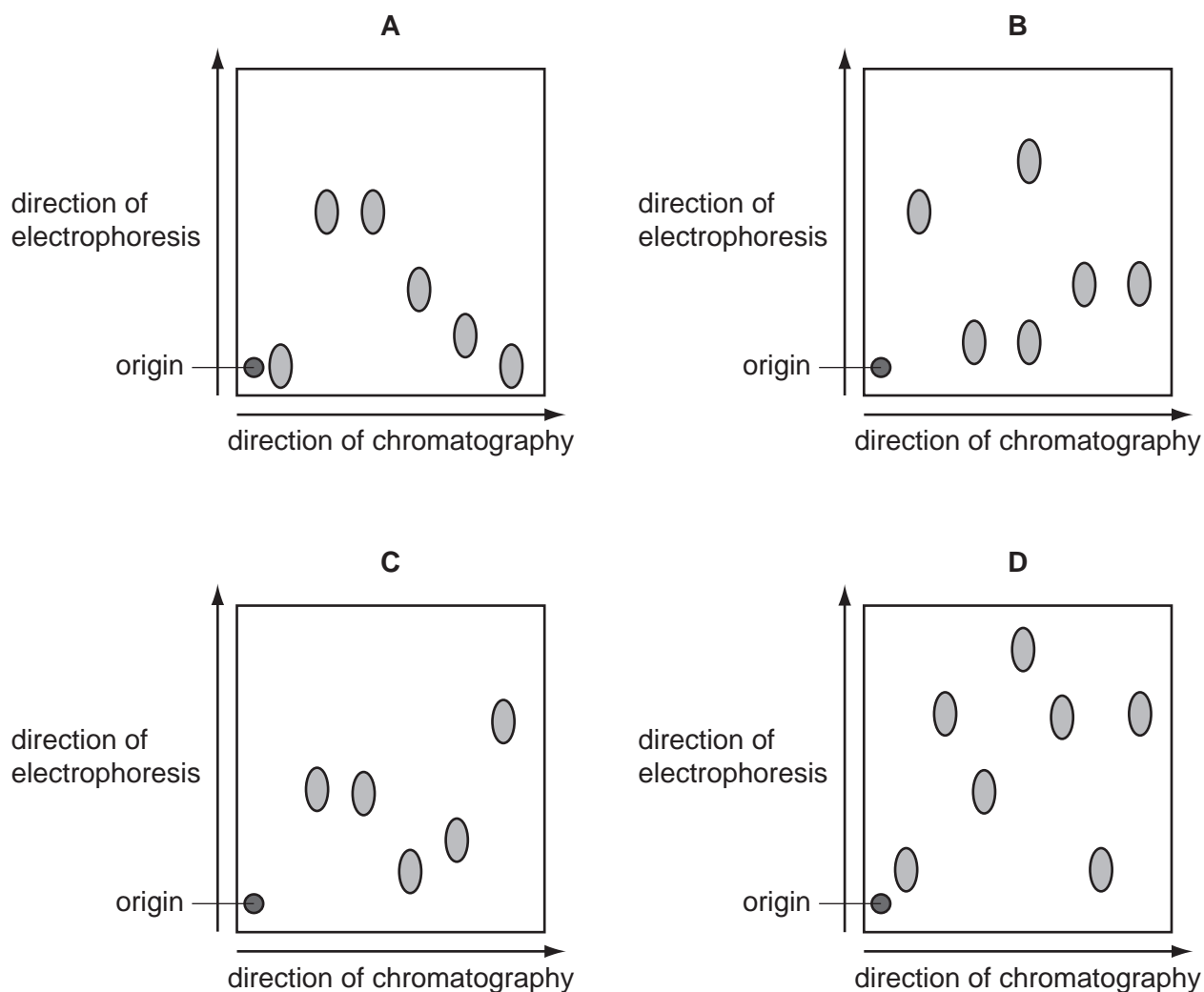
A 1 and 3 only **B** 2 and 3 only **C** 2 and 4 only **D** 1, 2, 3 and 4

10 Which monomers and types of bond are found in both glycogen and amylopectin?

- A** α -glucose, glycosidic, 1,6
- B** α -glucose, hydrogen, 1,4
- C** β -glucose, glycosidic, 1,4
- D** β -glucose, hydrogen, 1,6

- 11 The diagrams show the results of an investigation into the composition of different mixtures of amino acids. Each mixture of amino acids was separated using chromatography. Each chromatogram was then turned through 90° and the amino acids separated again by electrophoresis.

