

**VICTORIA JUNIOR COLLEGE****JC 2 PRELIMINARY EXAMINATION 2018**

NAME : _____

CT CLASS : _____

H1 BIOLOGY**8876/1****Paper 1 Multiple Choice****1 hour**Additional material: Multiple choice answer sheet

READ THESE INSTRUCTIONS FIRST**Write your name, exam number on the answer sheet provided.**

Do not use any staples, paper clips, highlighters, glue or correction fluid.

There are **30** 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.

Read the instructions on the answer sheet very carefully.

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 paper.

The use of an approved scientific calculator is expected, where appropriate.

1 Which of the following is/are the most likely consequence(s) for animal cell lacking functional Golgi bodies?

1. The cell dies because it is unable to make glycoproteins to detect stimuli from its environment.
2. The cell dies from a lack of enzymes to digest food taken in by endocytosis.
3. The cell dies because of the accumulation of worn-out organelles within itself.
4. The cell is unable to synthesize centrioles for cell division.
5. The cell is unable to export its enzymes or peptide hormones.

- A** 1 and 5 only
B 2, 3 and 4 only
C All except 4
D All of the above

2 Which of the following options correctly matches the functional and structural features of cellulose, amylose, amylopectin and triglycerides?

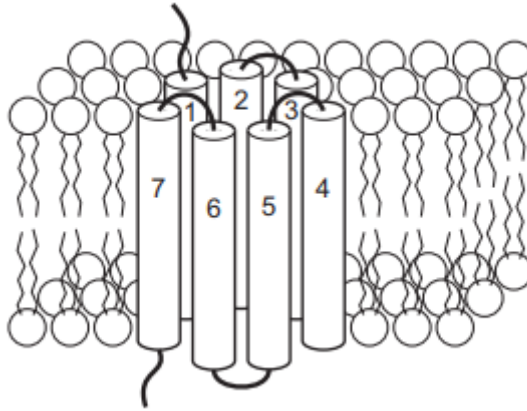
		Function	Structure		
			Linear/ Fibrous	Molecule held together by hydrogen bonds	Branched chains
A	Cellulose	Support	✓	x	✓
	Amylose	Storage	✓	✓	x
B	Cellulose	Support	✓	✓	x
	Triglyceride	Storage	x	x	x
C	Cellulose	Strengthening	✓	✓	✓
	Amylopectin	Storage	x	x	✓
D	Amylopectin	Storage	x	✓	✓
	Triglyceride	Storage	x	✓	x

3 Most wild plants contain toxins that deter animals from eating them. A scientist discovered that a toxin produced by a certain plant was also toxic to the same plant if it is applied to the roots of the plant. As the first step on finding out why the plant was not normally killed by its own toxin, he fractionated some plant cells and found that the toxin was in the largest organelle. He also found that the toxin was no longer toxic after it was heated.

Which of the following statements are consistent with the scientist's observations?

- A** The toxin is found in the mitochondria.
B The toxin is likely to be lipid-soluble.
C The toxin is possibly an enzyme.
D The toxin is likely to be very small in size.

- 4 Proteins which transport sugars out of cells have been identified. These proteins are called SWEETs. Each SWEET has seven coiled, cylindrical regions which together make up a pore through the cell surface membrane bilayer, as shown in the diagram below.



Which of the following describes each of the seven coiled regions (1-7) of a SWEET shown in the diagram?

- A primary structure held in its shape by bonds such as hydrogen bonds
 B primary structure held in its shape by peptide bonds
 C secondary structure held in its shape by bonds such as hydrogen bonds
 D secondary structure held in its shape by peptide bonds
- 5 An unusual enzyme has been found in a tropical grass.
- It catalyses the hydrolysis of the fungal polysaccharide, chitin, into amino sugars.
 - It also inhibits the activity of an enzyme in locust guts which catalyses the digestion of amylose.

What describes the actions of this unusual enzyme?

reaction catalysed	reaction inhibited
A hydrolysis of glycosidic bonds	condensation of glycosidic bonds
B hydrolysis of glycosidic bonds	hydrolysis of glycosidic bonds
C hydrolysis of peptide bonds	condensation of glycosidic bonds
D hydrolysis of peptide bonds	hydrolysis of glycosidic bonds

- 6** Influenza virus has an enzyme called neuraminidase which breaks down glycoproteins in the membrane of the cell that the virus will infect. The glycoprotein binds to the active site of neuraminidase by induced fit.

Which statements about the induced fit hypothesis of enzyme action are correct?

