

JURONG JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATIONS
Higher 1

CANDIDATE
NAME

CLASS

BIOLOGY

8875/01

Paper 1 Multiple Choice

18 September 2015

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name and class on the Answer Sheet in the spaces provided unless this has been done for you.

There are **thirty** questions on 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 booklet.

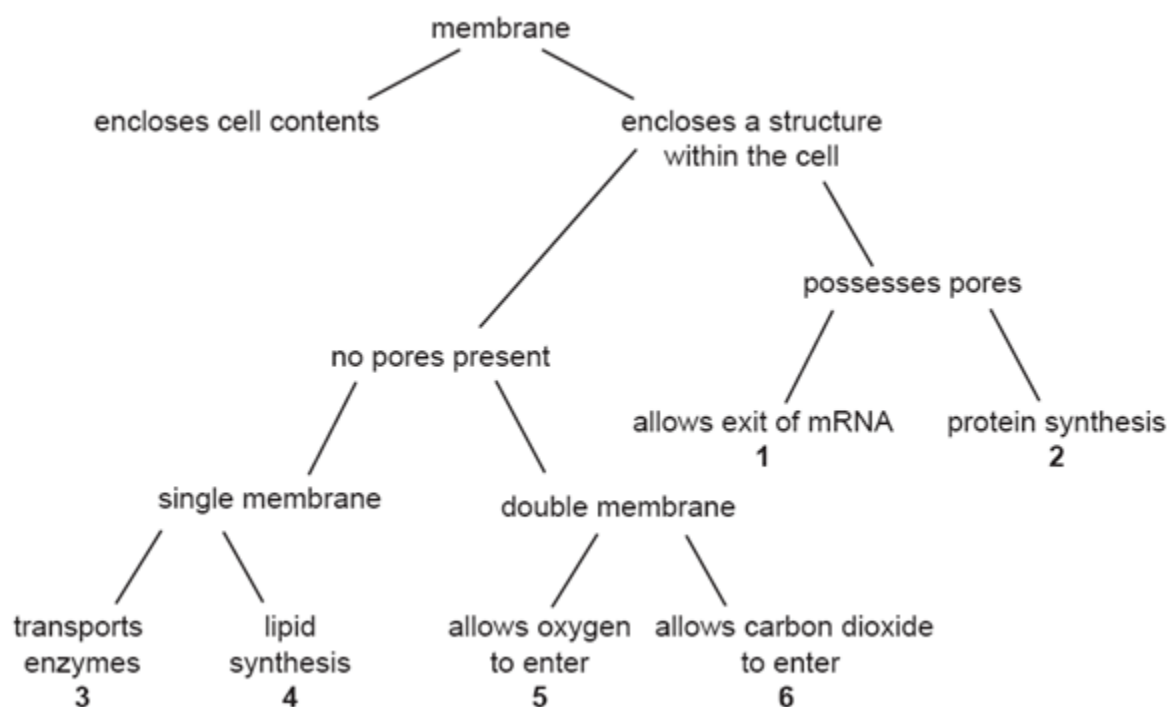
The use of an approved scientific calculator is expected, where appropriate.

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

[Turn over

1 Membranes within and at the surface of cells have different roles.

The diagram allows the identification of the various organelles within the cell, by describing the membrane structure and function.



Which of the outcomes shown below correctly identifies the organelles that possess the membrane and function concerned?

	1	2	3	4	5	6
A	nucleus	ribosome	vesicle	smooth ER	mitochondrion	chloroplast
B	nucleolus	rough ER	vesicle	smooth ER	nucleus	mitochondrion
C	nucleus	rough ER	vesicle	smooth ER	mitochondrion	chloroplast
D	nucleus	smooth ER	mitochondrion	rough ER	vesicle	chloroplast