Which diagram shows an amino acid mixture in which the solubility of some of the amino acids is the same but the charge on those particular amino acids is different?



- 12 The protein cytochrome c functions only when it contains an atom of iron.

Which term describes the atom of iron?

- A part of an active site
- B part of a coenzyme
- C part of a hydrogen carrier
- D part of a prosthetic group

13 Which statements describe properties of water that are useful to living things?

- 1 Strong cohesive forces between water molecules at the water surface mean that it is a good medium for support.
- 2 Cohesive forces between water molecules and the sides of xylem vessels allow water to move in the transpiration stream.
- 3 Hydrogen bonds between water molecules attract the molecules to each other, but are weak so that the water molecules can move easily in relation to one another.
- 4 Water has a minimum density at 4°C, hence ice forming at the surface of ponds acts as a thermal insulator for organisms in the water.

A 1 and 3 only **B** 1 and 4 only **C** 2 and 3 only **D** 2 and 4 only

14 Which two features contribute to the great tensile strength of cellulose?

- 1 glycosidic bonds linking the long chains of 1,4 α -glucose molecules
- 2 the -OH groups of the glucose molecules project outwards and form H bonds with neighbouring chains
- 3 the strength of the glycosidic bonds between the neighbouring chains of molecules
- 4 the successive glucose molecules are orientated at 180° to each other

A 1 and 3 only **B** 1 and 4 only **C** 2 and 3 only **D** 2 and 4 only

15 Which statements are correct interpretations of Darwinian evolutionary theory?

- 1 Advantageous behaviour acquired during the lifetime of an individual is likely to be inherited.
- 2 In competition for survival, the more aggressive animals are more likely to survive.
- 3 Species living in a stable environment will not evolve any further.
- 4 Variation between individuals of a species is essential for evolutionary change.