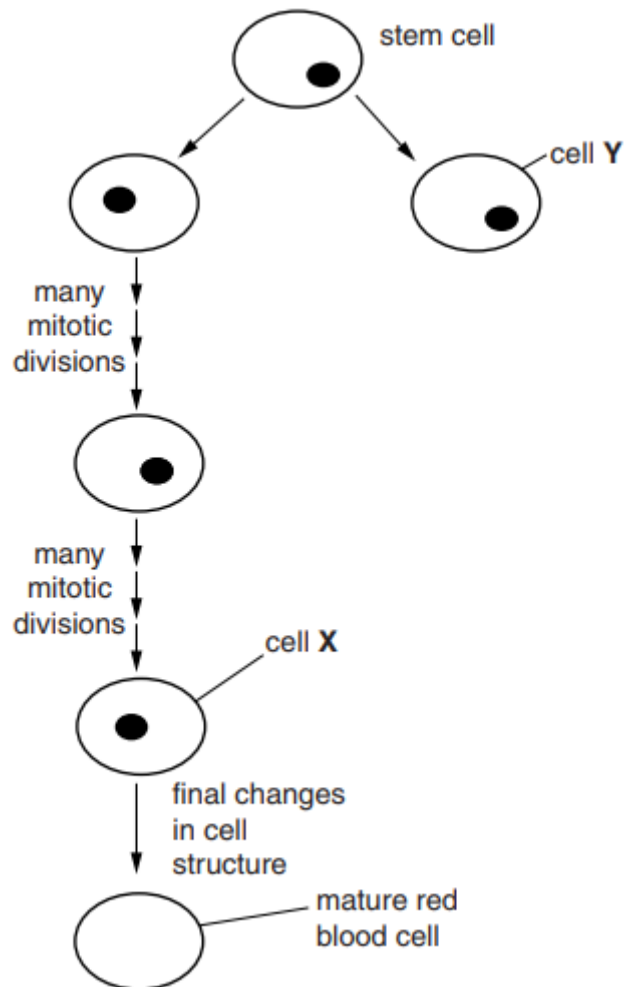
- 1 The active site must have a complementary shape to the substrate for them to bind together.
- 2 Activation energy is lowered when enzyme-substrate complex is formed, just like in the lock and key mechanism.
- 3 The substrate is converted to product by specific R-groups in the active site just like the lock and key mechanism.

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

- 7** Which of the following correctly describes the difference between adult stem cells and embryonic stem cells?

	Adult stem cells	Embryonic stem cells
A	Are differentiated, hence have limited longevity	Are not differentiated, hence are immortal
B	Found within mature tissue	Found within blastocysts
C	Limited lifespan as they cannot undergo mitosis indefinitely	Unlimited lifespan as they can undergo mitosis indefinitely
D	Pluripotent	Totipotent

- 8** Bone marrow contains many stem cells. Some of these stem cells are responsible for the replacement of red blood cells. During the production of red blood cells, a series of changes occur to the cell structure. The figure below shows the production of a red blood cell from one of these stem cells.



Which of the following correctly describes the changes that occur as cell X becomes a mature biconcave red blood cell?

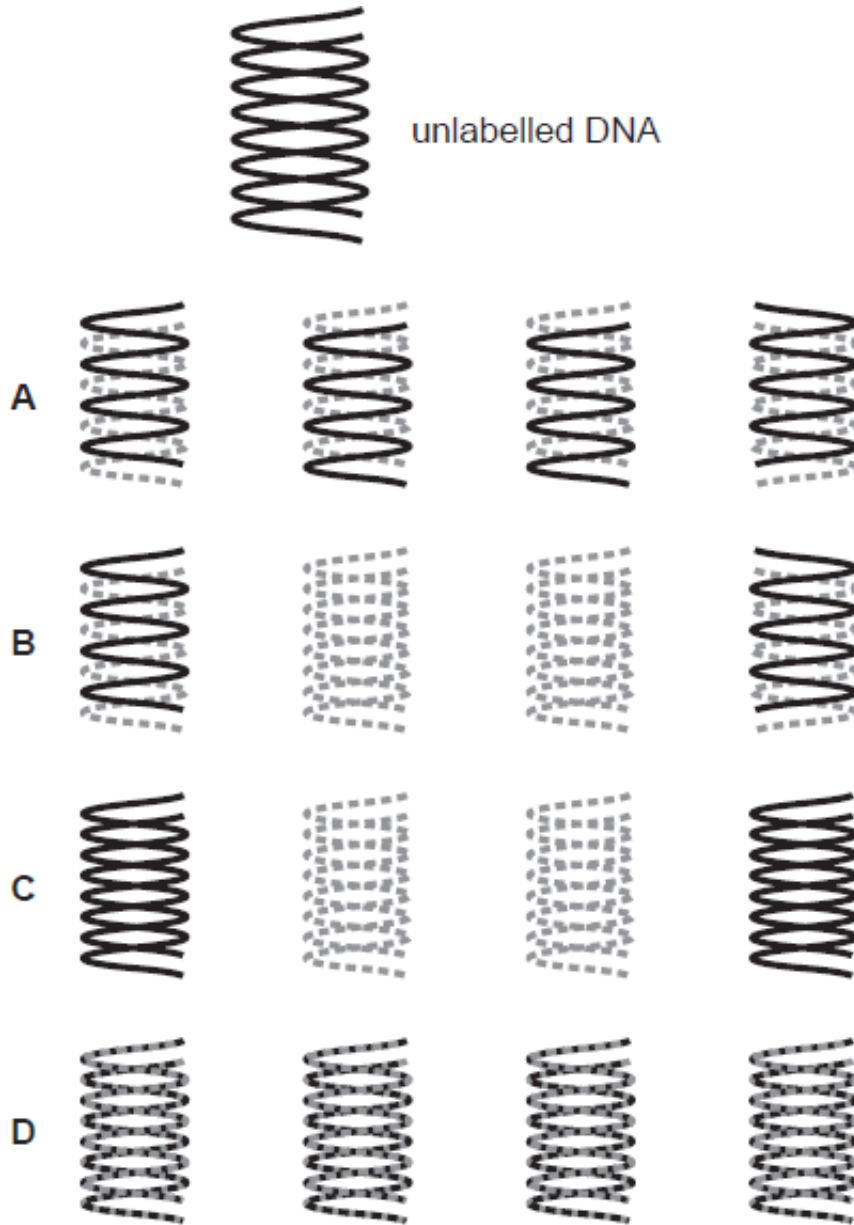
1. displays cell surface glycoproteins such as ABC antigens
2. becomes multipotent
3. synthesises haemoglobin and carbonic anhydrase
4. loses its nucleus
5. loses organelles such as ribosomes, ER, mitochondria
6. loses ability to divide indefinitely

