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| <b>Name:</b> |  | <b>Index Number:</b> |  | <b>Class:</b> |  |
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# DUNMAN HIGH SCHOOL

## Preliminary Examination

### Year 6

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## H1 BIOLOGY

Paper 1 Multiple Choice Questions

8875/01

**28 September 2016**

**1 hour**

Additional Materials: OTAS sheet

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### 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.

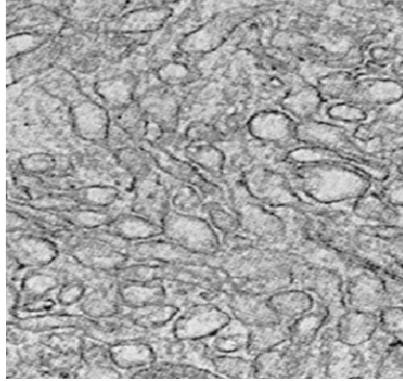
Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

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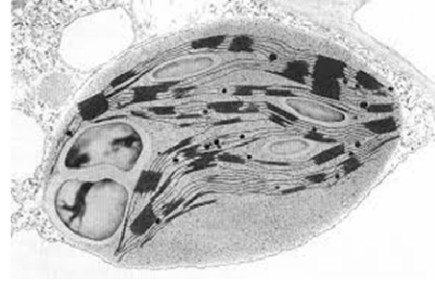
This document consists of **18** printed pages and **0** blank page.

Answer **all** questions in this section.

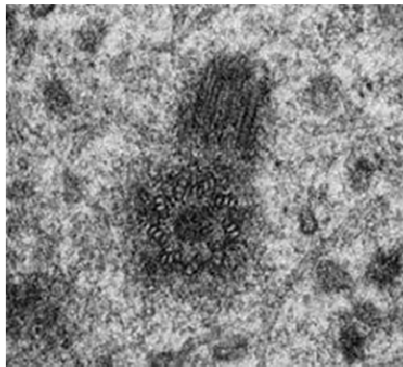
- 1 The figure below shows electron micrographs of 4 different organelles **PQRS**.



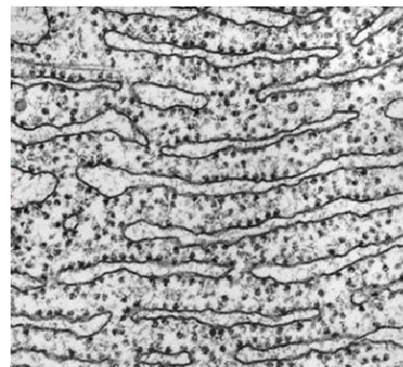
**P**



**Q**



**R**



**S**

Which of the following matches the organelle to its function?

|          | organelle | function                  |
|----------|-----------|---------------------------|
| <b>A</b> | <b>P</b>  | phospholipid synthesis    |
| <b>B</b> | <b>Q</b>  | enzyme secretion          |
| <b>C</b> | <b>R</b>  | protein synthesis         |
| <b>D</b> | <b>S</b>  | glycosylation of proteins |

- 2 Some germinating seeds were crushed with water and the extract was tested. The table below shows the results of these tests.

| Test                             | Result             |
|----------------------------------|--------------------|
| Barford's test for disaccharides | Positive           |
| Benedict's test                  | Yellow precipitate |
| Biuret test                      | Purple colour      |
| Clinistix test for glucose       | Negative           |
| Emulsion test                    | Clear solution     |
| Iodine test                      | Blue-black colour  |

