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DUNMAN HIGH SCHOOL
Preliminary Examination
Year 6

H1 BIOLOGY

Paper 1 Multiple Choice Questions

8875/01

29 September 2015

1 hour

Additional Materials: OTAS sheet

INSTRUCTIONS TO CANDIDATES:

DO NOT TURN THIS PAGE OVER UNTIL YOU ARE TOLD TO DO SO.

READ THESE NOTES CAREFULLY.

Section A MCQ [30 marks]

There are **thirty** questions in this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

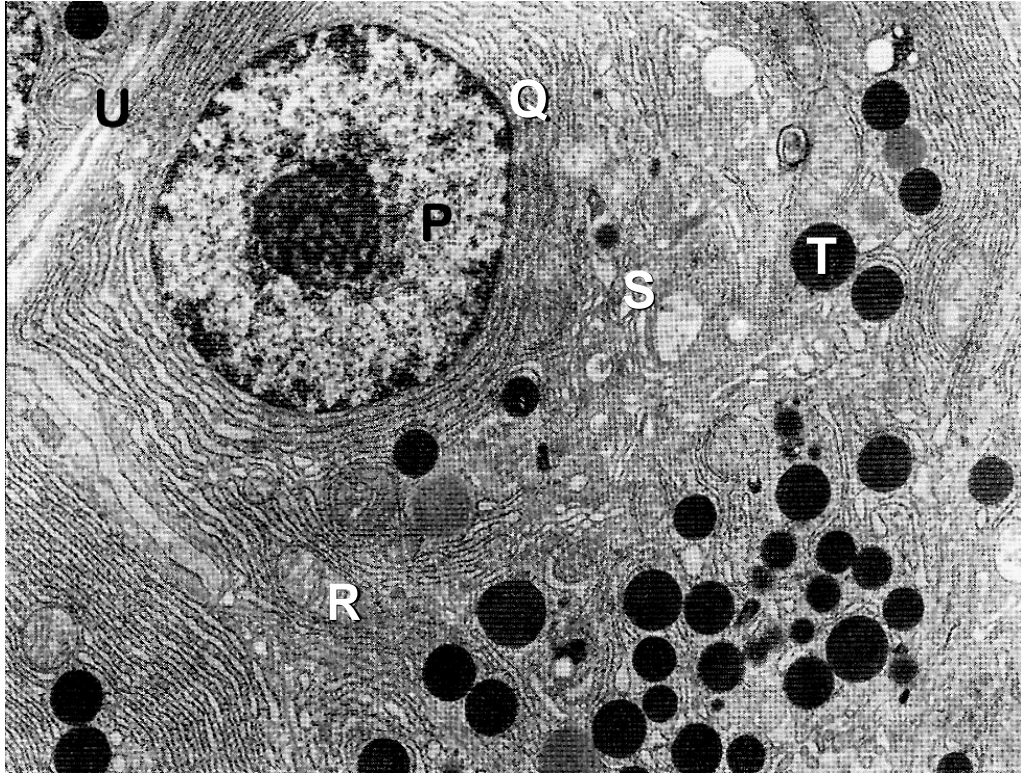
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

This document consists of **21** printed pages and **1** blank page.

Answer **all** questions in this section.

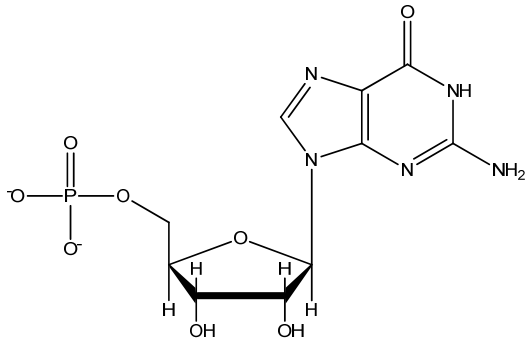
- 1 The figure below is an electron micrograph of a human cell.



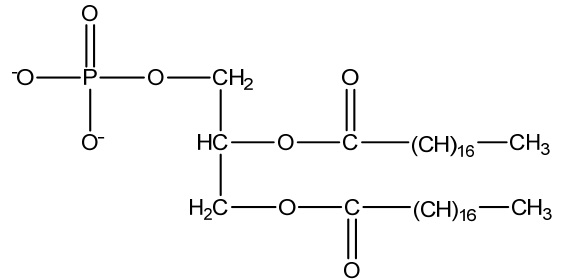
Which of the following correctly identifies its structure-function adaptation?

	structural adaptation	function
A	prominent P	antibody production
B	extensive Q , S and T	enzyme secretion
C	extensive R	phagocytosis
D	extensively-folded U	absorption

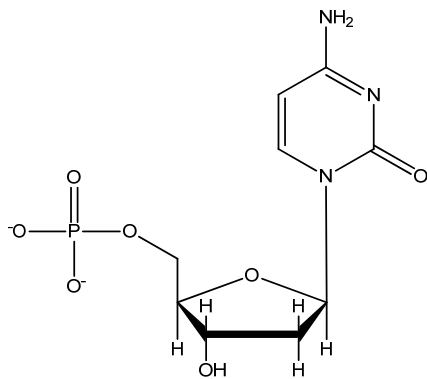
- 2 A student uses centrifugation to separate the various subcellular structures of human epithelial cells by size and density. Which of the following molecule(s) would you expect to find in the pellet containing the cell membrane?