- A** 1, 2, 4, 6
B 2, 3, 4, 6
C 1, 3, 4, 5
D 3, 4, 5, 6

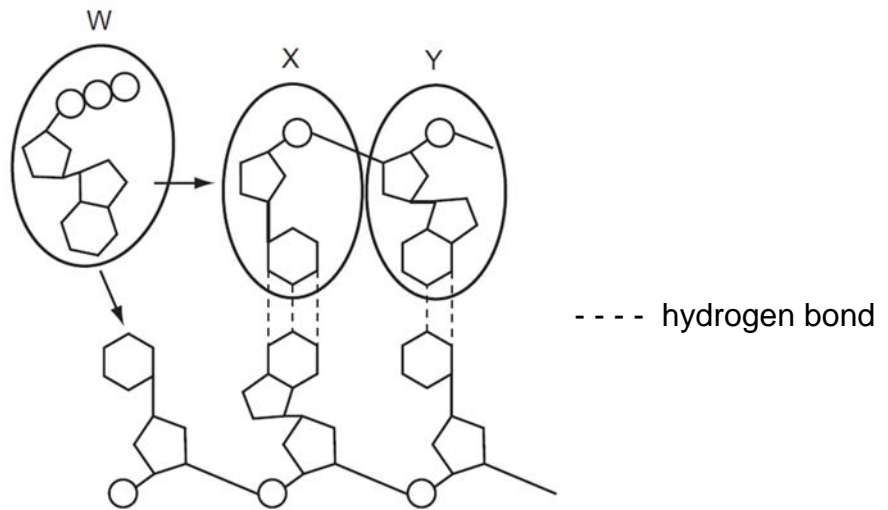
- 9 The sets of diagrams show four possible outcomes when an unlabelled molecule of DNA is allowed to replicate twice in the presence of ^{15}N -labelled nucleotides.

Labelled sections of DNA are represented by dotted lines.

Which set of diagrams correctly shows the result of DNA replication? (B)



- 10** The diagram shows the synthesis of a polynucleotide. Molecule W is a nucleoside triphosphate.



Which statements are correct?

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

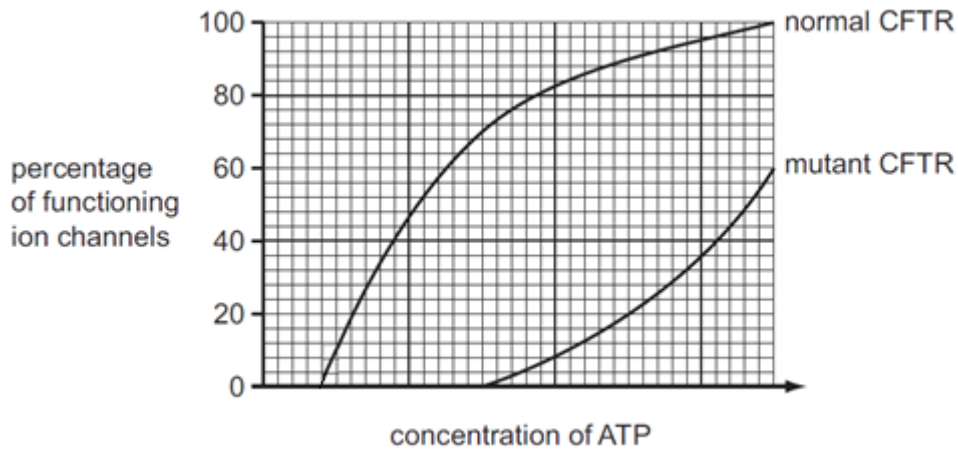
- A** 1 and 3 only
B 2 and 3 only
C 2 and 4 only
D 1, 2, 3 and 4

- 11** Which statements correctly describe the structure and function of prokaryote ribosomes?

