

NATIONAL JUNIOR COLLEGE, SINGAPORE
Senior High 2
Preliminary Examination
Higher 1

CANDIDATE
NAME

BIOLOGY
CLASS

2bi1A

REGISTRATION
NUMBER

BIOLOGY

8875/01

Paper 1 Multiple Choice

15 September 2016

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your Biology class, registration number and name above and on the Answer Sheet provided.

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.

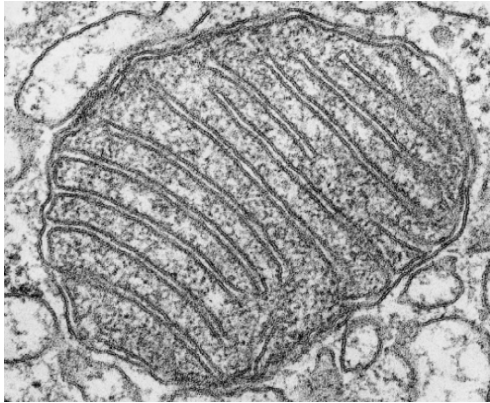
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **18** printed pages.

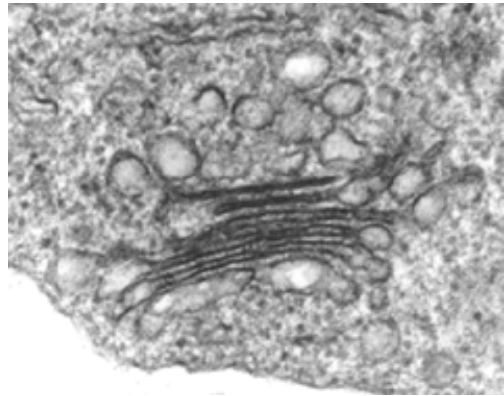
[Turn over

- 1 The electron micrographs, which are taken at different magnifications, show four different organelles that can be found in different eukaryotic cells.

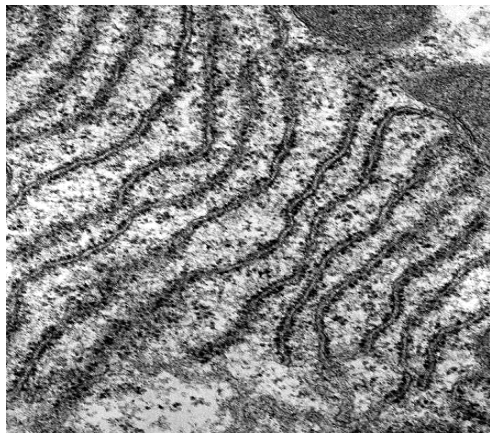
1



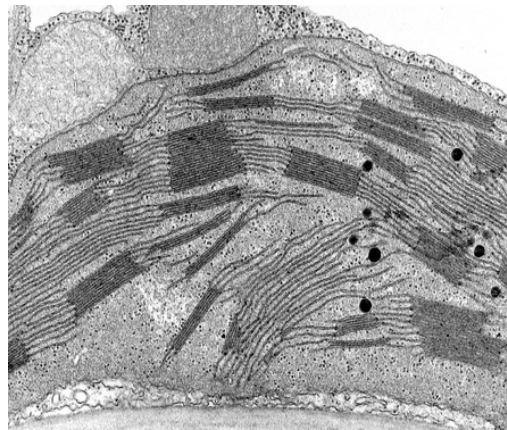
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3



4



Which organelle(s) contain(s) nucleic acids?

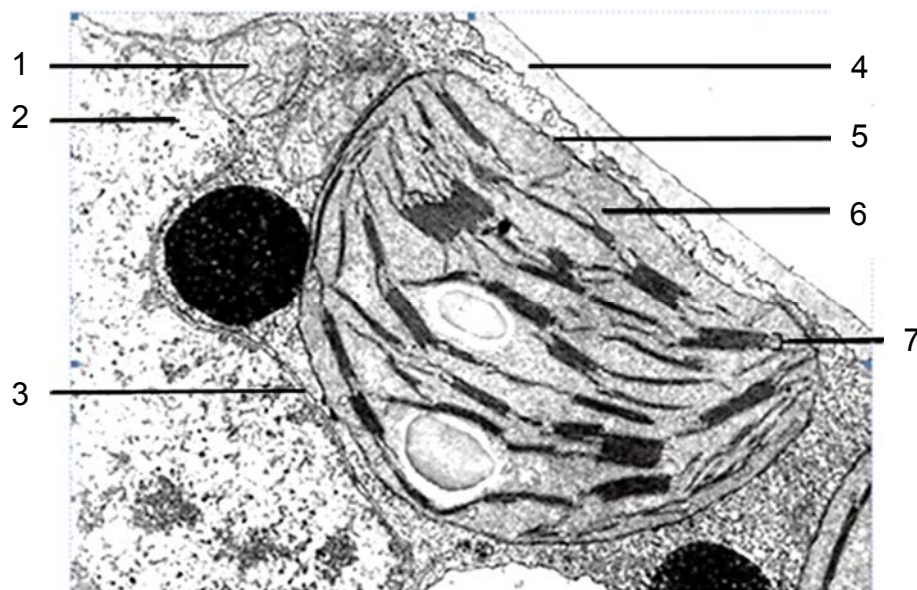
- A 4 only
- B 1 and 4 only
- C 1, 3 and 4 only
- D 1, 2, 3 and 4