2 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

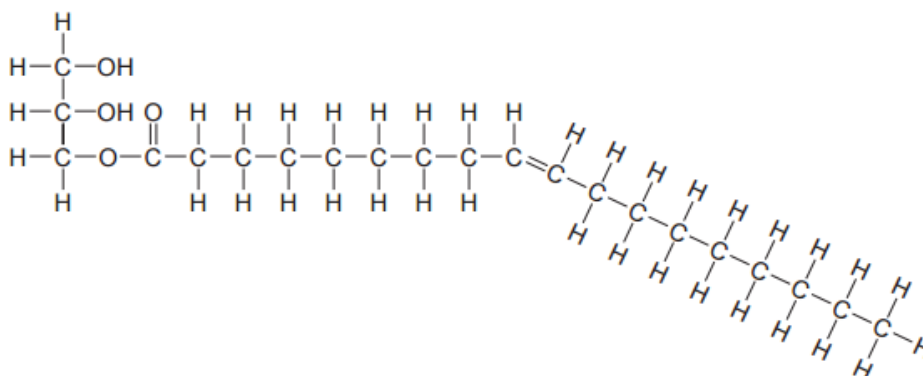
A 1 and 3 only

B 1 and 4 only

C 2 and 3 only

D 2 and 4 only

3 The diagram shows a triglyceride molecule that has been partially hydrolysed.



What will be the products of the total hydrolysis of the molecule shown?

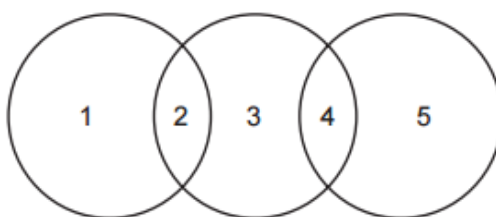
A a molecule of glycerol and a saturated fatty acid molecule only

B a molecule of glycerol and an unsaturated fatty acid molecule only

C a molecule of water, a molecule of glycerol and a saturated fatty acid molecule

D a molecule of water, a molecule of glycerol and an unsaturated fatty acid molecule

- 4 The diagram shows the relationship between the levels of protein structure and bonds.



Which row is correct?

	1	2	3	4	5
A	primary	peptide	secondary	ionic	tertiary
B	secondary	hydrogen	tertiary	peptide	primary
C	tertiary	ionic	primary	peptide	quaternary
D	quaternary	ionic	tertiary	ionic	secondary

- 5 What is the effect of an enzyme in an enzyme-catalysed reaction?

- A** decreases the activation energy and has no effect on the energy yield
- B** increases both the activation energy and the energy yield
- C** decreases the activation energy and increases the energy yield
- D** decreases both the activation energy and the energy yield

- 6 Ethylene glycol is a chemical used to prevent water from freezing. If ethylene glycol is swallowed accidentally, it is metabolised by an enzyme found in liver cells to produce a toxic product. The enzyme normally catalyses the oxidation of ethanol to a harmless product.

People who have swallowed ethylene glycol are treated with large doses of ethanol. This prevents formation of a toxic product and allows the body to excrete the ethylene glycol.

Which statement describes why this treatment works?

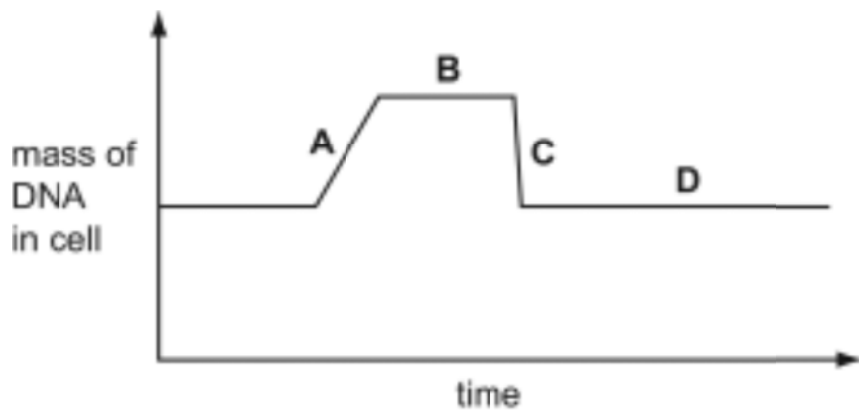
- A** Ethanol binds near the active site on the enzyme, altering its shape.
- B** Ethanol binds permanently to the active site of the enzyme, blocking it.
- C** Ethanol changes the tertiary structure of the enzyme, denaturing it.
- D** Ethanol is more likely to bind to the active site on the enzyme.

- 7 The electron micrograph shows a cell at a particular stage during the cell cycle.



The graph shows the mass of DNA within a cell during the cell cycle.

When does the stage shown in the diagram occur?



- 8 Nocodazole is a chemical used in the study of mitosis. It causes all mitotic cells to stop dividing at metaphase.