1. A prokaryote ribosome can accommodate only one amino acyl-tRNA at a time.
2. Prokaryote ribosomes are smaller than eukaryote ribosomes and sediment at 70 S.
3. In prokaryotes, ribosomes can begin translating mRNA before its synthesis has been completed.
4. In prokaryotes, ribosomes translate mRNA in the same cellular compartment in which it is transcribed.

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

- 12** One of the many recessive mutations of the CFTR gene changes one amino acid in the region of the CFTR protein that binds ATP. The graph shows the effect of different concentrations of ATP on normal and mutant CFTR proteins.

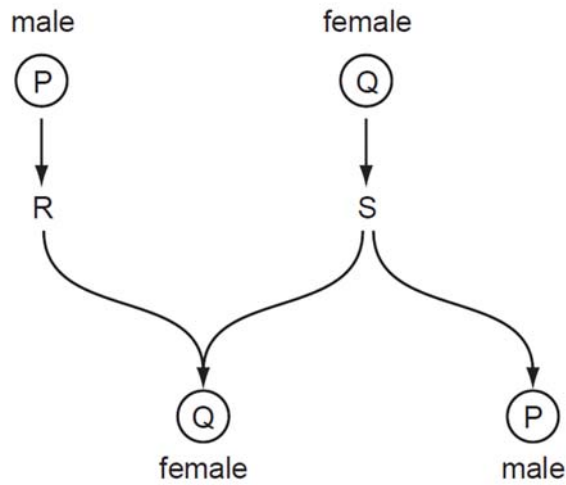


Which correctly describes individuals who are homozygous for this mutation?

1. Their CFTR protein cannot bind ATP and cannot act as an ion channel.
2. Their CFTR protein binds ATP less readily than normal CFTR protein.
3. These individuals produce a mutant CFTR protein that can bind ATP to function as an ion channel.
4. These individuals produce a mixture of normal and mutant CFTR protein, both of which can act as an ion channel.

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

- 13** Sex determination in some insects such as bees and wasps is not controlled by sex chromosomes.



Using the diagram, which row in the table shows how sex is determined in these insects?

	P	Q	R	S
A	n	n	mitosis	mitosis
B	n	2n	mitosis	meiosis
C	2n	n	meiosis	meiosis
D	2n	2n	meiosis	mitosis

- 14** The protein p53 is produced in a cell in response to DNA damage. This protein stops the cell cycle for a short time just before the DNA is replicated, so that the DNA can be repaired.

At which phase of the cell cycle will this stop occur?

- A** S
- B** M
- C** G1
- D** G2

- 15** In cattle, the gene responsible for normal development of hair and teeth, ectodysplasin 1 (*ED1*) is located on the X chromosome. Mutations in the *ED1* gene result in a rare genetic disorder, anhidrotic ectodermal dysplasia. Another character, the presence of horns, is determined by a gene on an autosome. The allele for the absence of horns (**H**) is dominant and the allele for the presence of horns (**h**) is recessive.

A horned bull with anhidrotic ectodermal dysplasia was mated on several occasions to the same female. A large number of offspring consisting of males and females in equal numbers in all combinations of phenotypes are shown in the table.

Offspring phenotypes
No anhidrotic ectodermal dysplasia, horns present
No anhidrotic ectodermal dysplasia, horns absent
Anhidrotic ectodermal dysplasia, horns present
Anhidrotic ectodermal dysplasia, horns absent

If X^E represents an X chromosome carrying the normal *ED1* allele and X^e represents an X chromosome carrying the *ED1* allele for anhidrotic ectodermal dysplasia, what is the genotype of the female parent?

- A** $X^E X^E H H$
- B** $X^E X^E H h$
- C** $X^E X^e H H$
- D** $X^E X^e H h$
- 16** Duchenne muscular dystrophy is a condition characterised by progressive muscle wasting. It is caused by a recessive mutation in the DMD gene, located on the X chromosome. The DMD gene codes for a protein known as dystrophin, which, in healthy individuals, prevents damage and weakening of muscle fibres.

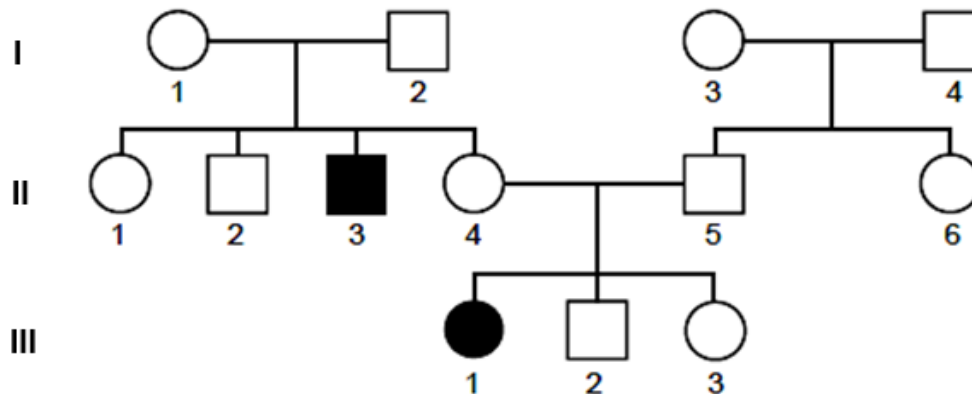
Which statement explains why not all affected males inherit the mutation from their mother?