2 Which statements about membrane fluidity are correct?

- 1 The less unsaturated the fatty acid chains of the phospholipids, the more fluid the membrane is.
- 2 The greater the amount of cholesterol in the membrane, the less fluid the membrane is at high temperatures.
- 3 The longer the hydrocarbon tails of the phospholipids, the more fluid the membrane is.
- 4 The lower the temperature, the less fluid the membrane is.

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

3 The diagram shows part of a eukaryotic cell.



Which row is correct?

	composed of two membranes	site of Calvin cycle	composed of cellulose	stack of membrane bound structures	site of ATP synthesis
A	3	6	4	7	1
B	3	4	6	5	1
C	5	6	4	7	2
D	5	6	3	1	2

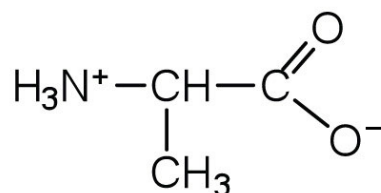
4 The following statements describe three orders of structure of the insulin molecule.

- 1 The molecule consists of two polypeptide chains joined and folded around one another.
- 2 The sequence and number of amino acids in each polypeptide chain are known.
- 3 The amino acids in each chain are coiled into a helix and held in position by hydrogen bonds.

Which order is described by each statement?

	1	2	3
A	primary	secondary	tertiary
B	quaternary	primary	secondary
C	quaternary	primary	tertiary
D	secondary	tertiary	primary

5 The diagram shows the structure of an amino acid.

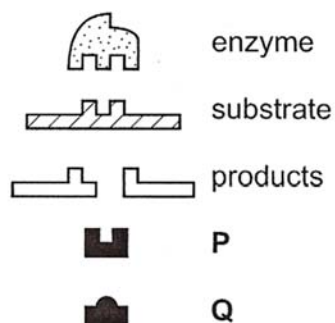


What is true about this amino acid?

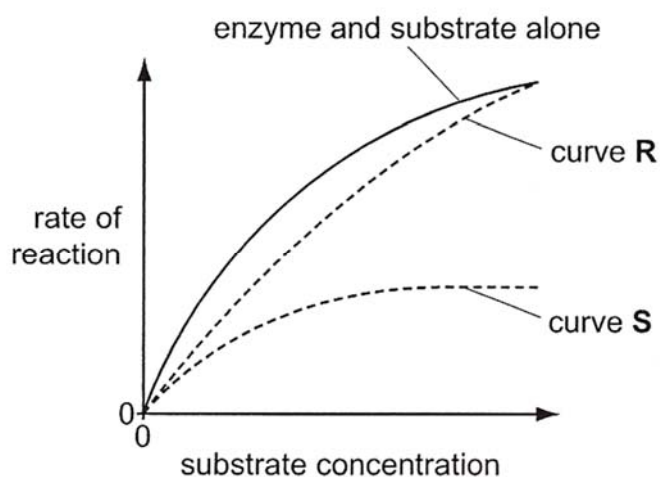
- 1 It has a hydrophobic R group.
- 2 It is amphoteric.
- 3 It is insoluble in water.

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

- 6 The diagram shows an enzyme molecule with its normal substrate and products. P and Q are other molecules that can bind to the enzyme.



The graph shows the effect of P and Q on the rate of reaction of the enzyme at different substrate concentrations.