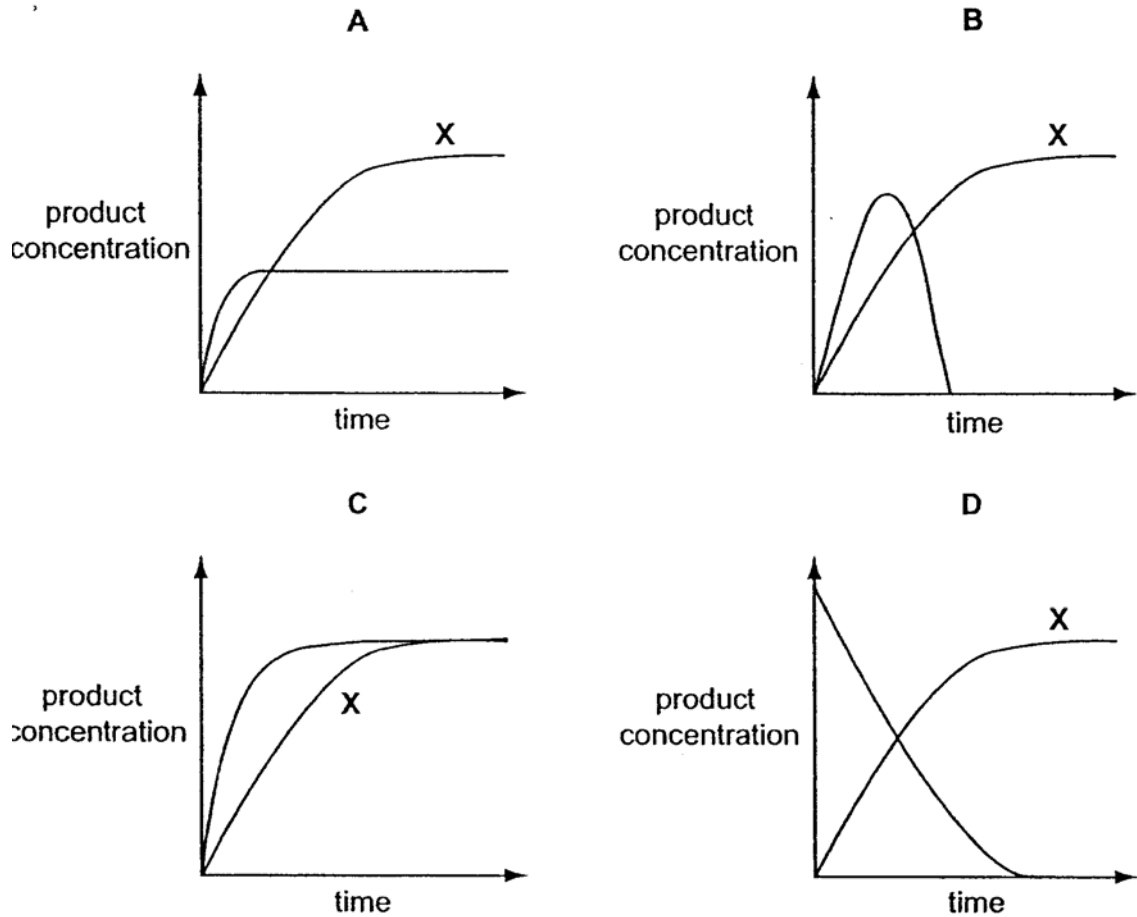
Which molecules were present in the extract?

- A Fat, maltose and starch only
  - B Maltose, protein and starch only
  - C Glucose, protein and starch only
  - D Sucrose, protein and starch only
- 3 Which pair shows the ***CORRECT*** classification?

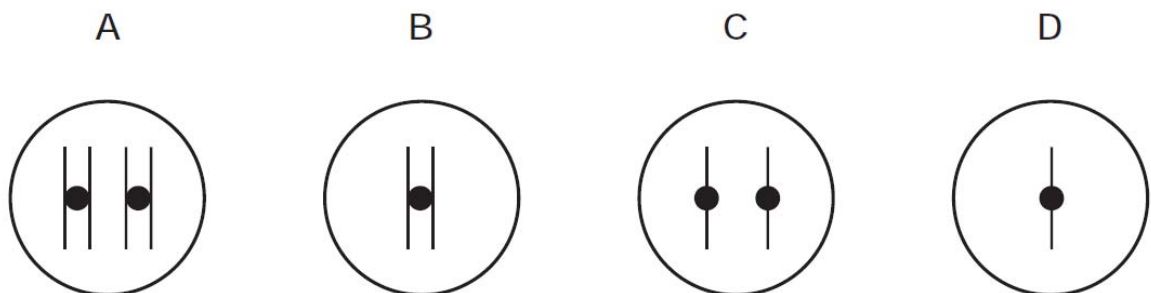
|   | branched structure | unbranched structure |
|---|--------------------|----------------------|
| A | amylose            | glycogen             |
| B | amylopectin        | cellulose            |
| C | cellulose          | amylopectin          |
| D | glycogen           | amylopectin          |

- 4 Two enzyme experiments were carried out. The first, experiment **X**, was carried out at a constant temperature of 37°C. During the second experiment the temperature was increased from 37°C to 80°C.

Which graph shows the results?



- 5 A cell with one pair of chromosomes ( $2n = 2$ ) undergoes meiosis. Which nucleus is formed as a result of this division?



- 6 There are distinct checkpoints in the cell cycle at which the cell monitors its internal equilibrium before proceeding to the next stage of the cell cycle. Which of the following statements **INCORRECTLY** describe the checkpoints?
- A At G<sub>1</sub> checkpoint, the cell monitors its size and determines if its DNA has been damaged.
  - B At G<sub>1</sub> checkpoint, there are events that ensure that origins of DNA replication are being activated.
  - C At G<sub>2</sub> checkpoint, if DNA replication or repair to any DNA damage has not been completed, the cell cycle arrests.
  - D At M checkpoint, if spindle fibres are not properly formed or attachment to kinetochore is not adequate, mitosis is arrested.
- 7 The mechanism of action of four drugs that inhibit DNA replication is stated below.
- **Aphidicholine** inhibits DNA polymerase III.
  - **Cytarabine** is converted into a molecule that can substitute for a DNA nucleotide and also inhibits DNA repair mechanisms.
  - **Epirubicin** inhibits an enzyme involved in the unwinding and separation of DNA strands.
  - **Hydroxycarbamide** inhibits an enzyme involved in the production of deoxyribonucleotides.