- A** Some affected males inherit the mutation from their father, who has inherited the mutation from a carrier mother.
- B** Some affected males inherit the normal allele of a carrier mother but synthesise dystrophin molecules that have an altered tertiary structure.
- C** Some males with mothers who are not carriers of the mutated allele are affected as a result of a new mutation in the DMD gene.
- D** The single X chromosome of some affected males become inactivated and no dystrophin is synthesised.

17 Which statement concerning chrysanthemum plants, of the genus *Dendranthema*, is a valid example of how the environment may affect the phenotype?

- A** Anthocyanins and anthoxanthins are vacuolar pigments, whereas xanthophylls and carotenes are pigments found in membrane-bound organelles known as plastids. These, together with molecules known as co-pigments, are responsible for the variation observed in petal colour in *Dendranthema*.
- B** Identical genetic crosses performed between varieties of *Dendranthema* result in a greater proportion of offspring plants with plastids exhibiting a yellow colour when grown in a field and a greater proportion of offspring plants with colourless plastids when grown in a glasshouse.
- C** The seeds of a cross between *Dendranthema weyrichii* and *Dendranthema grandiflora* produce plants that are far more frost-tolerant and exhibit an extended flowering season compared with both parent plants.
- D** The seeds of a cross between *dendranthema weyrichii* (height varying between 12.5 – 15.0 cm) and *Dendranthema grandiflora* (height varying between 8.0 – 25.0 cm) produce plants, when grown in natural day length, of a height varying between 55.0 – 71.0 cm.

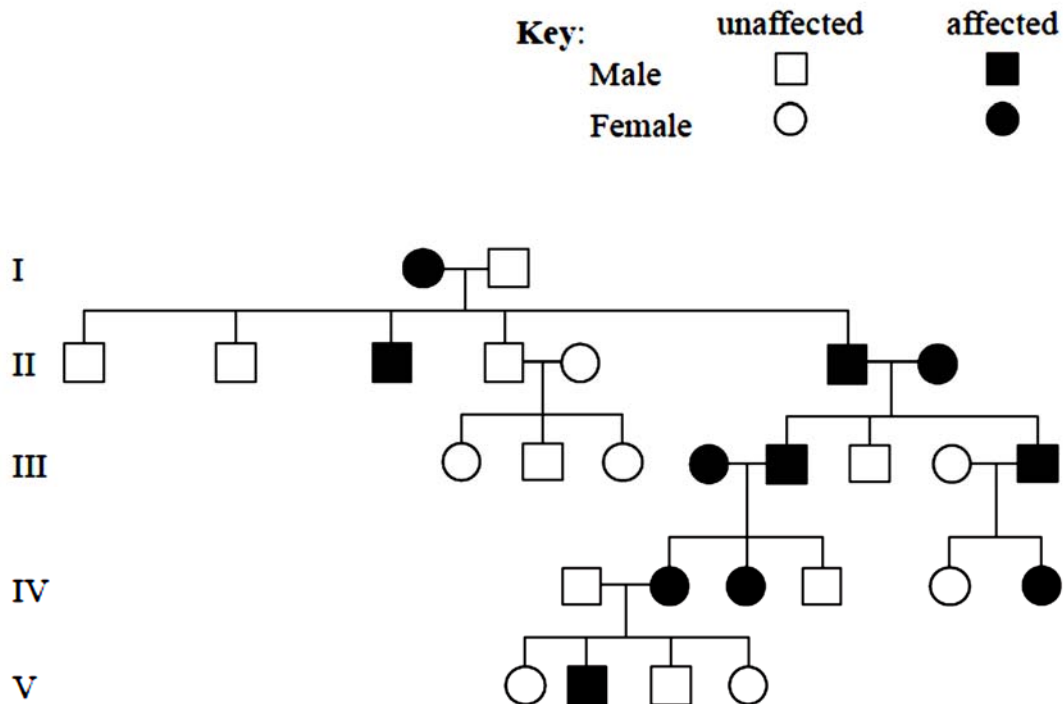
18 ALDOA deficiency is a genetic condition in which affected individuals fail to produce the enzyme aldolase A, leading to haemolytic anaemia. The pedigree shows a family where two members have ALDOA deficiency.



If individual **III-3** was to marry an affected man, what is the probability that their first child is an affected boy? $2/3 \times 1/2 \times 1/2 = 1/6$

- A** 2/3
- B** 1/4
- C** 1/3
- D** 1/6

- 19 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 autosomal**
- C Recessive and sex-linked
- D Recessive and autosomal
- 20 In a breed of rabbits, multiple alleles with the following dominance relationships control coat colouration:

C (agouti) > **c^{ch}** (chinchilla) > **c^h** (Himalayan) > **c** (albino)

An experimental cross between agouti and Himalayan produced 50% agouti and 50% Himalayan progeny.