A 1, 2 a

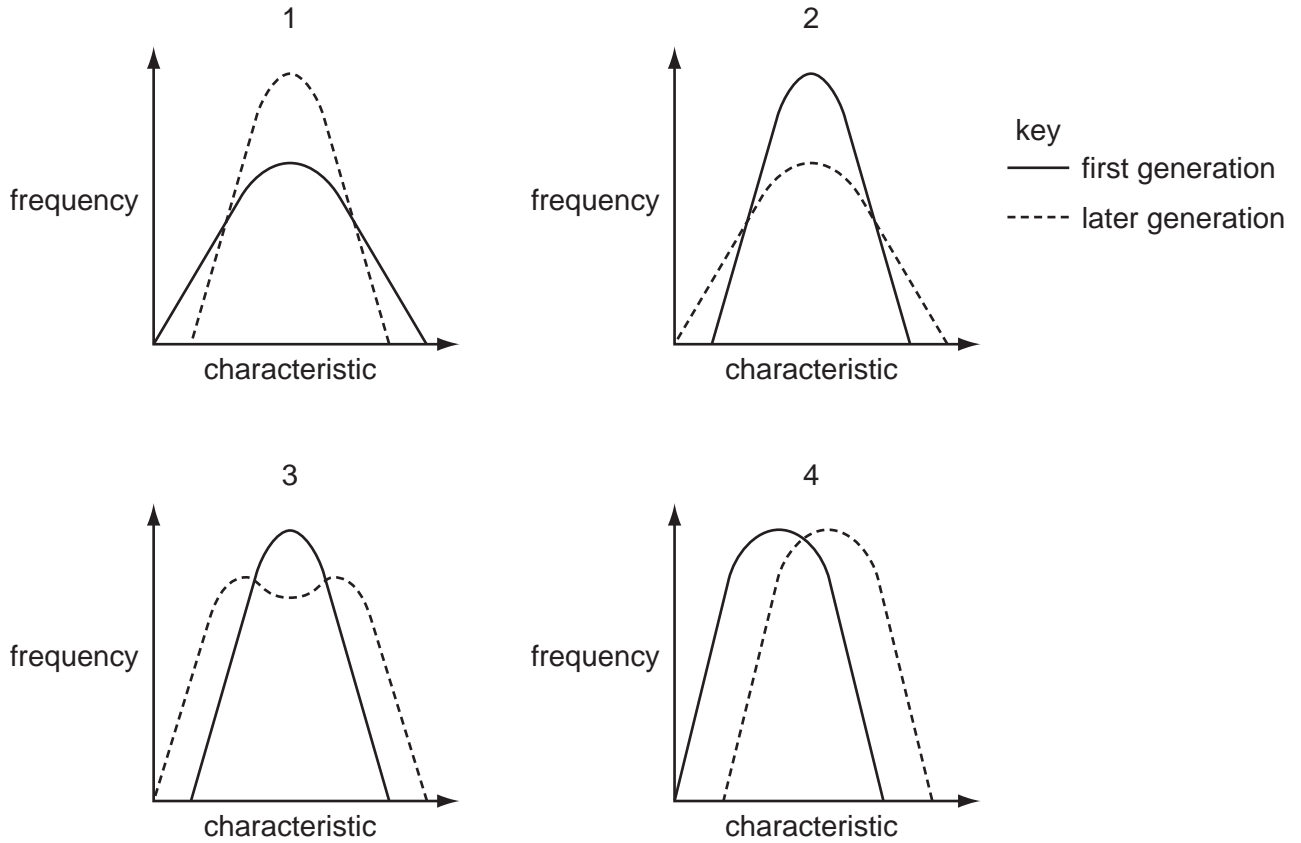
B 2 and 3 only

C 3 and 4 only

D 4 only

answer [1]

16 The graphs show frequency against a measured characteristic in the first and later generation of an organism.



Which graph represents each type of natural selection?

	directional	disruptive	stabilising
A	1		
B	2		
C	3		
D	4		

17 The following statements relate to molecular phylogenetics.

- 1 Lines of descent from a common ancestor to present-day organisms have undergone similar, fixed rates of DNA mutation.
- 2 Organisms with similar base sequences in their DNA are closely related to each other.
- 3 The number of differences in the base sequences of DNA of different organisms can be used to construct evolutionary trees.
- 4 The proportional rate of fixation of mutations in one gene relative to the rate of fixation of mutations in other genes stays the same in any given line of descent.

Which statements, when taken together, suggest the existence of a ‘molecular clock’ that enables scientists to estimate the time at which one species might have diverged from another?

- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

18 Darwin’s view of the process of evolution to form new species (speciation) has been reinforced by more recent discoveries in genetics and cell biology.

In this view, which sequence of events is considered most likely to lead to speciation?

A	adaptation of population	→	competition and predation leading to natural selection	→	behavioural isolation	→	sympatric speciation
B	adaptation of population	→	competition and predation leading to natural selection	→	behavioural isolation	→	allopatric speciation
C	competition and predation leading to natural selection	→	geographical isolation	→	adaptation of isolated populations	→	sympatric speciation
D	competition and predation leading to natural selection	→	geographical isolation	→	adaptation of isolated populations	→	allopatric speciation

- 19 The huia, *Heteralocha acutirostris*, was found in New Zealand until 1907, when it became extinct. This bird had a ground-feeding habit and was particularly noted for large, attractive tail feathers.

Males and females had very different beak forms, with the males having a short strong beak, whilst the females had a long curved beak to reach into otherwise inaccessible places.

What is the most likely reason for the extinction of the huia?

- A Huia fed on species introduced by humans. When these declined, the huia population fell.
 - B In the face of a declining population the huia evolved into a tree-living species.
 - C Male and female huia were unable to breed successfully owing to strong sexual dimorphism.
 - D New competitors in New Zealand occupied part of the huia's niche.
- 20 It is possible to introduce an allele for a functioning CFTR protein into lung epithelial cells of patients suffering from the genetically inherited condition cystic fibrosis.

Why can this strategy **never** provide a permanent cure for the patient?

- A epithelial cells are continually dying and being replaced
 - B the DNA molecule that makes up the functioning allele is very unstable
 - C the methods of inserting the allele have low success rate
 - D this is only somatic and not germ line therapy
- 21 Which statements are acceptable parts of Darwinian evolutionary theory?
- 1 Advantageous behaviour acquired during the lifetime of an individual is likely to be inherited.
 - 2 In competition for survival, the more aggressive animals are more likely to survive.
 - 3 Species perfectly adapted to a stable environment will continue to evolve.
 - 4 Variation between individuals of a species is essential for evolutionary change.
- A 1, 2 a
 - B 2 and 3 only
 - C 3 and 4 only
 - D 4 only

- 22** Which is a correct statement about classifying and ranking organisms using a phenetic system?
- A** A phenetic classification system is most useful when applied to higher organisms that have many characteristics.
 - B** A phenetic-based classification always produces different results to a phylogenetically-based classification.
 - C** In a phenetic system, one factor used to classify organisms is how recently they diverged.
 - D** Slight changes in features used for a phenetic classification may result in very different outcomes.

answer [1]