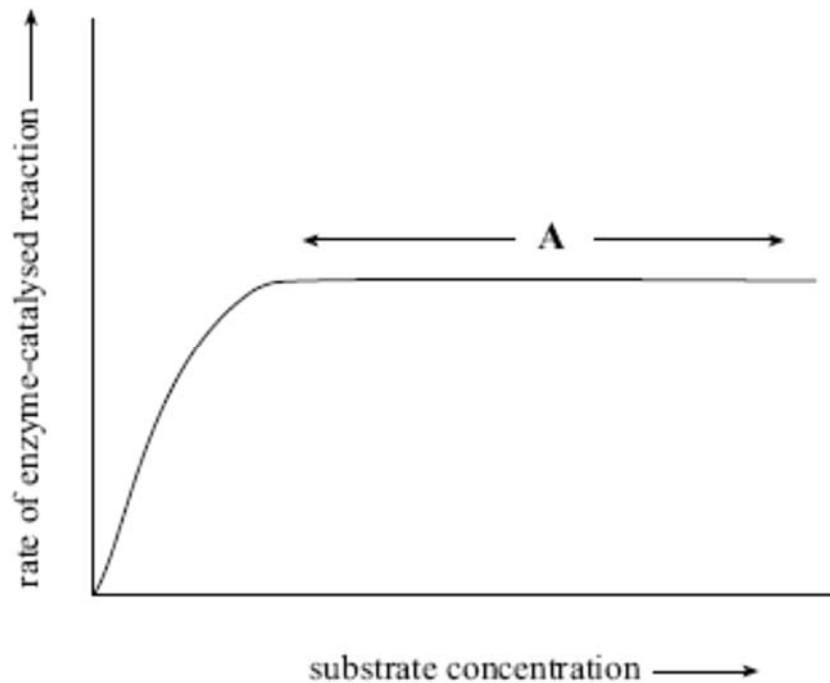


Which statement correctly describes the activity of the enzyme?

- A P is a competitive inhibitor that binds to the active site, resulting in curve R.
- B P is a non-competitive inhibitor that distorts the shape of the enzyme, resulting in curve S.
- C Q is a competitive inhibitor that distorts the shape of the enzyme, resulting in curve R.
- D Q is a non-competitive inhibitor that binds to the active site, resulting in curve S.

- 7 The graph shows the results of an experiment to determine the effect of varying substrate concentrations on the rate of an enzyme-catalysed reaction.

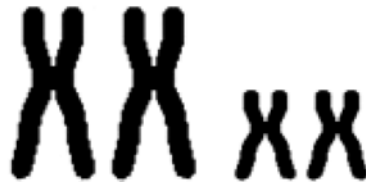
The experiment was conducted at the optimum pH for the enzyme and in the presence of an inhibitor.



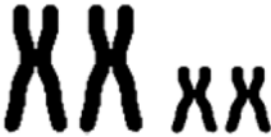



What would result in a higher rate of the enzyme-catalysed reaction in the section labelled A on the graph?

- A decreased enzyme concentration
- B decreased inhibitor concentration
- C increased pH
- D increased substrate concentration

- 8 How does the second meiotic division differ from mitosis?
- A Chiasmata form between the chromatids of a bivalent in the second meiotic division but not in mitosis.
 - B Each chromosome replicates to form two chromatids during metaphase in the second meiotic division but not in mitosis.
 - C Exchange of genetic material occurs between chromatids in the second meiotic division but not in mitosis.
 - D The separating chromatids of a pair differ genetically in the second meiotic division but not in mitosis.
- 9 The diagram shows the chromosomes of a cell just before the metaphase stage of mitosis.



What will be the appearance of the chromosomes at telophase?

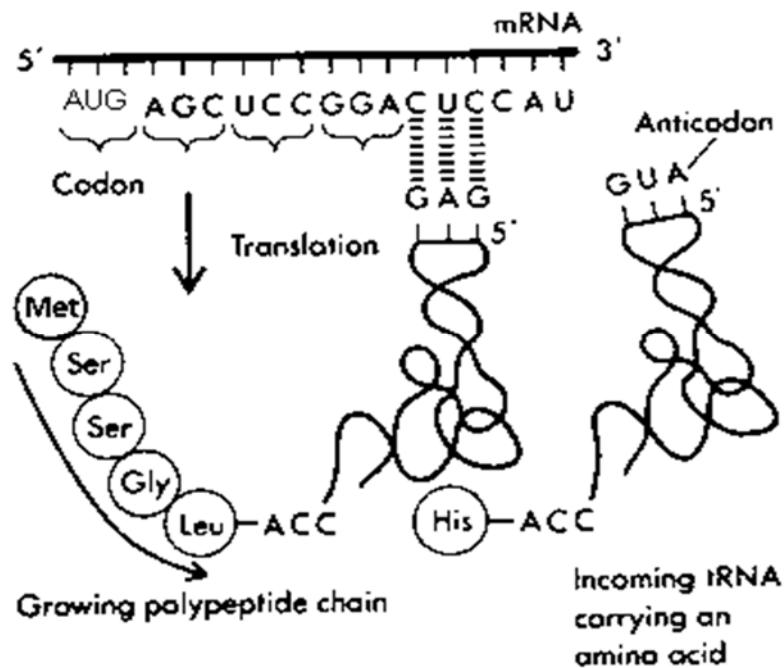
- A 
- B 
- C 
- D 

- 10 Suppose a cell with 14 chromosomes divides mitotically and one of the two new cells has 13 chromosomes and the other has 15 chromosomes.