Which statement(s) correctly identify how this chemical might work?

- 1 inhibits chromatin condensing in the nucleus
- 2 prevents replication of the centrioles
- 3 stops sister chromatids migrating to opposite poles

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

- 9 The table shows the relative amounts of the bases adenine, thymine, guanine and cytosine in DNA from different organisms.

source	adenine	thymine	guanine	cytosine
bacterium	23.8	23.1	26.8	26.3
maize	26.8	27.2	22.8	23.2
fruit fly	30.7	29.5	19.6	20.2
chicken	28.0	28.4	22.0	21.6
human	29.3	30.0	20.7	20.0

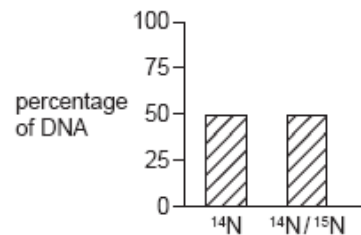
Which statements account for the importance of the ratios of A to T and G to C to the structure of DNA?

- 1 Complementary base pairing can occur.
- 2 Mutation will occur when pairing ratio is lost.
- 3 Semi-conservative DNA replication can occur to copy DNA strands.
- 4 Phosphodiester bonds helps to hold two strands together.
- 5 Purines and pyrimidines have different sizes and shapes.

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

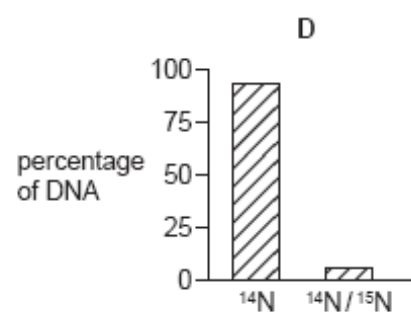
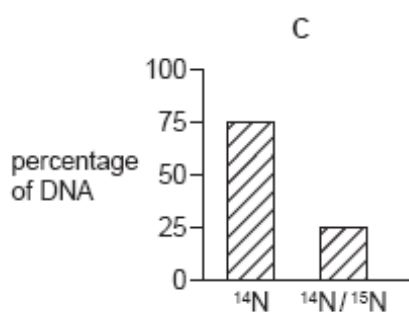
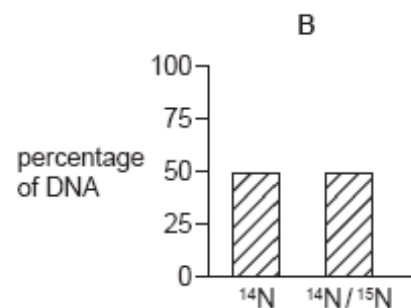
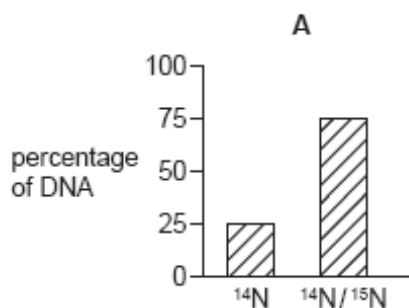
- 10 Bacteria were grown in a medium containing ^{15}N . After several generations, all of the DNA contained ^{15}N . Some of these bacteria were transferred to a medium containing the common isotope of nitrogen, ^{14}N . The bacteria were allowed to divide once. The DNA of some of these bacteria was extracted and analysed. This DNA was all hybrid DNA containing equal amounts of ^{14}N and ^{15}N .

Some bacteria from the medium with ^{15}N were transferred into a medium of ^{14}N . The bacteria were allowed to divide twice. The graph shows the percentages of ^{14}N and ^{15}N in the DNA of these bacteria.