Which cross would have the lowest probability of producing this result?

- A **Cc^h** x **c^hc^h**
- B Cc** x **c^hc**
- C **Cc^h** x **c^hc**
- D **Cc** x **chch**

- 21** In an experiment to measure the rate of photosynthesis of a water plant, bubbles of oxygen produced by the cut end of the stem were collected under the funnel-shaped end of a glass tube. After 20 minutes, a syringe attached to the far end of the tube was used to draw the oxygen bubble up the tube so that its length could be measured against a mm scale.

The mean length of the bubble was 12 mm in a tube of diameter 0.5 mm.

What is the hourly rate of oxygen production in this plant?

- A** 7.1 mm³ h⁻¹
B 22.2 mm³ h⁻¹
C 28.3 mm³ h⁻¹
D 56.5 mm³ h⁻¹

- 22** Which of the following is a correct comparison between aerobic respiration and anaerobic respiration in yeast?

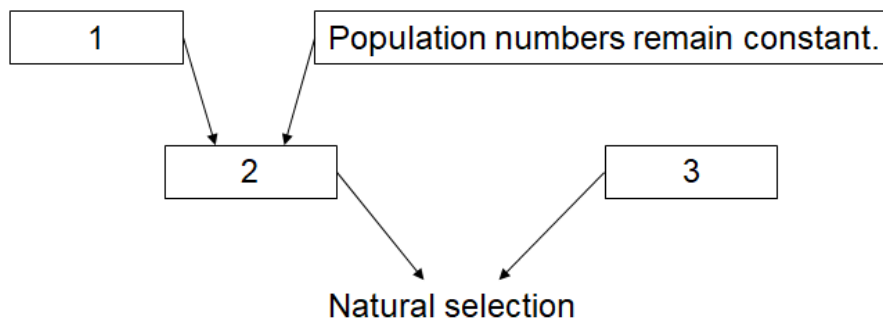
	Similarity	Difference
A	Both result in ATP and carbon dioxide being produced.	Anaerobic respiration involves enzyme catalysis but not aerobic respiration.
B	Both occur during strenuous activities.	Anaerobic respiration produces ethanol but aerobic respiration produces water.
C	Both include process(es) that occur(s) in the cytoplasm.	Aerobic respiration gives 18-19 times as much ATP as anaerobic respiration per glucose molecule.
D	Both involve the complete oxidation of glucose.	Pyruvate remains in the cytoplasm in anaerobic respiration, but it enters the mitochondria in aerobic respiration.

- 23** Which of the following correctly explain how mitochondria are adapted for cellular respiration?

1. The mitochondrial membranes contain transport protein for glucose.
2. The inner membrane forms cristae to increase surface area to make more ATP.
3. The mitochondrial matrix contains starch granules that can be broken down.
4. The mitochondrial membranes are permeable to oxygen and carbon dioxide.

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

24 The diagram shows a summary of Darwin's theory of natural selection.



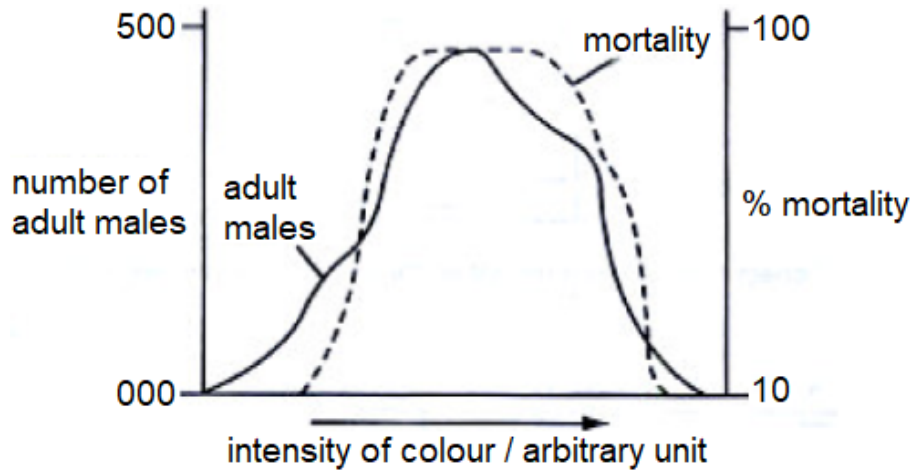
Which statements should be placed in boxes 1, 2 and 3?

	Individuals show great reproductive capacity.	Variation is observed within the population.	There is a struggle for existence.
A	1	2	3
B	1	3	2
C	2	3	1
D	3	1	2

25 Which of the following does not explain why the population is the smallest unit that can evolve?

- A** Natural selection involves competition between individuals in a population.
- B** Evolution occurs when allele frequency in a population changes due to selection or chance events like infections with lethal diseases.
- C** Differential reproductive success is observed at the population level due to the phenotypic variations in the population.
- D** Evolution involves the introduction of advantageous mutations into the gene pool of a population as a result of a selective pressure.