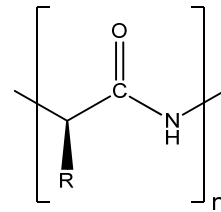
I



II



III



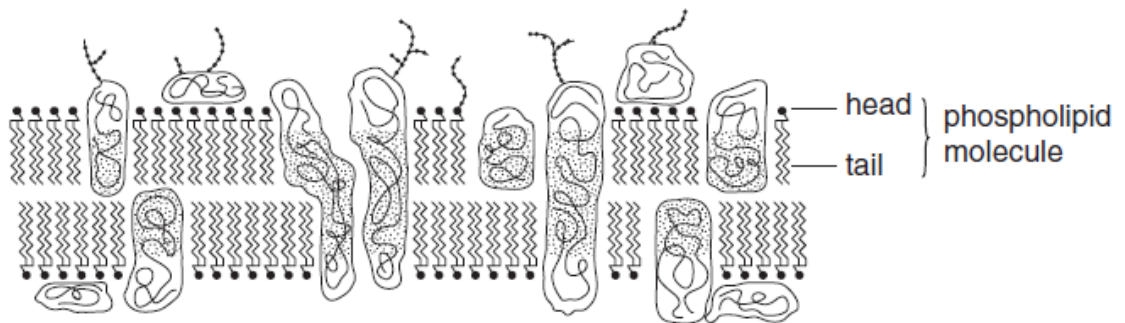
IV

- A II only
 B III only
 C II and IV only
 D I, III and IV only

- 3 An enzyme is a globular protein held together by several different types of chemical bond, giving the enzyme primary, secondary and tertiary levels of structure. What of the following correctly summarises the types of bond involved in each level of structure?

	disulfide bonds	hydrogen bonds	ionic bonds	peptide bonds
A	tertiary	secondary, tertiary	tertiary	primary
B	primary, tertiary	primary	secondary, tertiary	secondary
C	secondary	secondary	tertiary	primary
D	primary	tertiary	secondary	tertiary

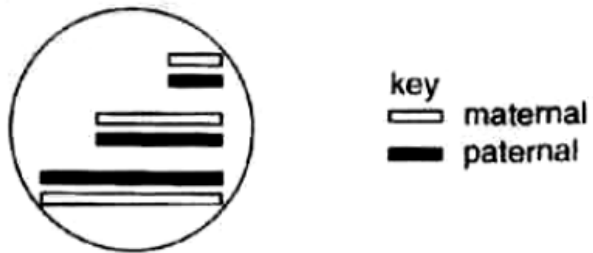
- 4 The diagram shows a section of a cell surface membrane.



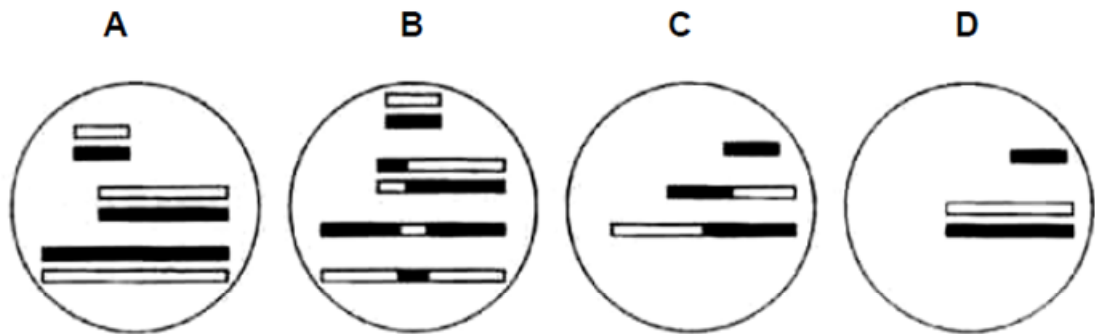
What causes the phospholipid molecules to be arranged as shown?

- A** The heads are hydrophilic and point towards water molecules.
- B** The heads are hydrophobic and point away from water molecules.
- C** The tails are hydrophilic and point away from water molecules.
- D** The tails are hydrophobic and point towards water molecules.

- 5 The diagram shows the maternal and paternal chromosomes from a diploid cell.



If the cell divides by meiosis, which diagram shows a possible viable gamete?