Which row **CORRECTLY** matches the effects of these drugs on DNA replication?

|   | Effects of Drug on DNA Replication |                                |  |  |
|---|------------------------------------|--------------------------------|--|--|
|   | Inhibition of chain elongation     | DNA damaged during replication | DNA strands not available as templates for replication | Exposed DNA template strands unable to be copied |
| A | aphidicholine                      | hydroxycarbamide               | epirubicin   | cytarabine                                       |
| B | cytarabine                         | epirubicin                     | aphidicholine  | hydroxycarbamide                                 |
| C | epirubicin                         | hydroxycarbamide               | cytarabine   | aphidicholine                                    |
| D | hydroxycarbamide                   | cytarabine                     | epirubicin   | aphidicholine                                    |

- 8 In an attempt to synthesise DNA molecules *in vitro*, a student isolated and purified various molecules needed for DNA replication. She added some DNA to the mixture, and replication occurred. However, the DNA molecules formed were defective. Each molecule consists of a normal DNA strand paired with numerous segments of DNA, each about hundreds of nucleotides long.

What might she have left out in the mixture?

- A DNA primer
  - B RNA primer
  - C DNA ligase
  - D DNA polymerase III
- 9 The diagram shows part of the normal sequence of an mRNA molecule.

CCAAGUGGUCCGCUAAGAAGGC

A mutation in the DNA resulted in a polypeptide beginning with the following sequence.

glycine - serine - proline - glycine - isoleucine - leucine

The DNA triplets for some amino acids are

| Glycine | Isoleucine | Leucine | Proline | Serine |
|---------|------------|---------|---------|--------|
| CGA     | ATA        | TTA     | CCA     | TCA    |
| GGT     | ATT        | CTT     | CCG     | TCG    |
| GGC     |            | CTC     |         |        |

Which mutation has occurred in the DNA molecule?

- A The replacement of one nucleotide by a different nucleotide.
- B A reversal in the order of nucleotides.
- C An addition of an extra nucleotide.
- D The loss of a nucleotide.

- 10 A length of double-stranded DNA contains 120 nucleotides and codes for polypeptide X. What is the maximum length of polypeptide X?

A 19 amino acids  
 B 20 amino acids  
 C 39 amino acids  
 D 40 amino acids

- 11 Fruit flies (*Drosophila*), homozygous for long wings, were crossed with flies homozygous for vestigial wings. The F<sub>1</sub> and F<sub>2</sub> generations were raised at three different temperatures.

At each temperature, the F<sub>1</sub> generation all had long wings.

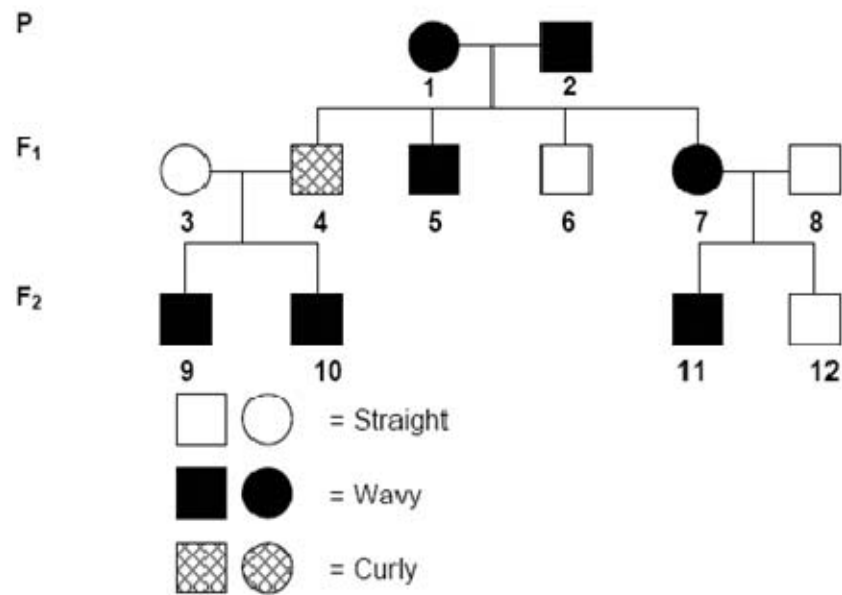
The table shows the results in the F<sub>2</sub> generation.

| temperature / °C | result   |
|------------------|--|
| 21               | $\frac{3}{4}$ long wings, $\frac{1}{4}$ vestigial wings          |
| 26               | $\frac{3}{4}$ long wings, $\frac{1}{4}$ intermediate wing length |
| 31               | all long wings   |

Which statement explains these results?