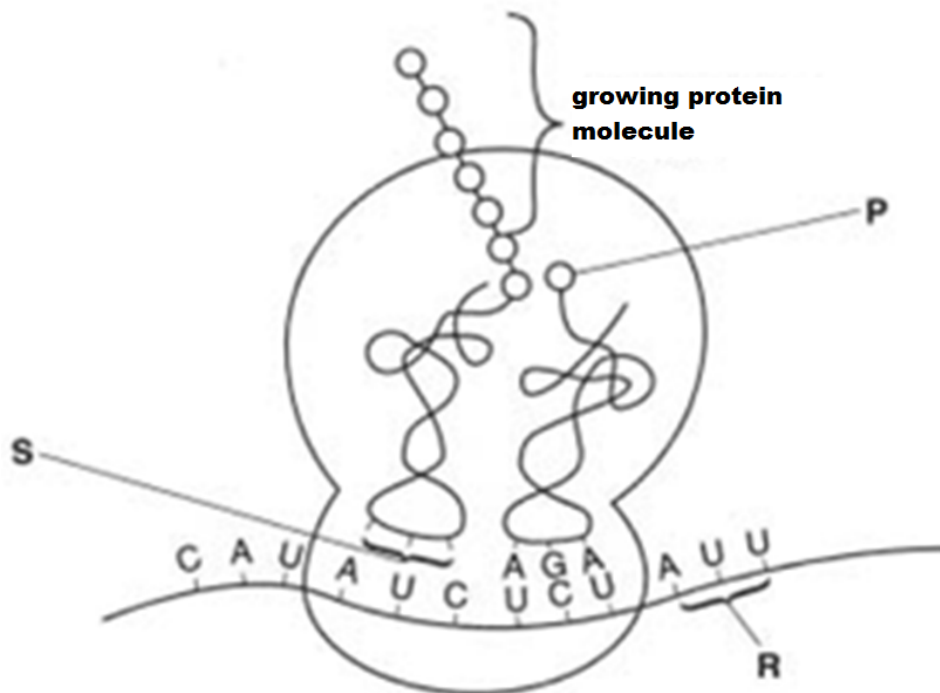


Some bacteria from the medium with ^{15}N were transferred into a medium of ^{14}N . The bacteria were allowed to divide three times.

What would be the percentages of ^{14}N and ^{15}N in the DNA extracted from these bacteria?



- 11 The diagram shows the process of translation occurring at a ribosome in a cell that synthesises secretory enzymes.



The table shows some triplet base sequences of mRNA and the amino acids for which they code.

mRNA	amino acid
AUU	isoleucine
AUC	isoleucine
AUG	methionine
AGA	arginine
UUA	leucine
UCU	serine
CAU	histidine

Which row correctly identifies P, S and R?

	P	S	R
A	arginine	UAG	codes for isoleucine
B	serine	GAU	codes for leucine
C	arginine	TAG	codes for leucine
D	serine	UAG	codes for isoleucine

12 In three different genetic dictionaries, the genetic code for the amino acid cysteine is given as:

ACA or ACG OR
TGT or TGC OR
UGU or UGC

The explanation for this may be:

- 1 Some genetic dictionaries show mRNA codons, others show DNA triplets.
- 2 Some genetic dictionaries show the triplet code complementary to the mRNA code, others show the triplet code for the other strand.
- 3 The genetic code can be read in either the 3' or 5' direction along the DNA.
- 4 The genetic code is a degenerate triplet code.

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

13 What do chromosomal aberrations and gene mutations have in common and how are they different?

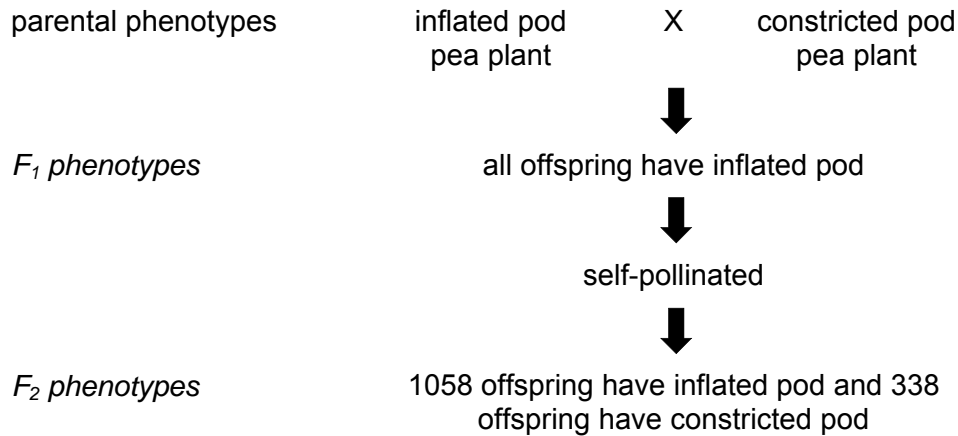
	similarity	difference
A	Both may involve addition of nucleotides.	Gene mutations always produce dominant alleles but not chromosomal aberrations.
B	Both may not result in disorders.	Gene mutations do not involve inversions but inversion of segments of chromosomes does occur.
C	Both affect DNA sequence.	Gene mutations occur within a chromosome but chromosomal aberrations may occur across chromosomes.
D	Both may not result in a difference in protein expression.	Chromosomal aberrations are more harmful than gene mutations.