At which phase of the cell cycle could an error have occurred and resulted in the unequal number of chromosomes in the two new cells?

- A anaphase
- B interphase
- C prophase
- D telophase

- 11 The diagram shows the process of translation.



Which pair of statements is correct?

1. The ribosome is translocating from right to left.
2. The diagram shows degeneracy of the genetic code.
3. The polypeptide would be attached to the tRNA after histidine was added.
4. The number of hydrogen bonds formed between the respective codons and anticodons is the same for the two tRNAs.

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

- 12** The following DNA sequence of the coding strand, which is complementary to the mRNA, is taken randomly from a bacterial genome.

3' TTACGCTTCGAAATAGGAATATCATAGGCT 5'

This DNA sequence is cloned into a plasmid, which is introduced into a suitable host.

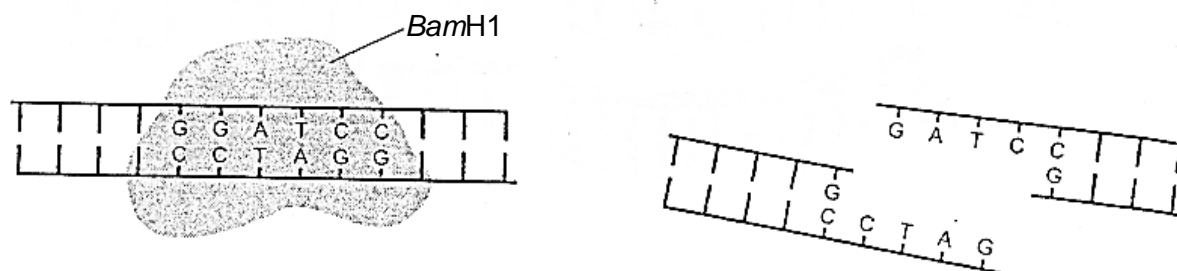
The table shows the mRNA codons for some amino acids.

arg	CGA, CGG, AGA, AGG	leu	CUU, CUC, CUA, CUG
asp	GAU, GAC	lys	AAA, AAG
ile	AUU, AUC, AUA	phe	UUU, UUC
met	AUG	ser	UCA, UCG, AGU, AGC
stop	UAG, UGA, UAA	tyr	UAU, UAC

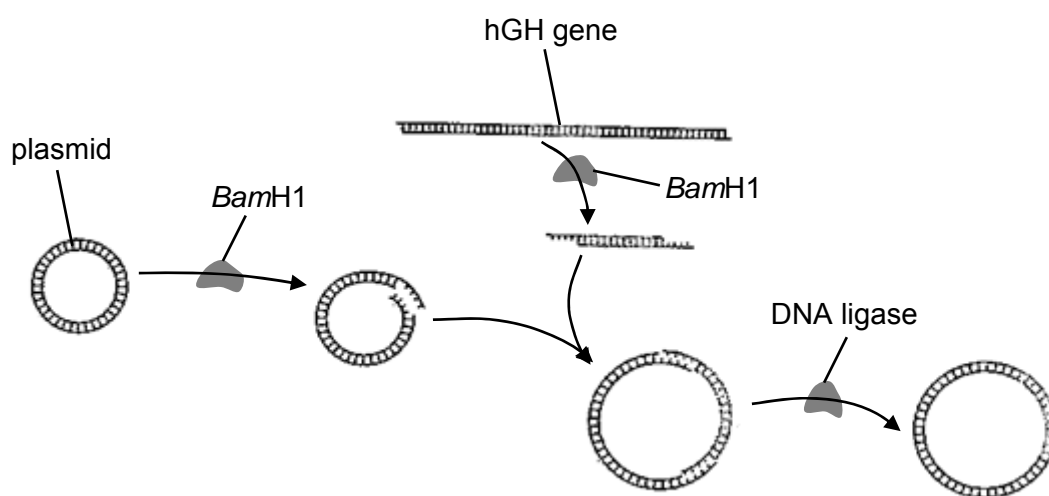
What are the first four amino acids of the polypeptide generated from this DNA sequence?

- A** met-arg-ser-lys
B met-arg-ser-phe
C met-ile-phe-leu
D met-tyr-lys-asp
- 13** Which is not a characteristic of a cancer cell?
- A** It grows and divides without stimulation by a growth factor.
B It releases factors that cause nearby cells to become cancerous.
C It replicates an unlimited number of times.
D Its DNA damage does not halt cell division or stimulate apoptosis.