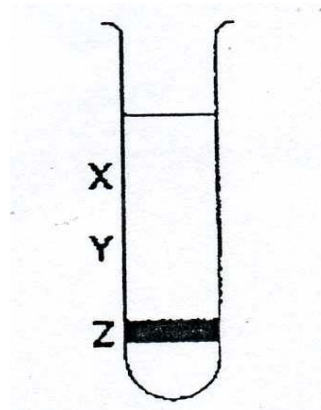


- 6 Which one of the following is the complementary sequence of 5'-TTAAGCGTAC-3'?

- A 5'-GTACGCTTAA-3'
- B 5'-AATTCGCATG-3'
- C 5'-CATGCGAATT-3'
- D 5'-TTAAGCGTAC-3'

- 7 A culture of bacteria had all its DNA labelled with the heavy isotope of nitrogen, ^{15}N . The culture was then allowed to reproduce using nucleotides containing normal ^{14}N . The DNA was examined using a centrifuge after one generation and again after two generations.

The diagram shows the position of the DNA band at **Z** in the centrifuge tube when the DNA was first labelled.



In which pattern would the DNA be found after the first and after the second cell generations?

	After first generation	After second generation
A	Half at X and half at Y	Quarter at X and at Z and half at Y
B	Half at X and half at Z	Quarter at X and at Z and half at Y
C	All at X	Half at X and half at Y
D	All at Y	Half at X and half at Y

- 8 Part of the amino acid sequences in normal and sickle cell haemoglobin are shown.

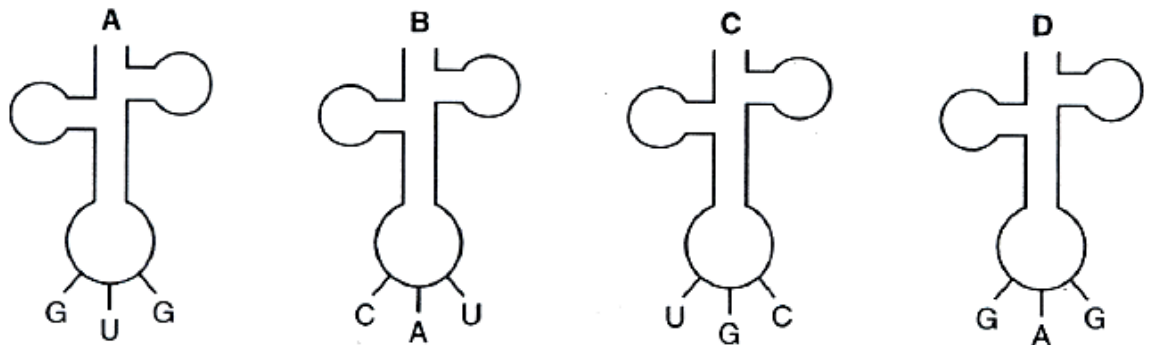
normal haemoglobin
thr-pro-glu-glu

sickle cell haemoglobin
thr-pro-val-glu

mRNA codons for these amino acids are:

Name of amino acid	mRNA codons	
Glutamine (glu)	GAA	GAG
Threonine (thr)	ACU	ACC
Proline (pro)	CCU	CCC
Valine (val)	GUA	GUG

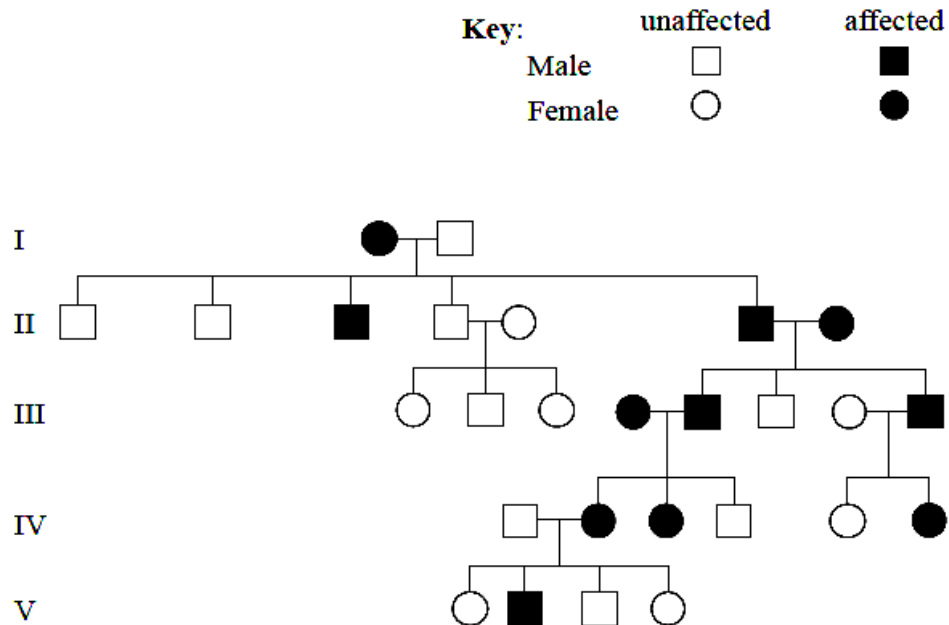
Which transfer RNA molecule is involved in the formation of this part of the sickle cell haemoglobin?