- 14** In a bacterial cell, a mutation in a gene coding for aminoacyl-tRNA synthetase leads to the attachment of alanine to the entire tRNA^{Ser} population (alanyl-tRNA^{Ser}).

Which statement describes the result of using these aminoacyl-tRNAs for protein synthesis in the cell?

- A** The alanyl-tRNA^{Ser} will not function in protein synthesis.
 - B** Proteins synthesised using the alanyl-tRNA^{Ser} will contain serine and alanine in equal amounts.
 - C** Proteins synthesised using the alanyl-tRNA^{Ser} will contain only serine where alanine would normally occur.
 - D** Proteins synthesised using the alanyl-tRNA^{Ser} will contain only alanine where serine would normally occur.
- 15** A certain breed of mouse can have fur that is either black or brown. A mouse breeder performs a test cross using a brown mouse to determine the unknown genotype of a black mouse. There are four offspring produced by the cross. What conclusions can be drawn?
- A** If the black mouse is homozygous, one of the four offspring must be brown.
 - B** If the black mouse is heterozygous, three of the four offspring must be black.
 - C** The black mouse must be homozygous if all four offspring are black.
 - D** The black mouse must be heterozygous if any of the offspring are brown.

- 16 In 1925, Sinnott and Dunn repeated one of Mendel's experiments and recorded the following result after crossing two pure-breeding pea plants.



What conclusions are consistent with these results?

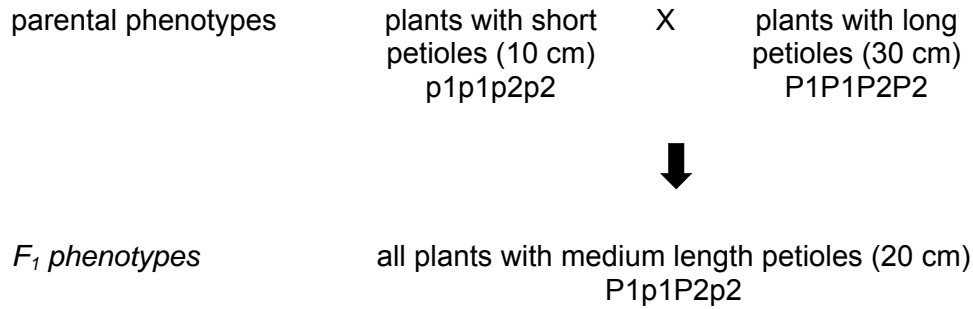
- 1 Inflated or constricted pod shape in peas is dependent on the inheritance of a pair of codominant alleles for pod shape.
- 2 Each pea plant carries two alleles of the gene for pod shape in all its cells except for its gametes.
- 3 A gamete produced by a plant in the *F*₁ generation has an equal chance of carrying the allele for inflated pod shape or the allele for constricted pod shape.
- 4 The inflated pod plants in the *F*₂ generation all carry the allele for constricted pod shape.

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

- 17 The length of the petiole (leaf stalk) in a type of flowering plant is controlled by two genes, P1 and P2. These genes are at different loci on non-homologous chromosomes.

Plants with long petioles (30 cm) are homozygous dominant.
 Plants with short petioles (10 cm) are homozygous recessive.
 Each dominant allele contributes 5 cm to the petioles length.

To obtain plants which have medium length petioles (20 cm), a plant breeder carries out the cross below.