- A Heterozygous flies have vestigial wings only at 21°C or below but have long wings at 31°C or above.  
 B Long wing and vestigial wing illustrate codominance at 26°C.  
 C Long wing is dominant at higher temperatures but vestigial wing is dominant at lower temperatures.  
 D Vestigial wing is recessive but causes a vestigial wing phenotype only at lower temperatures.

12 The pedigree below shows the inheritance of type of hair.



Which of the following statements are **TRUE**?

- I One of the parents of individual 2 may not always have the same phenotype as individual 2
  - II if individual 10 married someone with wavy hair, the first child would have wavy hair
  - III If individual 6 married a woman with straight hair, all of the offspring would have straight hair
  - IV if individual 7 married a man with curly hair, the first child would have curly hair
- A I and III only
- B I and IV only
- C II and III only
- D II and IV only



- 13 In mice, the gene for “dappled” coat (D) and its recessive allele for “plain” coat (d), are located on the X chromosome. The gene for “straight” whiskers (W) and its recessive allele for “bent” whiskers (w), are autosomal.

A male mouse with plain coat and bent whiskers was mated on several occasions to the same female and the large number of offspring consisted of males and females in equal numbers in all possible combinations of phenotypes,

What is the genotype of the female parent?

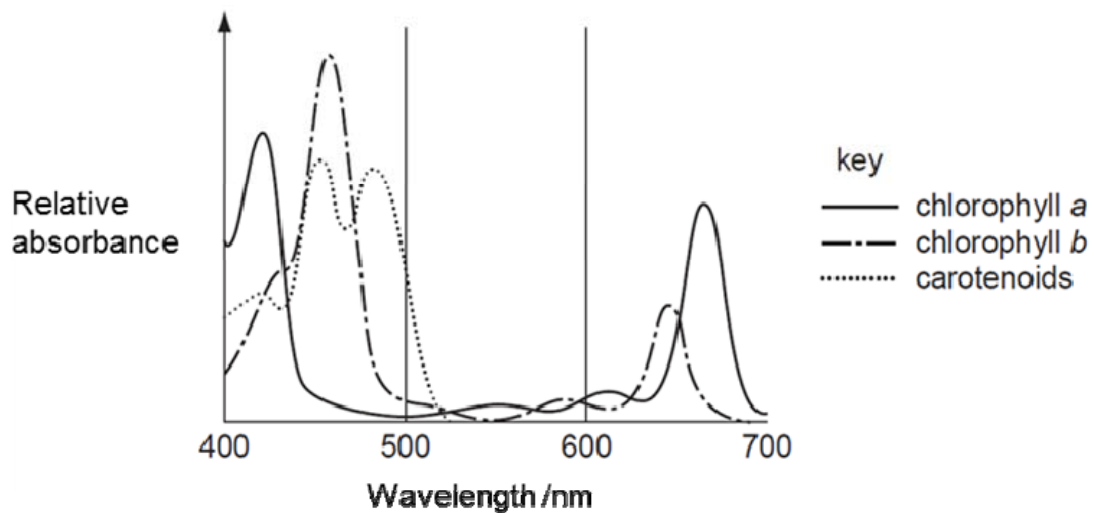
- A  $X^D X^D WW$
- B  $X^D X^d WW$
- C  $X^D X^D Ww$
- D  $X^D X^d Ww$

- 14 Which of the following statements are **CORRECT**?

1. A mutation in an allele occupying a gene locus may result in a change in the individual's phenotype.
2. Gene mutations always give rise to recessive alleles.
3. Chromosomal mutations can give rise to new alleles.
4. Aneuploids have extra chromosomes or chromosomal fragments in their genome.

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

- 15 The graph shows the absorption spectra of some pigments found in chloroplasts.