- 9 It was discovered in an alien species that their DNA contained two types of nitrogenous bases and there were 30 amino acids. What would be the minimum number of bases per codon that could code for the amino acids?

- A 3
- B 5
- C 6
- D 8

- 10 The pedigree chart below shows the inheritance of a genetic disease in a family. What is the nature of the allele that causes this disease?



- A Dominant and sex linked
- B Dominant and non-sex linked
- C Recessive and sex linked
- D Recessive and non-sex linked
- 11 Two plants of genotype **DdEeff** were crossed. Assuming independent assortment and simple dominance, what proportion of the offspring is expected to show the same phenotypic appearance as the parents?
- A 1 out of 4
- B 3 out of 4
- C 3 out of 8
- D 9 out of 16

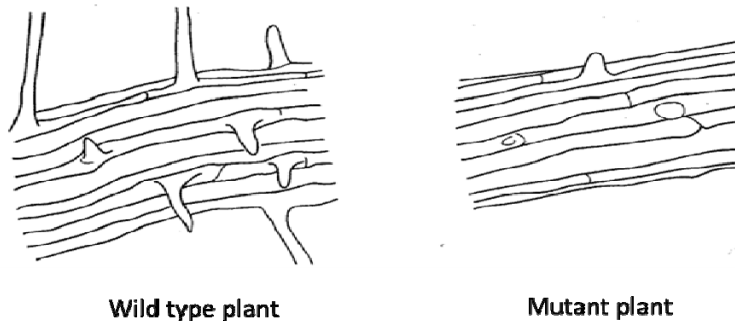
- 12** An insect collection contains 102 specimens of a species of butterfly. This species is sexually dimorphic, meaning that the males and females look different from each other. A student examined the specimens and collected the following data.

Observation	Frequency
Blue wing colour (male)	64
Brown wing colour (female)	38
Wing span 35-37 mm	15
Wing span 37-39 mm	68
Wing span 39-41 mm	19

How should these observations be classified?

	Continuous variation	Discontinuous variation
A	Sexual dimorphism	Colour
B	Colour	Sexual dimorphism
C	Sexual dimorphism	Wing span
D	Wing span	Sexual dimorphism

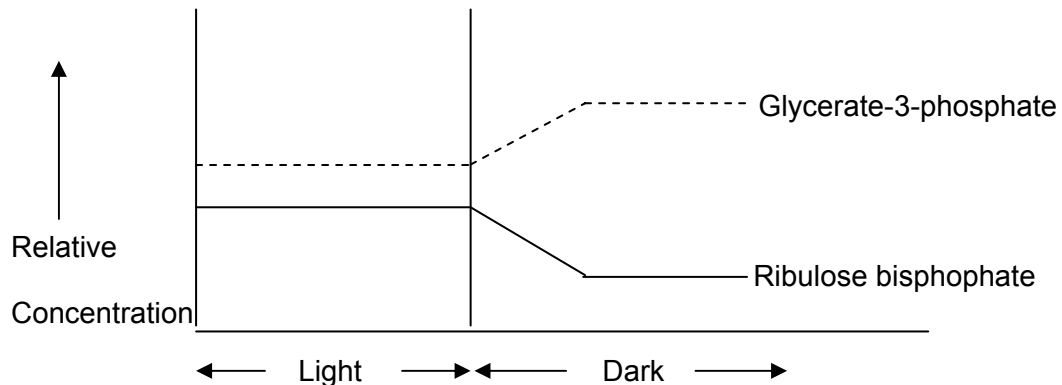
- 13** A mutant form of the plant *Arabidopsis thaliana* was discovered to have very short root hairs. The mutant contains a mutation in the gene coding for the enzyme reduced NADP oxidase. The normal enzyme converts reduced NADP (NADPH) to NADP^+ .



Which of the following could account for the presence of very short root hairs in the mutant?