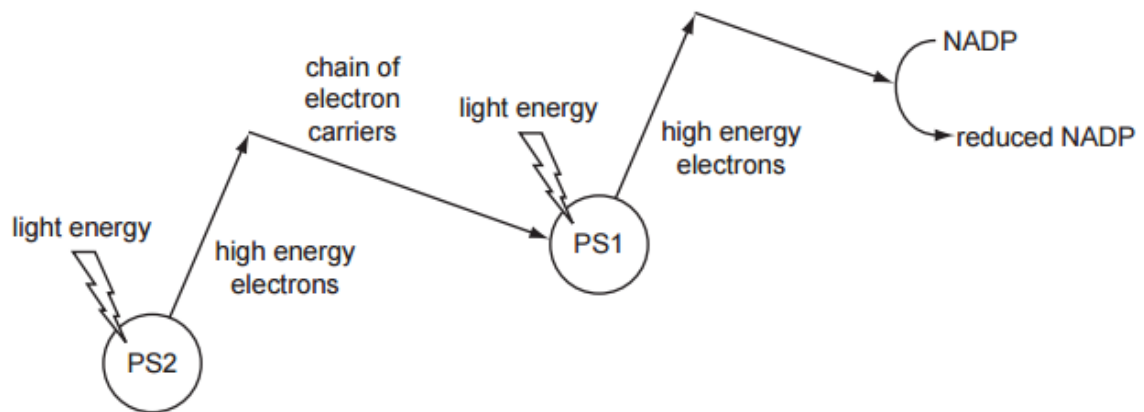
If the *F*₁ generation plants with medium length petioles were allowed to cross, what proportion of their offspring would be expected to have medium length (20 cm) petioles?

- A 0.0625
- B 0.250
- C 0.375
- D 0.5

18 If photosynthesising green algae are provided with CO_2 synthesised with heavy oxygen (^{18}O), later analysis will show that all but one of the following compounds produced by the algae contain the ^{18}O label. That one exception is

- A glycerate phosphate
- B glucose
- C RuBP
- D O_2

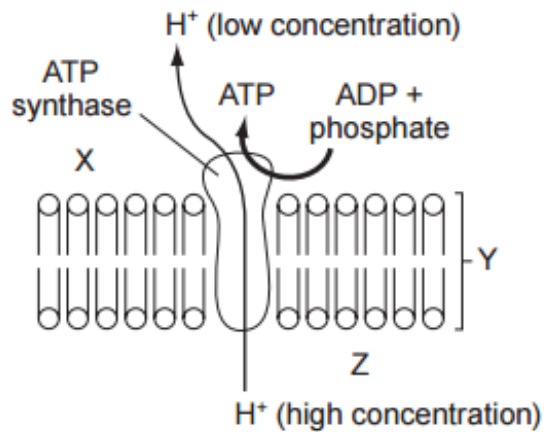
19 The diagram shows some of the processes in the light-dependent stage of photosynthesis.



For the light-dependent stage to continue, photosystem two (PS2) must gain electrons. Where do these electrons come from?

- A electron carriers
- B reduced NADP
- C photolysis
- D the formation of ATP

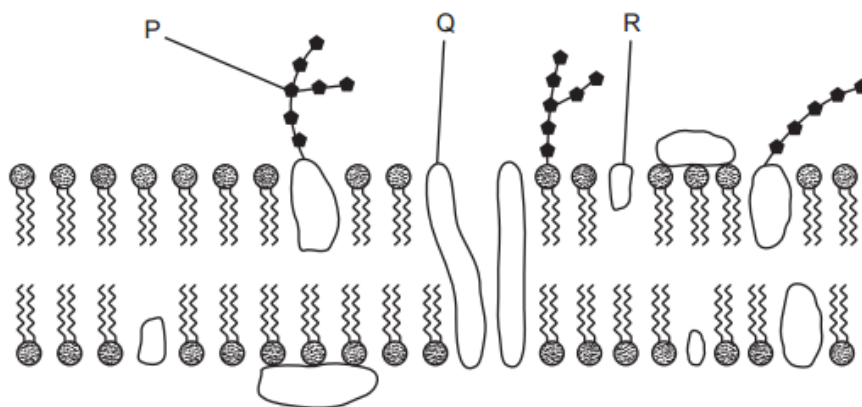
20 The diagram shows a membrane in a cell.



Which would be true of the diagram?

- A** X is the thylakoid space, Y is the thylakoid membrane and the diagram shows ATP synthesis in a chloroplast.
- B** X is the stroma, Y is the thylakoid membrane and the diagram shows ATP synthesis in a mitochondrion.
- C** Y is the thylakoid membrane, Z is the cytosol and the diagram shows ATP synthesis in a chloroplast.
- D** Z is the intermembranous space, X is the matrix and the diagram shows ATP synthesis in a mitochondrion.