- 26** The graph below shows data on a population of a species of moth which shows considerable variation in colour intensity. Which conclusion can be made from this graph?



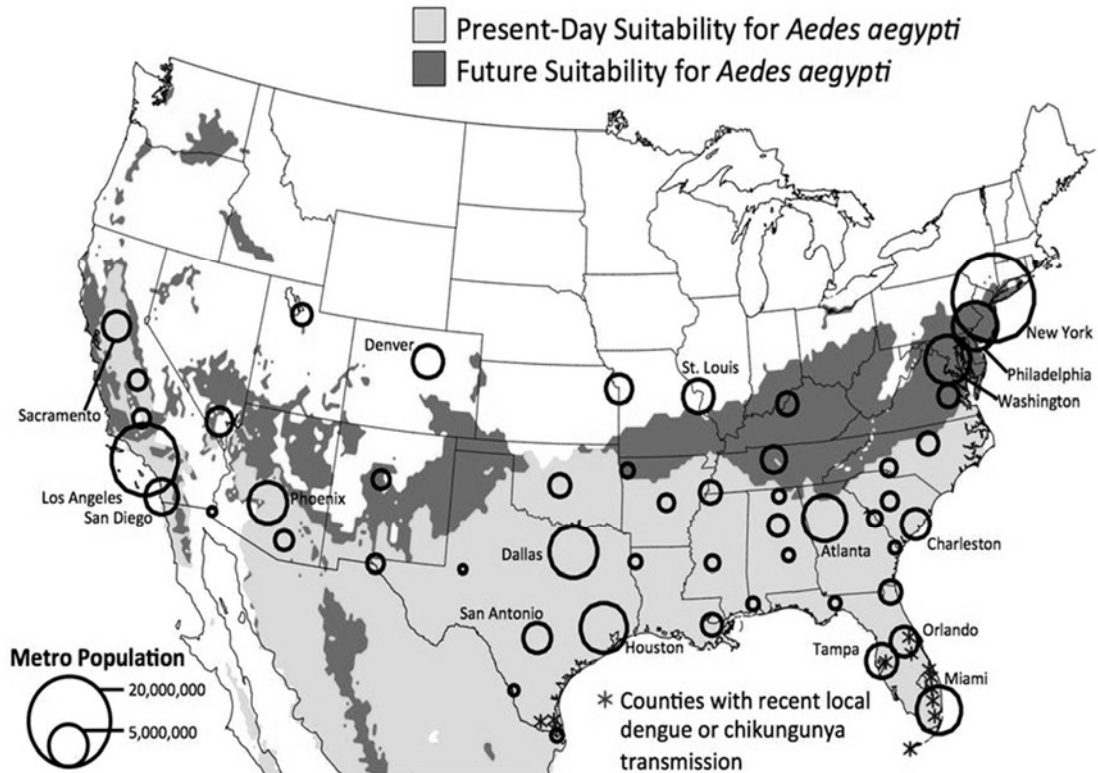
- A Stabilising selection is occurring.
 B Females preferably mate with males with extreme colour intensities.
 C Male moths develop different colour intensities as they mature into adults.
D Colour variation is due to the additive effect of polygenes.
- 27** Corals are colonies of marine animals that contain photosynthetic algae inside their cells. Environmental changes can result in coral bleaching, where the pigmented algae are lost from the corals.

Which of the following statement(s) support(s) the idea that algal photosynthesis is important to corals?

1. Bleached corals grow more slowly.
2. Corals receive carbohydrates from the algae they host.
3. Carbon dioxide from coral respiration is used by the algae in their cells.

- A (i) only
B (i) and (ii) only
 C (ii) and (iii) only
 D (i) and (iii) only

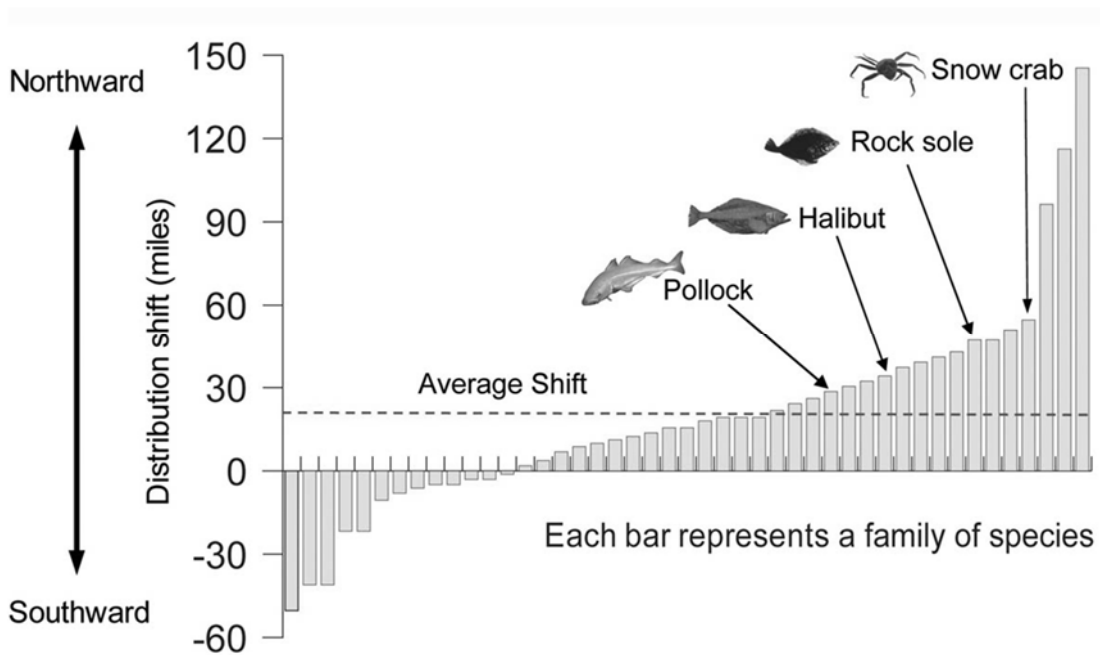
- 28** The figure below shows the current and potential spread of dengue and chikungunya across the United States.