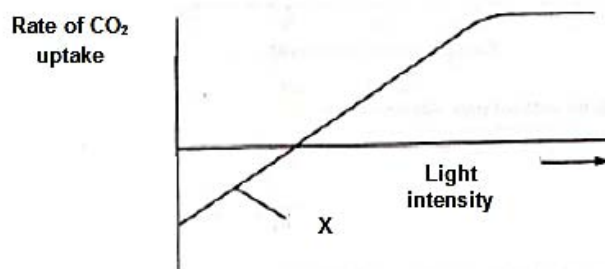
- A** As NADPH cannot be oxidised, rate of light-dependent reactions will decrease and cellular growth will also decrease.
 - B** As NADPH cannot be oxidised, rate of light-dependent reactions will decrease and less water is needed for photolysis, hence root hairs can be shorter.
 - C** As NADP^+ cannot be reduced, rate of light-independent reactions will decrease and cellular growth will also decrease.
 - D** As NADP^+ cannot be reduced, rate of light-independent reactions will decrease and less water is needed for photolysis, hence root hairs can be shorter.
- 14** Which of the following statements correctly compares oxidative phosphorylation and non-cyclic photophosphorylation?
- A** Both types of phosphorylation produce ATP and oxygen as end products.
 - B** Both types of phosphorylation involve the synthesis of ATP through ATPase.
 - C** Oxidative phosphorylation is involved in the conversion of one form of chemical energy to another while non-cyclic photophosphorylation is involved in converting light energy to chemical energy.
 - D** Water is an electron donor in non-cyclic photophosphorylation while it is an electron acceptor in oxidative phosphorylation.

- 15 The graph below shows the effects of a change from light to dark conditions on the relative concentrations of glycerate-3-phosphate (GP) and ribulose biphosphate (RuBP) in a plant.



Which of the following features of the graph does **not** support the hypothesis that RuBP is converted to GP? The compounds _____.

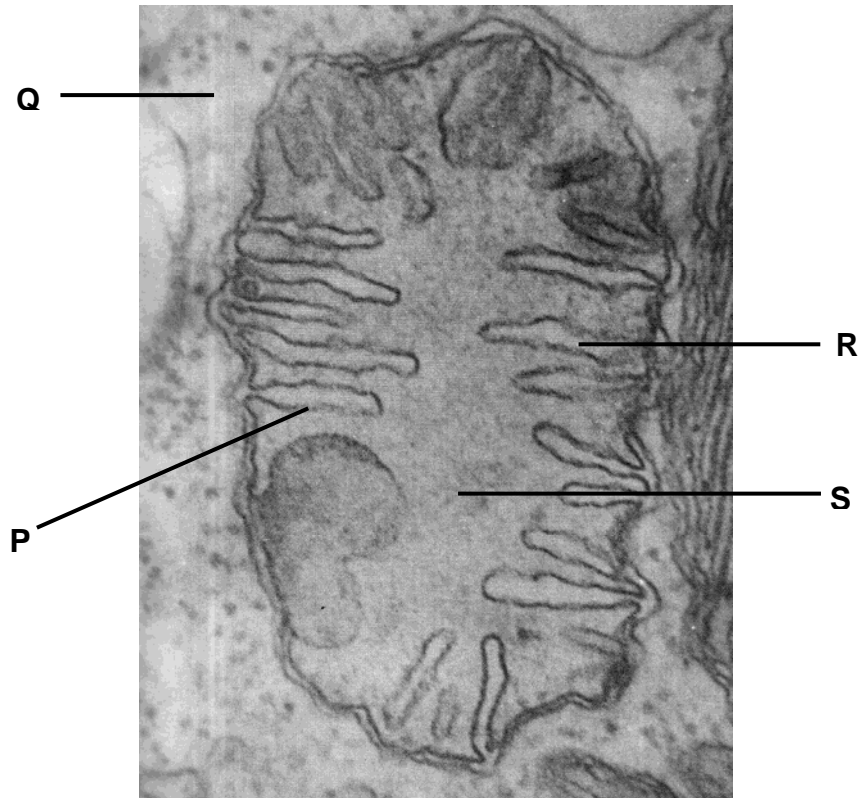
- A respond at the same time to the changed condition
 - B have constant concentrations at the start of the experiment
 - C achieve a new steady concentration at the same time
 - D have the same rate of response, one negative and the other positive
- 16 In the graph below, the rate of CO₂ uptake by plant cells is shown to vary with increasing light intensity.



Which of the following is true at point X?

- A The plant is photosynthesising.
- B Rate of respiration equals rate of photosynthesis.
- C CO₂ is a limiting factor.
- D There is not enough light for photosynthesis to have commenced.

17 The figure below shows an electron micrograph of an organelle.



Match the following processes with the structures labelled P – S above.

	Breakdown of fructose-6-phosphate	Oxidative phosphorylation only	Temporary lowering of pH	Formation of reduced co-enzymes
A	Q	R	S	P
B	R	S	P	Q
C	S	P	Q	R
D	Q	P	R	S