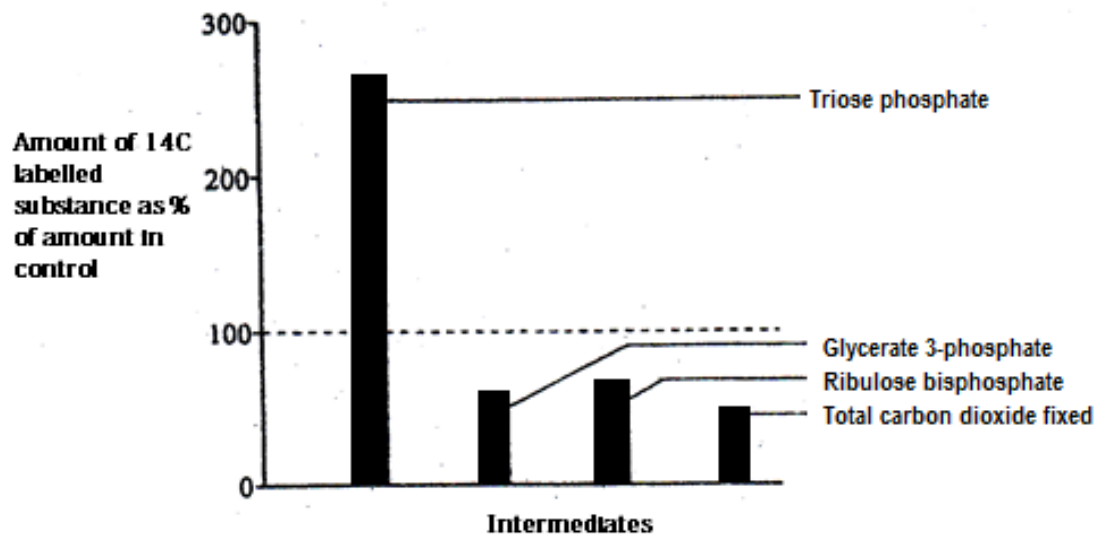
Which statement is **NOT** correct?

- A** Having several pigments rather than one increases the efficiency of photosynthesis.
- B** Photosynthesis will be fastest when exposed to red light as red light has higher energy than blue light.
- C** Prior to leaf fall, chlorophyll is broken down, leaving carotenoids which makes leaves look yellow or red.
- D** Most leaves are green as chlorophyll absorbs light in the blue and red regions of the spectrum.
- 16 Removal of the source of carbon dioxide from photosynthesising chloroplasts results in rapid changes in the concentration of certain chemicals. Which one of the following represents the **CORRECT** combination of concentration changes?

|          | <b>ATP</b> | <b>ribulose bisphosphate</b> | <b>glycerate-3-phosphate</b> |
|----------|------------|------------------------------|------------------------------|
| <b>A</b> | increases  | increases                    | decreases                    |
| <b>B</b> | increases  | decreases                    | increases                    |
| <b>C</b> | decreases  | increases                    | decreases                    |
| <b>D</b> | decreases  | decreases                    | increases                    |

- 17 An experiment was conducted to test the properties of a chemical G on the photosynthetic capabilities of a unicellular alga, *Chlorella*. An illuminated suspension of the alga was treated with carbon dioxide labelled with  $^{14}\text{C}$  in the presence of an unknown chemical G. The light was switched off and the amount of radioactivity present in some intermediates was determined after 10 minutes in the dark.

A control suspension of alga without chemical G being added was treated in exactly the same manner. The bar chart below shows the amount of radioactivity in these intermediates in the alga with chemical G added as a percentage of the intermediates in the control alga.



Which option **CORRECTLY** describes the action of chemical G?

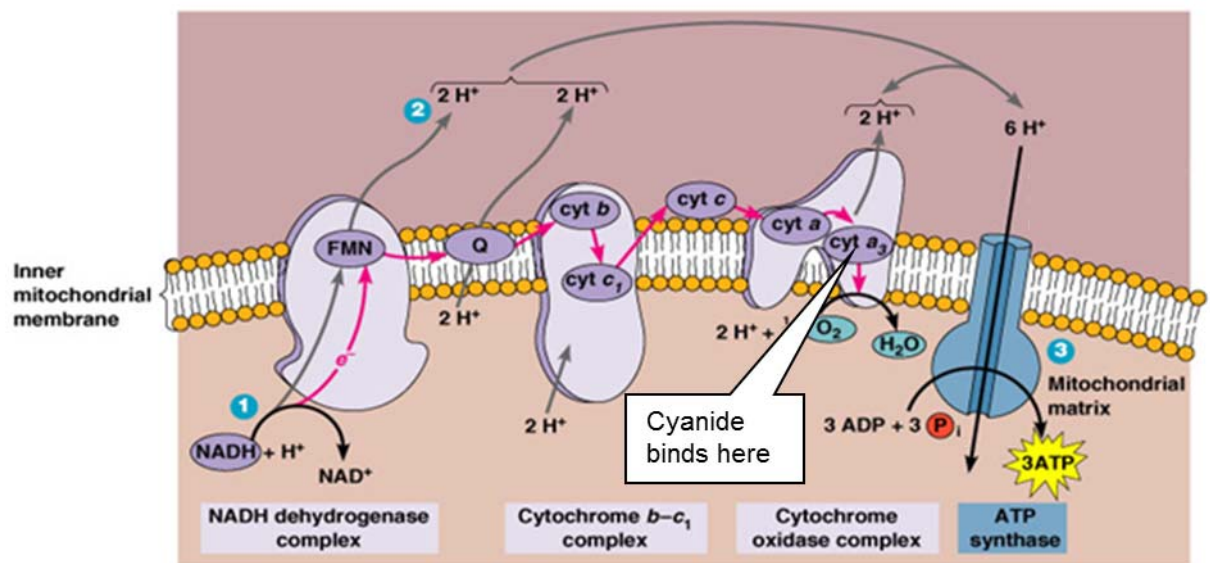
- A G binds to NADPH produced in light reactions and prevent its oxidation process.
- B G competes with triose phosphate for the active site of the enzyme that converts triose phosphate into hexose phosphate.
- C G inhibits the ribulose biphosphate carboxylase enzyme, preventing carbon fixation from taking place efficiently.
- D G prevents the regeneration of ribulose biphosphate at the stage after triose phosphate was formed.