- 14 *Bam*H1 is a restriction enzyme that cuts DNA as shown in the diagram.



The diagram shows part of the procedure for producing *E.coli* that will synthesise human growth hormone, hGH.

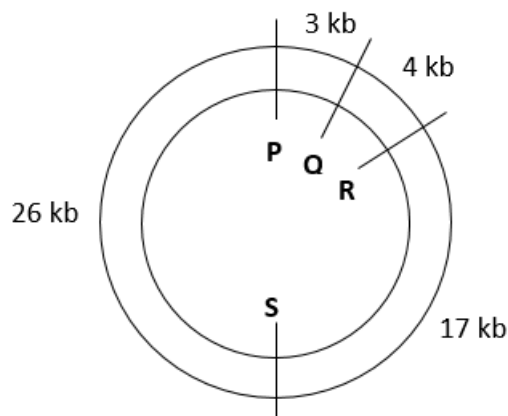


At the end of this process, many plasmids do not contain the hGH gene.

What could explain this?

- A Different alleles of the hGH gene have different sticky ends.
- B Not all of the plasmids cut by *Bam*H1 have sticky ends.
- C Some of the plasmids are cut at more than one position.
- D The sticky ends of some of the plasmids rejoin with each other.

- 15 The diagram shows a plasmid with the positions of four restriction sites P to S indicated.



Copies of the plasmid were cut using two different restriction enzymes at a time, and the resulting fragments were separated by gel electrophoresis.

The diagram shows the results following gel electrophoresis of three samples.

Length of fragment (kb)	Restriction enzymes used		
	<i>BalI</i> and <i>EcoRI</i>	<i>PvuII</i> and <i>AvaI</i>	<i>PvuII</i> and <i>EcoRI</i>
40	■		
30		■	■
20		■	
10	■		■

Which row correctly matches the four restriction enzymes to their respective restriction sites on the plasmid?

	P	Q	R	S
A	<i>AvaI</i>	<i>EcoRI</i>	<i>PvuII</i>	<i>BalI</i>
B	<i>BalI</i>	<i>AvaI</i>	<i>EcoRI</i>	<i>PvuII</i>
C	<i>EcoRI</i>	<i>PvuII</i>	<i>BalI</i>	<i>AvaI</i>
D	<i>PvuII</i>	<i>BalI</i>	<i>AvaI</i>	<i>EcoRI</i>

- 16** A sample of DNA was treated separately with two different restriction enzymes. The products of digestion were then run on a gel and stained with ethidium bromide.

Which of the following statements cannot account for the difference in the number of bands seen on the gel?