18 What would be the effect of inhibition of lactate dehydrogenase in a mammalian cell under anaerobic conditions?

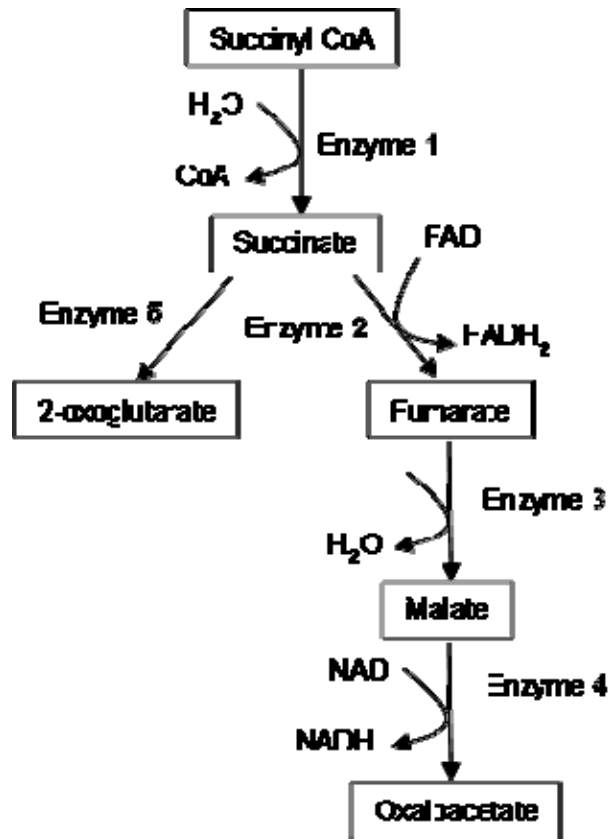
- A An increase in ATP production, due to increased amounts of reduced NAD.
- B A decrease in cell pH, due to the accumulation of lactic acid.
- C A decrease in glycolysis, due to the lack of NAD^+ .
- D An increase in the activity of Krebs cycle, due to increased amounts of pyruvate.

19 Which one of the following substances, when added, would directly result in a decline in ATP production in glycolysis?

- I** A chemical that would bind to NAD^+ irreversibly and induces its reduction to NADH.
- II** An inhibitor that has a similar structure to glucose but cannot be broken down by respiratory enzymes.
- III** A chemical that creates an anaerobic environment by combusting in oxygen
- IV** A reagent that binds to the active site of ATPase permanently

- A** I and II only
- B** III and IV only
- C** I, II and IV only
- D** All of the above

- 20 A competitive inhibitor of the enzyme catalyzing the oxidative decarboxylation of α -ketoglutarate (5C) was added to respiring animal tissues.



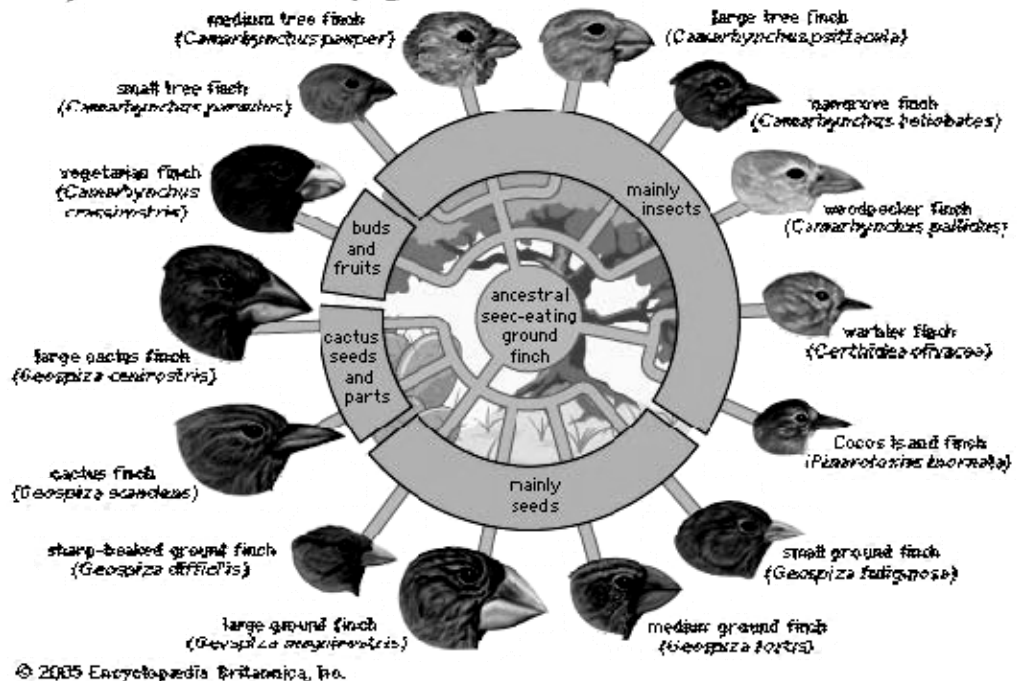
Which will occur in the presence of a high concentration of oxaloacetate?

- 1 Positive feedback will occur, resulting in the production of more fumarate and malate.
- 2 Oxidative phosphorylation will cease.
- 3 Krebs cycle will proceed due to a high concentration of oxaloacetate to form less 2-oxoglutarate.
- 4 Higher rates of link reaction will occur with oxidative decarboxylation taking place in the mitochondrial matrix to produce more acetyl-CoA.