21 The diagram shows part of a cell surface membrane.



What is the correct function for each of the structures labelled?

	regulates membrane fluidity	forms hydrogen bonds with water to stabilise membrane	transports ions and large polar molecules
A	R	R	Q
B	P	Q	R
C	Q	R	P
D	R	P	Q

22 The fluidity of the cell surface membrane can be changed by a number of factors.

As the fluidity of cell surface membranes decreases, which process would be least changed?

- A active transport
- B diffusion
- C endocytosis
- D osmosis

23 Male fiddler crabs have an oversized claw to attract the attention of their mates. What might explain how the crabs evolved to have an oversized claw?

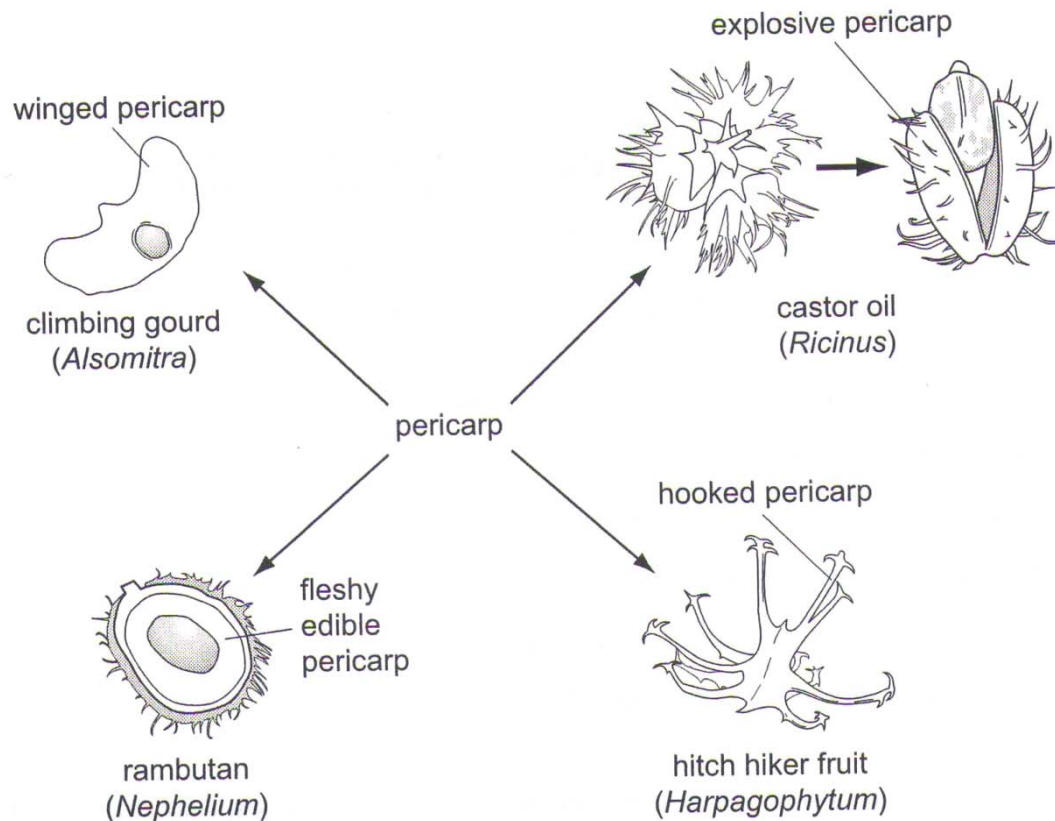
- A** Lack of success in finding a mate results in the crabs gradually developing oversized claws to attract them. They then pass on the allele for oversized claw to their offspring.
- B** Crabs waved at their mates to attract their attention. Over time, they gained more muscles at that claw and developed the oversized claw.
- C** Crabs with oversized claws find mates more successfully and can pass on the allele for oversized claw to their offspring.
- D** The smaller claws succumbed to wear and tear more easily as a result of wave action by the beach while the larger claws could withstand the action of waves.

24 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** 4 only
- B** 2 and 4 only
- C** 1, 2 and 4 only
- D** 1, 2, 3 and 4

- 25 The diagram illustrates variation in the pericarp (fruit wall) for a variety of methods of seed dispersal.



What do these examples illustrate?

- A The adaptive radiation of analogous structures showing convergent evolution.
- B The adaptive radiation of analogous structures showing divergent evolution.
- C The adaptive radiation of homologous structures showing convergent evolution.
- D The adaptive radiation of homologous structures showing divergent evolution.