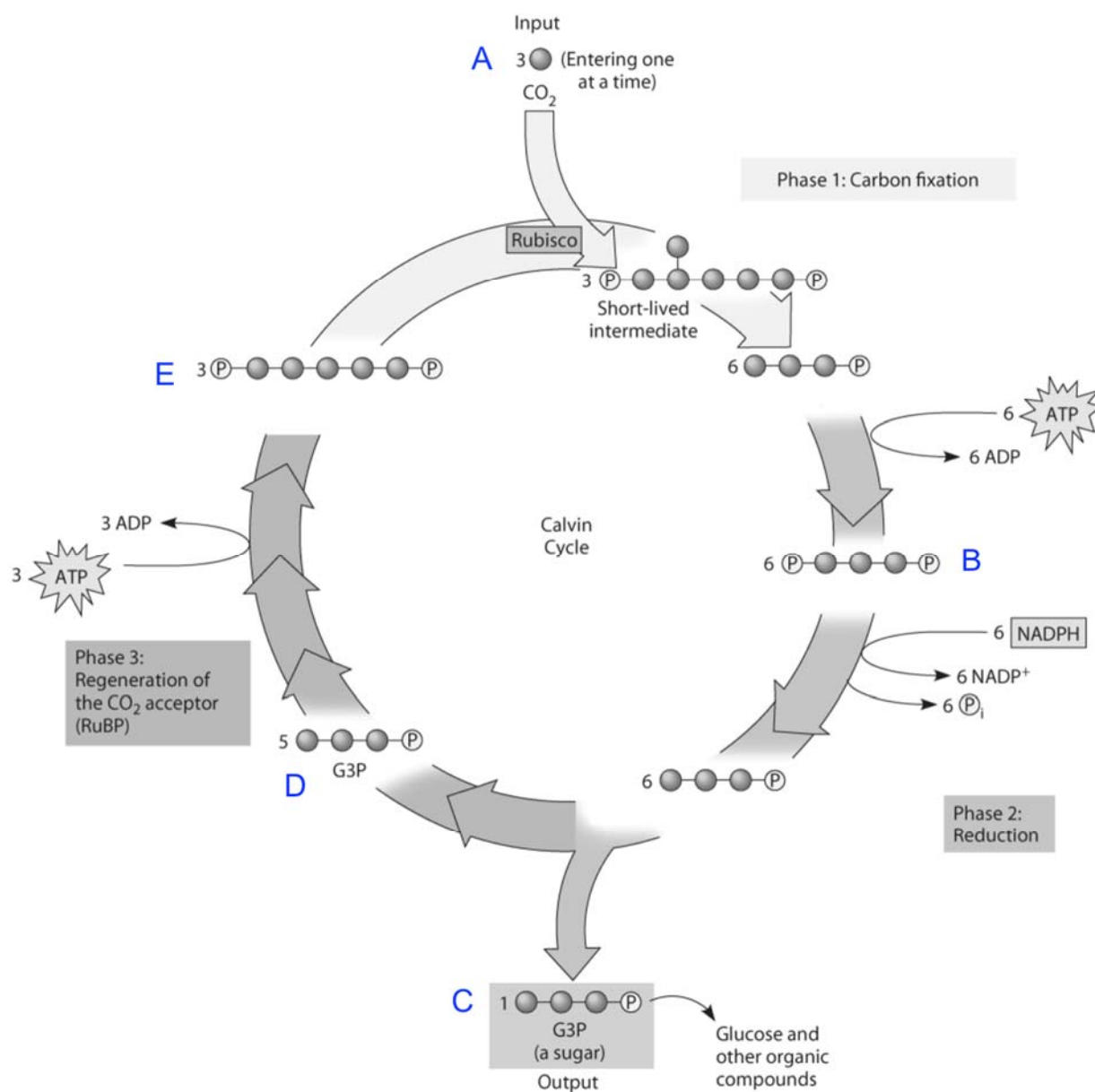
- 1 The two enzymes have active sites that are of different shapes.
- 2 One of the enzymes produces blunt ends while the other produces sticky ends.
- 3 Ethidium bromide binds with greater affinity to double stranded DNA than single stranded DNA.

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

- 17** Which combination correctly describes the light-dependent reactions of photosynthesis?

	site of reaction in chloroplast	ATP	NADP
A	granum	$\text{ADP} + \text{P}_i \rightarrow \text{ATP}$	reduced
B	granum	$\text{ATP} \rightarrow \text{ADP} + \text{P}_i$	reduced
C	stroma	$\text{ADP} + \text{P}_i \rightarrow \text{ATP}$	oxidised
D	stroma	$\text{ATP} \rightarrow \text{ADP} + \text{P}_i$	oxidised

18 The diagram shows some molecules that are involved in the Calvin cycle.



If ATP used by a plant is labelled with radioactive phosphorus, in which molecules would the radioactivity be measurable after one "turn" of the Calvin cycle?

- A A and B only
- B A, C and D only
- C B, D and E only
- D B, C, D and E only

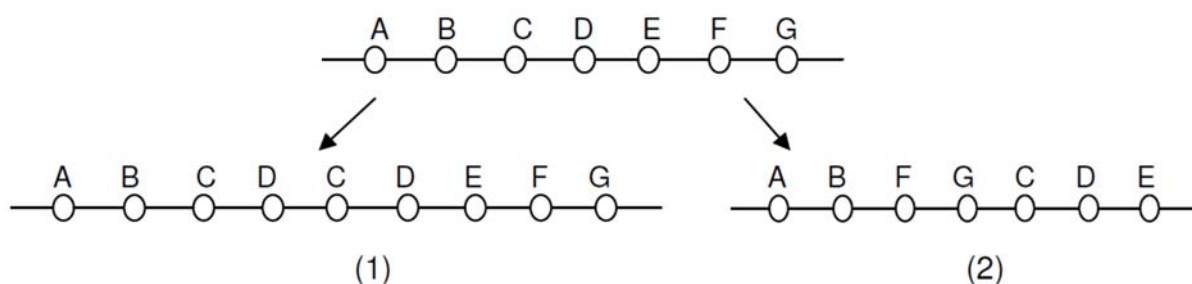
19 Which statement about the Krebs cycle is correct?

- A Oxygen is used to oxidise the acetyl group carbons of acetyl-CoA in the Krebs cycle.
- B Oxygen is not used in the Krebs cycle, so the cycle can occur in anaerobic conditions.
- C The Krebs cycle produces the water that is formed during the complete oxidation of glucose.
- D Three molecules of NADH and one molecule of FADH₂ are produced in one turn of the Krebs cycle.