18 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  $\text{NAD}^+$  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 combining with 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

19



Cyanide is an inhibitor that binds irreversibly with the enzyme cytochrome oxidase in the electron transport chain.

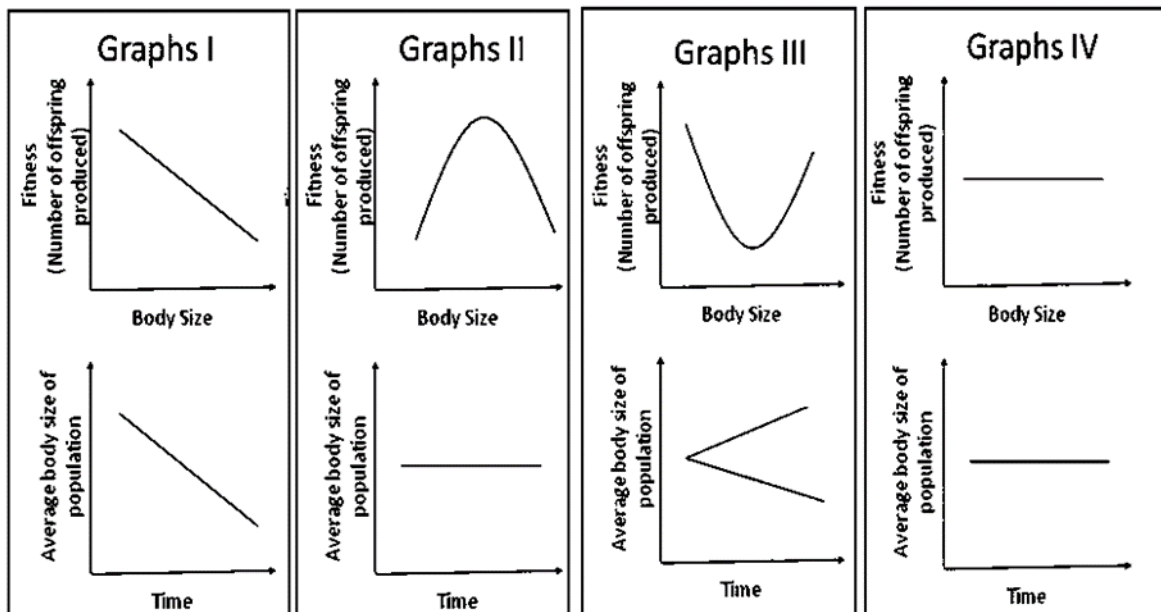
Which statement is **TRUE** of its effect on cellular respiration?

- A It prevents cells from breaking down glucose.
- B It prevents all synthesis of ATP in the cell.
- C The cell's demand for oxygen would decrease.
- D  $\text{NAD}^+$  would still be regenerated at the electron transport chain.

20 What is the 'link reaction' in eukaryotic respiration?

- A Oxidation of NADH to yield electrons and protons.
- B Passage of acetyl coenzyme A through the mitochondrial membrane.
- C Pyruvate joining with coenzyme A to produce  $\text{CO}_2$  and  $\text{NADH}/\text{H}^+$ .
- D Acetyl coenzyme A combining or joining with a  $\text{C}_4$  compound to give  $\text{C}_6$  + coenzyme A.

21 The different forms of natural selection can be distinguished according to their effect on the body size of the pink salmon (*Onchorhynchus gorbuscha*).



Select the **CORRECT** form of natural selection for each of the following sets of graphs.

|          | Graphs I              | Graphs II             | Graphs III            | Graphs IV             |
|----------|-----------------------|-----------------------|-----------------------|-----------------------|
| <b>A</b> | Disruptive selection  | Directional selection | Stabilizing selection | No selection          |
| <b>B</b> | No selection          | Stabilizing selection | Directional selection | Disruptive selection  |
| <b>C</b> | Directional selection | Stabilizing selection | Disruptive selection  | No selection          |
| <b>D</b> | Directional selection | Disruptive selection  | No selection          | Stabilizing selection |

- 22** A small population of copper-coloured butterflies was found in Eltham in 1938. The butterfly has since been found in one location in Castlemaine and six locations at Kiata. The butterfly lays its eggs on the native shrub sweet bursaria (*Bursaria spinosa*) and the larvae shelter in the nest of the Australian ant (*Notoncus emery*).