Which of the following best explains the current or potential trends in the spread of these diseases as shown in the figure?

- A** Most of the regions with recent local dengue or chikungunya transmission are coastal regions possibly because these regions receive more rainfall and provide more suitable breeding grounds for *Aedes aegypti*.
- B** The larger the size of the metro population, the higher the chances of mosquitoes transmitting the diseases from person to person.
- C** These diseases would spread higher in altitude in the future with increased global warming.
- D** The diseases are unlikely to spread to the northern regions (in white) in the future because they are mostly mountainous regions that are too cold to be affected by global warming.

- 29** The figure below shows the change in the distribution of numerous marine species due to climate change.

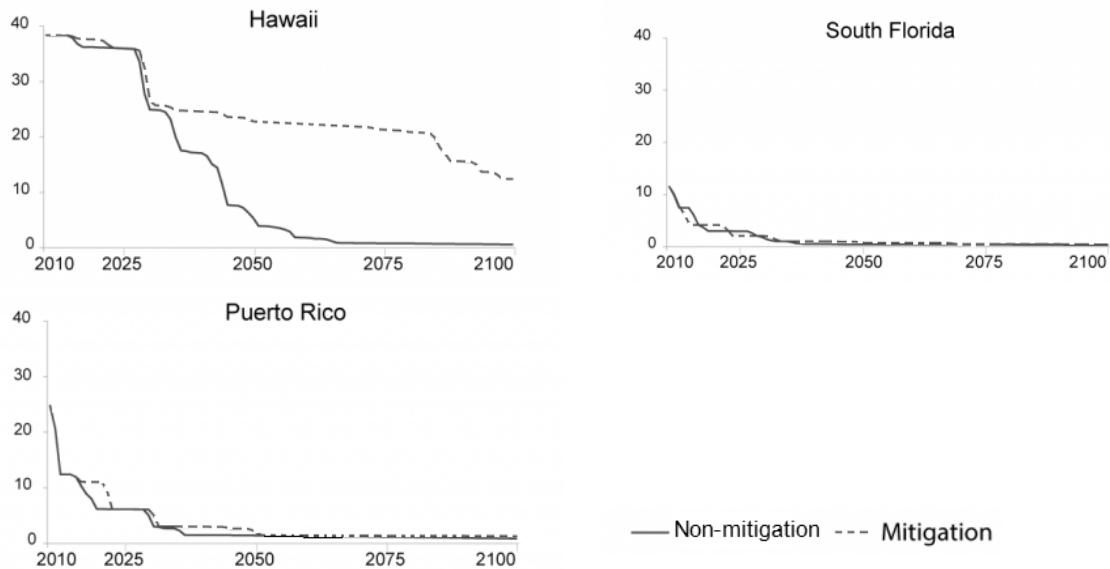


Which of the following conclusions can be verified from the data shown in the figure above?

1. There is an average northward migration of marine species by about 23 miles.
2. Most marine species migrated northward to escape their predators.
3. Some marine species that migrated southward will face competition for food and other resources from local species.

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

- 30** Some studies reveal that mitigating (reducing) global greenhouse gas emissions have varied effectiveness in reducing negative impact on coral growth. The figure below shows the projected coral reef cover (%) over time (year) in Hawaii (latitude 22.2°N), South Florida (24.5°N) and Puerto Rico (18.2°N) under mitigation and non-mitigation scenarios.



Based on the information given above, which of the following are possible explanations for the projected coral reef cover in the various locations after mitigation?

1. The coral reef cover in Hawaii is projected to improve significantly after mitigation because average sea temperatures there may not be significantly higher than the thermal limit of the corals.
2. It is projected that mitigation in South Florida and Puerto Rico would not significantly improve coral reef because these countries are closer to the equator as compared to Hawaii.
3. Recovery of coral cover after mitigation in South Florida is projected to be negligible because the extent of damage is already very high.

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