20 Which statement correctly describes the role of lactate dehydrogenase?

- A Lactate dehydrogenase catalyses the oxidation of pyruvate to lactate to regenerate NAD⁺.
- B Lactate dehydrogenase catalyses the reduction of pyruvate to lactate to regenerate NAD⁺.
- C Lactate dehydrogenase catalyses the oxidation of pyruvate to lactate to regenerate NADH.
- D Lactate dehydrogenase catalyses the reduction of pyruvate to lactate to regenerate NADH.

21 The diagram shows two types of chromosomal mutation producing changes from the normal gene sequence.



Which row correctly describes the two types of chromosome mutation shown above?

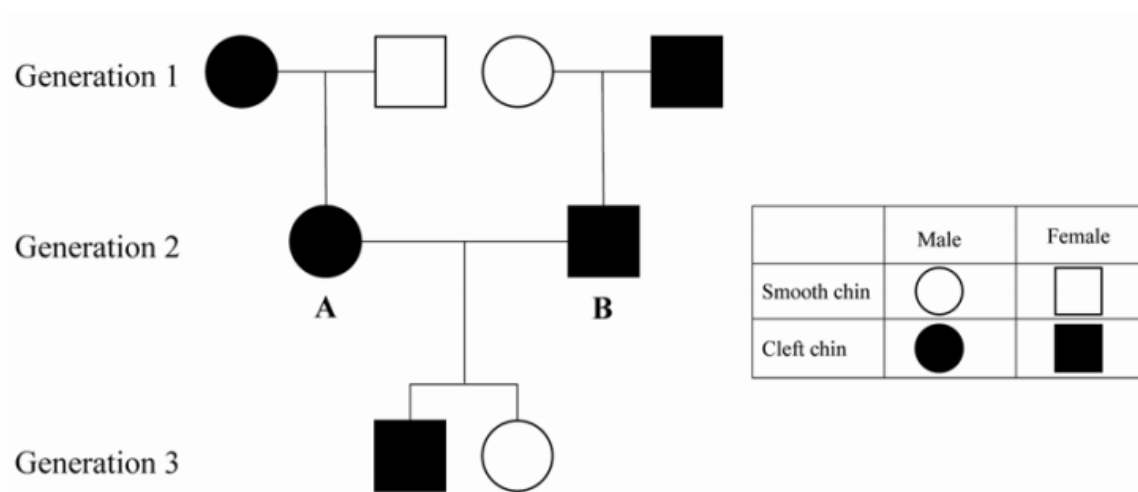
	(1)	(2)
A	deletion	duplication
B	duplication	translocation
C	duplication	inversion
D	inversion	duplication

- 22** A strain of toad has only one nucleolus in the nucleus of each cell instead of the usual two. When such toads are mated, approximately one quarter of the offspring have two nucleoli per nucleus, one half have one nucleolus per nucleus, and one quarter have no nucleoli at all.

What is the most likely explanation of these results?

- A** The allele for the inheritance of two nucleoli per nucleus is dominant.
- B** The allele for the inheritance of two nucleoli per nucleus is recessive.
- C** The possession of one nucleolus per nucleus is due to the effect of crossing over.
- D** The possession of one nucleolus per nucleus is due to the heterozygous condition.

- 23** The pedigree diagram shows the chin types in a family.