After 1956 it was thought that the butterfly was extinct, but it was found again in 1986.



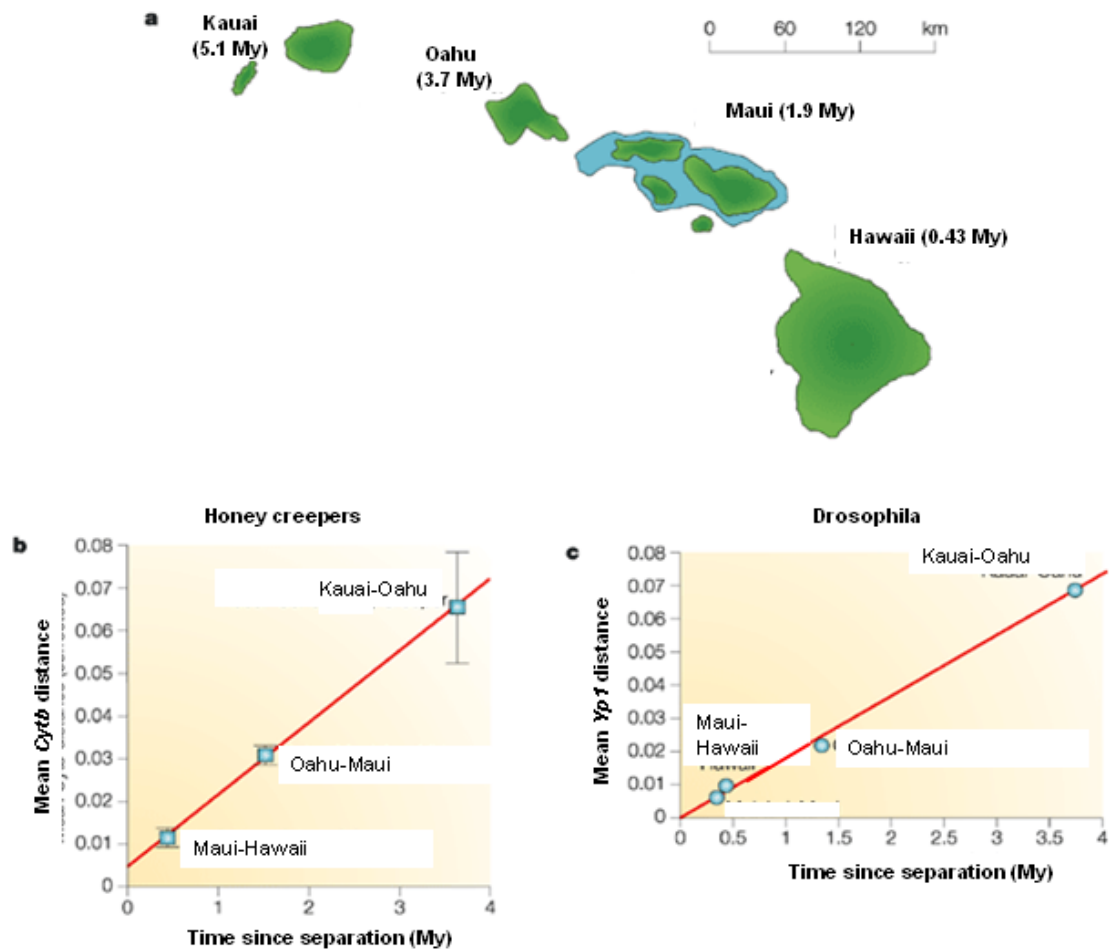
Extinction of the copper butterfly from all three areas would best be prevented by \_\_\_\_\_.

- A** moving the populations to one area to give greater genetic diversity
  - B** planting more sweet bursaria in reservation areas at all locations
  - C** burning off local undergrowth to remove competitive weeds
  - D** removing the nests of all Australian ants
- 23** Which one of the following statements about natural selection is **INCORRECT**?

Natural selection may \_\_\_\_\_.