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

- 21 The Galapagos Islands are a group of volcanic islands in the eastern Pacific Ocean, about 1000km from South America. The diagram below illustrates the finches found on the islands; they resemble each other closely but differ in their feeding habits and in the shape of their beaks.

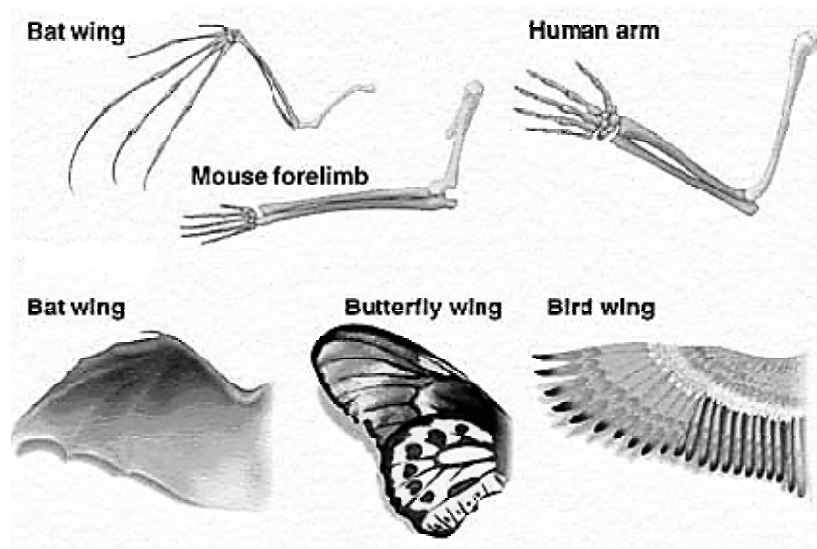
Adaptive radiation in Galapagos finches



Which statement below explains how so many distinct and yet similar species arose?

- A As a result of the different food sources available, the ancestral species acquired different mutations which resulted in the emergence of a variety of beak shapes.
- B The finches were subjected to similar selection pressures which resulted in similar phenotypic characteristics in the distinct populations.
- C The difference in food sources served as a selection pressure, allowing only finches with certain beak shapes to survive and reproduce.
- D The finches migrated only to environments that they are already adapted to; finches with different phenotypes migrated to different islands

- 22 The diagram below shows the bone structures of the human arm, mouse forelimb and bat wings as well as the morphology of the wings of bat, butterfly and birds.

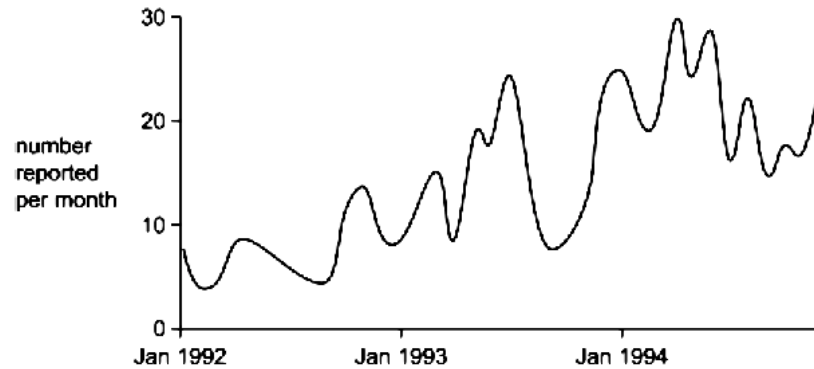


Which of the following are correct conclusions made from the diagram provided?

- 1 Bat, mouse and human share a common ancestor as their bone structure exhibit anatomical homology.
- 2 Variations in the bone morphology of bats, mouse and human are due to natural selection.
- 3 Bat, butterfly and bird share a recent common ancestor as shown by their common wing morphology.
- 4 Bat, butterfly and bird exhibit analogous structures.

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

- 23** The graph shows the change in the number of bacterial samples from some New York hospitals were resistant to the antibiotic vancomycin in 1992 to 1994. Forty samples were taken each month from randomly selected patients who had become infected with bacteria in the hospital.



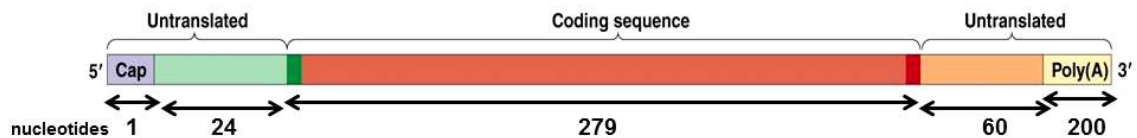
Which statement most accurately describes the cause of the changes in the frequency of the vancomycin resistant phenotype?