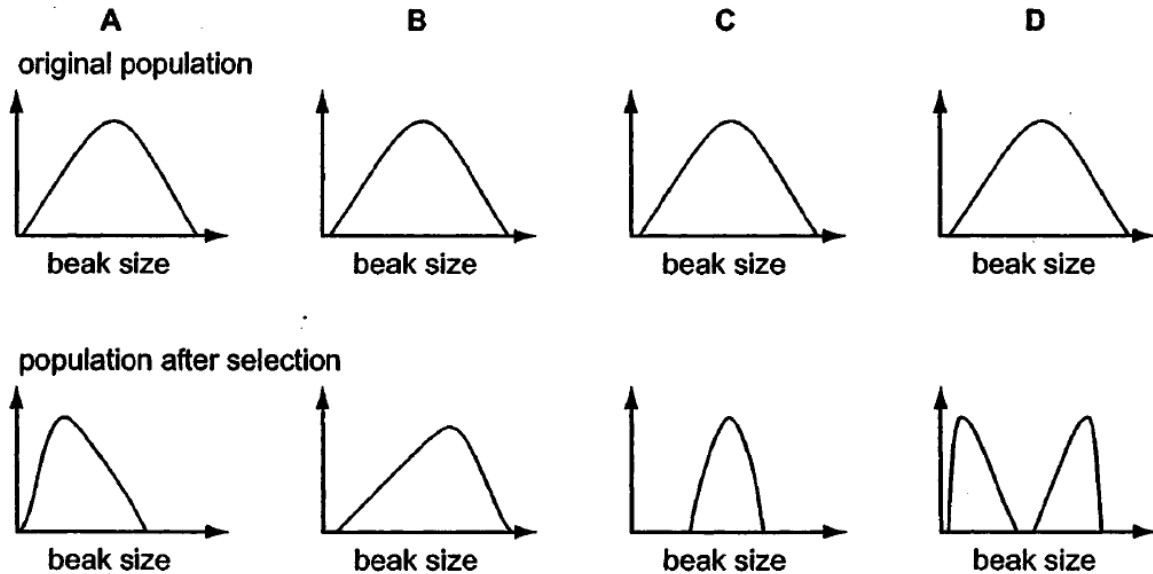


Which statement correctly describes the cleft chin allele and the smooth chin allele?

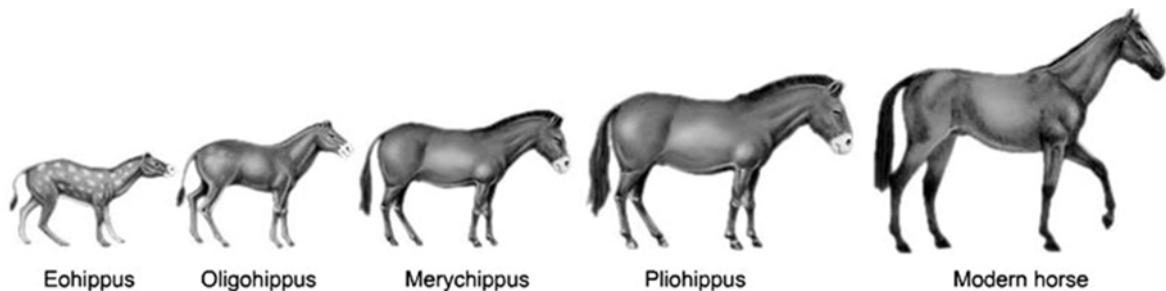
- A** Both alleles are codominant.
- B** Both alleles are linked on the X chromosome.
- C** The cleft chin allele is dominant over the smooth chin allele.
- D** The smooth chin allele is epistatic to the cleft chin allele.

- 24 One species of finch on an island shows variation in beak size. Birds with larger beaks can eat larger seeds. Following a dry period, fewer small seeds are available, with larger seeds and nuts being more plentiful.

Which graph shows the effect of natural selection on beak size of these birds following a dry period?



- 25 The diagram suggests the evolution of horses beginning from the Eohippus 58 million years ago.



Fossil records show that the ancestor of the modern horse is believed to have had relatively short legs. According to Darwinian views, what best explains the evolution of horses?

- A acquired characteristics
- B directional selection
- C disruptive selection
- D stabilising selection

- 26** When organochlorine insecticides such as DDT were in widespread use, mosquitoes in malarial regions developed resistance more rapidly than houseflies in Britain.

What could account for the difference in the rate of development of resistance against organochlorine insecticides?

- A** More insecticides were used in Britain.
 - B** More insecticides were used in malarial regions.
 - C** Mosquitoes have fewer random mutations when exposed to insecticides.
 - D** Mosquitoes have more random mutations when exposed to insecticides.
- 27** Which process involves one stem cell giving rise to two distinct daughter cells: one copy of the original stem cell as well as a second daughter cell programmed to differentiate into a non-stem cell?
- A** asymmetric replication
 - B** differentiation
 - C** potency
 - D** self renewal
- 28** Which is not a source for stem cells?
- A** bone marrow
 - B** early embryos
 - C** egg cells
 - D** umbilical cord blood

- 29** Which statements are possible issues of concern over the creation of genetically modified farmed animals?
- 1 Genetic engineering may result in the creation of new proteins that are harmful to the organisms that produce or consume them.
 - 2 Cross species gene transfer may compromise the genome integrity of the species involved.
 - 3 Over production of certain gene products may cause undue stress to the genetically modified farmed animals.
 - 4 Some genetically modified food products may not be acceptable to certain groups of people.
- A** 1 and 4 only
B 2 and 3 only
C 1, 3 and 4 only
D 1, 2, 3 and 4
- 30** Scientists are concerned about the escape of genetically modified mosquitoes into the wild. What is the most likely reason for this concern?
- A** The genetically modified mosquitoes may not survive in the wild.
B The mutation rate of the genetically modified mosquitoes will increase.
C The genetically modified mosquitoes may replace the wild mosquitoes population.
D The growth rate of the genetically modified mosquitoes will be affected.

- End of paper -