- A** cause new genes to appear in a gene pool
- B** occur in stable environmental conditions
- C** result in an increase in the frequency of favourable genes in a gene pool
- D** result in an increase in the percentage of well-adapted individuals in a population

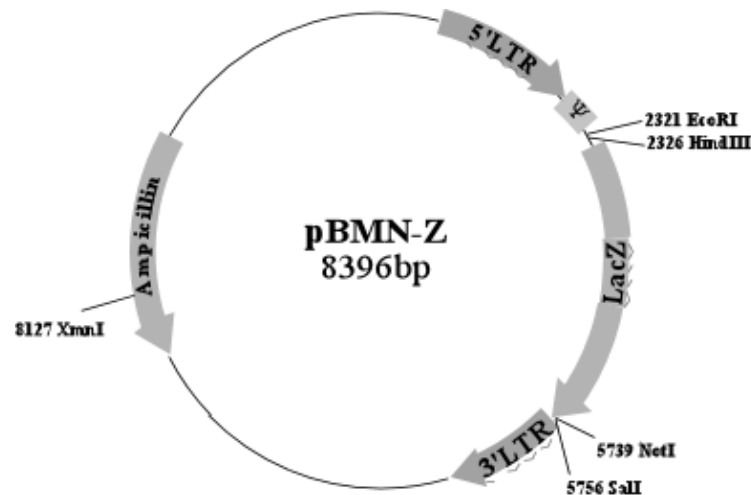
- 24 The volcanic islands that were formed millions of years ago, range from Kauai (the oldest) to Hawaii (the youngest). *Cytb* gene from honey creepers and *Yp1* gene from *Drosophila* were analysed for divergence.



Which of the following statement is **INCORRECT**?

- A Geographical isolation prevented colonization of newly formed islands.
- B There is a positive linear correlation between genetic distance and island age.
- C *Cytb* gene and *Yp1* gene are chosen because they are essential genes.
- D Genetic drift is a factor that contributes to the increase in the mean genetic distance.

- 25 As part of the procedure to produce recombinant proteins in *E. coli*, you are asked to insert the gene encoding for the MAL protein into the pBMN-Z vector. The restriction sites and selectable markers on the vector are shown below.

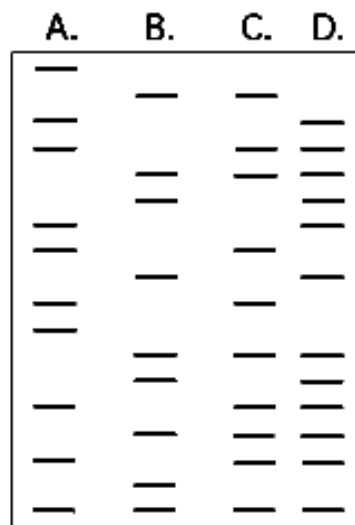


If the gene for MAL protein were to be inserted into Lac Z site, what should be added to the agar plate in order to screen for recombinant clones and how would the recombinant clones appear?

|          | Chemicals to be added  |         | Colour of colonies |
|----------|------------------------|---------|--------------------|
| <b>A</b> | Ampicilin              | X-gal   | Blue               |
| <b>B</b> | $\beta$ -galactosidase | X-gal   | Blue               |
| <b>C</b> | Ampicilin              | X-gal   | White              |
| <b>D</b> | $\beta$ -galactosidase | lactose | White              |



**26** The DNA profiles below represent four different individuals.



Which of the following statements is consistent with the results?

- A** B is the child of A and C.
- B** C is the child of A and B.
- C** D is the child of B and C.
- D** A is the child of B and C.

**27** Some of the goals of the Human Genome Project are:

- To determine the sequence of the entire human genome
- To identify all the genes in the human genome
- To find the locus of all the genes on the 46 human chromosomes

Which of the following are ethical concerns arising from the goals stated?

- 1** Anthropologist tracing the ancestry of human populations.
- 2** Parents choosing embryos for implantation only after tests for acceptable genes.
- 3** Insurance company offering cheaper rates to people with genetic disposition to fewer diseases.
- 4** Scientists developing tests for only some disease causing genes.
- 5** Genetic counsellors giving advice to people who are genetically pre-disposed to risks.

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

- 28 Totipotency is demonstrated when \_\_\_\_\_.
- A cancer cells give rise to heterogeneous cell types
  - B an isolated plant cell develops into a normal adult plant
  - C a hematopoietic stem cell differentiates into a lymphocyte
  - D an embryonic stem cell divides and differentiates
- 29 Which of the following genetic modifications would **NOT** decrease the quantity of chemicals sprayed onto crop plants by farmers?
- A Fungal resistance
  - B Herbicide resistance
  - C Insect resistance
  - D Viral resistance
- 30 Maize varieties are being developed in which the leaves produce proteins that are toxic to insects. The DNA coding for these toxic proteins was inserted into a maize chromosome via a bacterial plasmid. Many people are opposed to this process.
- Which objection is **NOT** biologically valid?
- A Beneficial insects may be killed if they eat genetically modified maize.
  - B Genes for antibiotic resistance are present in plasmids and these genes may be passed to harmful bacteria.
  - C Hybridisation may transfer the bacterial genes from maize to weeds, giving the weed species new and harmful characteristics.
  - D Mutations may be caused in cattle or humans that eat the genetically modified maize.

**END OF PAPER**

**2016 Y6 Preliminary Exam H1****MCQ Answer Scheme**

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