- A** effect of artificial selection
- B** effect of natural selection
- C** purely due to random mating in the population
- D** purely due to geographical isolation

- 24 The restriction enzyme *Ddel* recognizes a sequence on DNA, CTNAG (where N is any base). A portion of the β -haemoglobin sequence encoding normal haemoglobin is CCTGAGGAG. If the mutation leading to sickle cell anaemia had been CCTCAGGAG, would you be able to distinguish the two alleles with a restriction digest?

- A Yes, the normal allele will be digested, the sickle allele will not.
- B Yes, the sickle allele will be digested, the normal allele will not
- C No, both will be digested by *Ddel*.
- D No, neither will be digested by *Ddel*.

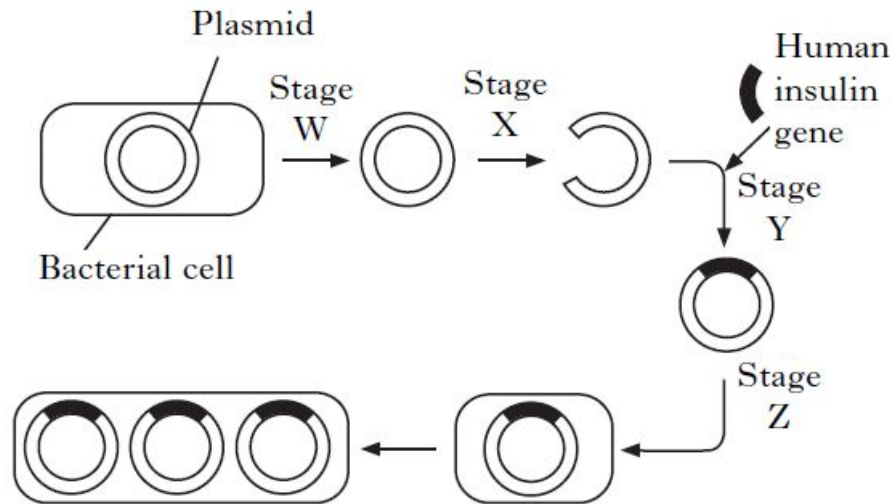
- 25 The mature eukaryotic mRNA contains the structure shown below.



When the reverse transcription of this mRNA is performed for insertion into a bacterial plasmid for transforming *E. coli* cells, the length of the resulting cDNA fragment will be _____.

- A 279 bp
- B 303 bp
- C 363 bp
- D 564 bp

- 26 The flow chart below represents the genetic engineering of *E. coli* bacteria to produce human insulin.



Which of the following identifies correctly the stages and functions of the endonuclease and ligase?

	Endonuclease	Function	Ligase	Function
A	X	Hydrolysis of Hydrogen bonds	Z	Formation of Phosphodiester bonds
B	W	Hydrolysis of Phosphodiester bonds	Y	Formation of Hydrogen bonds
C	X	Hydrolysis of Phosphodiester bonds	Y	Formation of Phosphodiester bonds
D	W	Hydrolysis of Hydrogen bonds	Z	Formation of Hydrogen bonds

27 Which of the following statements is/are true regarding zygotic stem cells and cancer cells?

- I** Both are able to move one from location to another.
- II** Both are able to divide by mitotic division.
- III** Both are specialised cells and capable to differentiate further.
- IV** Both are capable of indefinite replication.

- A** II only
- B** I and III
- C** II and IV
- D** I, II and IV

28 Which of the following is/ are the reasons that make embryonic stem cells particularly useful in medical research?

- 1** They can be fused together to form a zygote.
- 2** They have the characteristics of a multipotent stem cell.
- 3** They will continue to divide indefinitely.
- 4** They can be stimulated by chemical signals to express particular genes.
- 5** They can only differentiate into one particular tissue.

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

- 29** Creation of genetically modified (GM) crop plant has been made possible with the advancement of techniques of genetic engineering. In the creation of a GM crop, the desired gene is often isolated from an organism that is not related to the crop plant being modified. This gene of interest is introduced into the crop plant through the use of the plasmid from *Agrobacterium tumefaciens*.

Which genetic modification would enable higher yield in crops grown on fertile soil in a tropical region?

- A** Increased expression of enzyme for the synthesis of beta carotene
 - B** Tolerance to cold
 - C** Increased synthesis of rubisco
 - D** Tolerance to high levels of salt in water
- 30** Which of the following is **not** an example of genetically modified organisms?
- A** AquaAdvantage Salmon that grow to adult size quickly.
 - B** Bt corn plants that are insect-resistant.
 - C** Golden Rice that produce high levels of beta-carotene.
 - D** Milk-producing cows injected with bovine somatotrophin (BST).

END OF PAPER

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2015 Y6 Preliminary Exam H1**MCQ Answer Scheme**

1	B	11	D	21	C
2	C	12	D	22	D
3	A	13	A	23	B
4	A	14	C	24	C
5	C	15	B	25	D
6	A	16	A	26	C
7	D	17	D	27	C
8	B	18	C	28	C
9	B	19	A	29	C
10	B	20	A	30	D