- 26** A piece of DNA 20 kilobase pairs (kbp) long was digested using different restriction enzymes, *Bam*HI, *Eco*RI and *Pst*I. The results are shown in the table below.

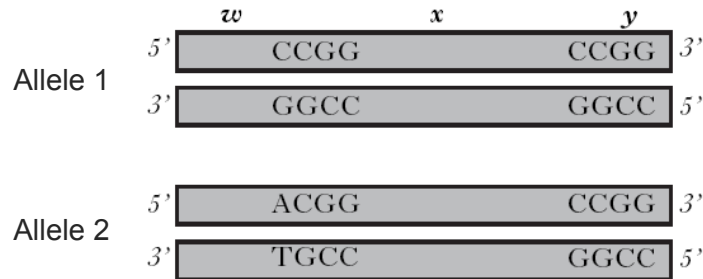
	Restriction enzyme used			
	<i>Pst</i> I	<i>Bam</i> HI	<i>Eco</i> RI	<i>Bam</i> HI <i>Pst</i> I
Lengths of DNA fragments (kbp)	15	17	12	12
	5	3	8	5
				3

Which set of fragments would result if all three enzymes were used together?

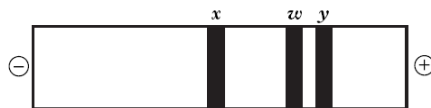
- A** 7, 5, 3, 2
- B** 9, 5, 3
- C** 12, 3, 2
- D** 8, 7, 3, 2

- 27** A certain restriction enzyme will only cut a DNA strand between two Cs when the base sequence CCGG is present.

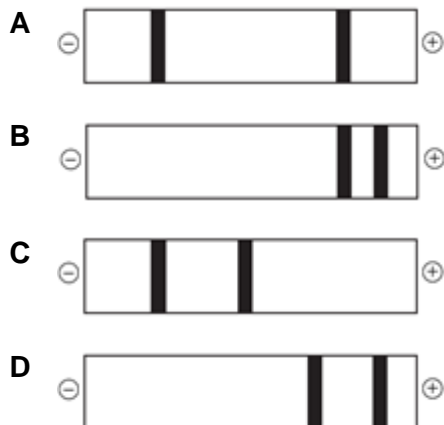
Two homologous segments of DNA that carry different alleles of a gene are shown below. Allele 2 has a single base-pair difference.



Allele 1 was treated with the restriction enzyme and the fragments *w*, *x* and *y* were obtained and separated by gel electrophoresis.



The resulting band pattern for allele 2 is



28 Some of the features of different types of stem cells are listed.

- 1 They are able to develop into all the cell types of the body to form a whole organism.
- 2 They can develop into a wide range of different types of cell.
- 3 They can divide indefinitely.
- 4 They can only develop into a limited range of cell types

Which feature(s) will not be shown by embryonic stem cells?

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

29 Which row correctly states the effects and possible consequences of producing the various genetically-modified organisms?

	Bt corn		GM salmon		Golden rice	
	effect	possible consequence	effect	possible consequence	effect	possible consequence
A	improve quality	might become weeds	improve yield	displace native species	improve yield	might become weeds
B	improve yield	toxic to closely related species	improve yield	displace native species	improve quality	cause allergies
C	improve yield	might become weeds	improve quality	cause allergies	improve yield	cause allergies
D	improve yield	toxic to closely related species	improve yield	cause allergies	improve quality	might become weeds

30 One type of genetically-modified corn has

- a gene for the production of Bt toxin which protects the plant against specific insect;
 - a *pat* gene for tolerance to the herbicide 'Basta' which is used for selection of transformed plants;
 - an *amp^R* gene which was introduced in the plant together with the Bt toxin gene.
- 1 The consumption of the toxin produced by the genetically-modified corn may have negative physiological effects in human.
 - 2 The consumption of new proteins produced by the genetically-modified corn may cause allergic reactions in human.
 - 3 The *amp^R* gene may be transferred to the cells lining the intestine tract making treatment with ampicillin ineffective for disease caused by bacteria.
 - 4 Gene transfer by cross breeding with wild plants may result in the emergence of super weeds.

Which statements are valid concerns regarding the mass propagation of such genetically-modified corn?

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

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