

**H1**ANDERSON JUNIOR COLLEGE  
HIGHER 1

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**BIOLOGY****8875/01**

Paper 1 Multiple Choice

**19 September 2017**  
**Tuesday**

Additional Materials: Multiple Choice Answer Paper

**1 hour**  
**30 marks**

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**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

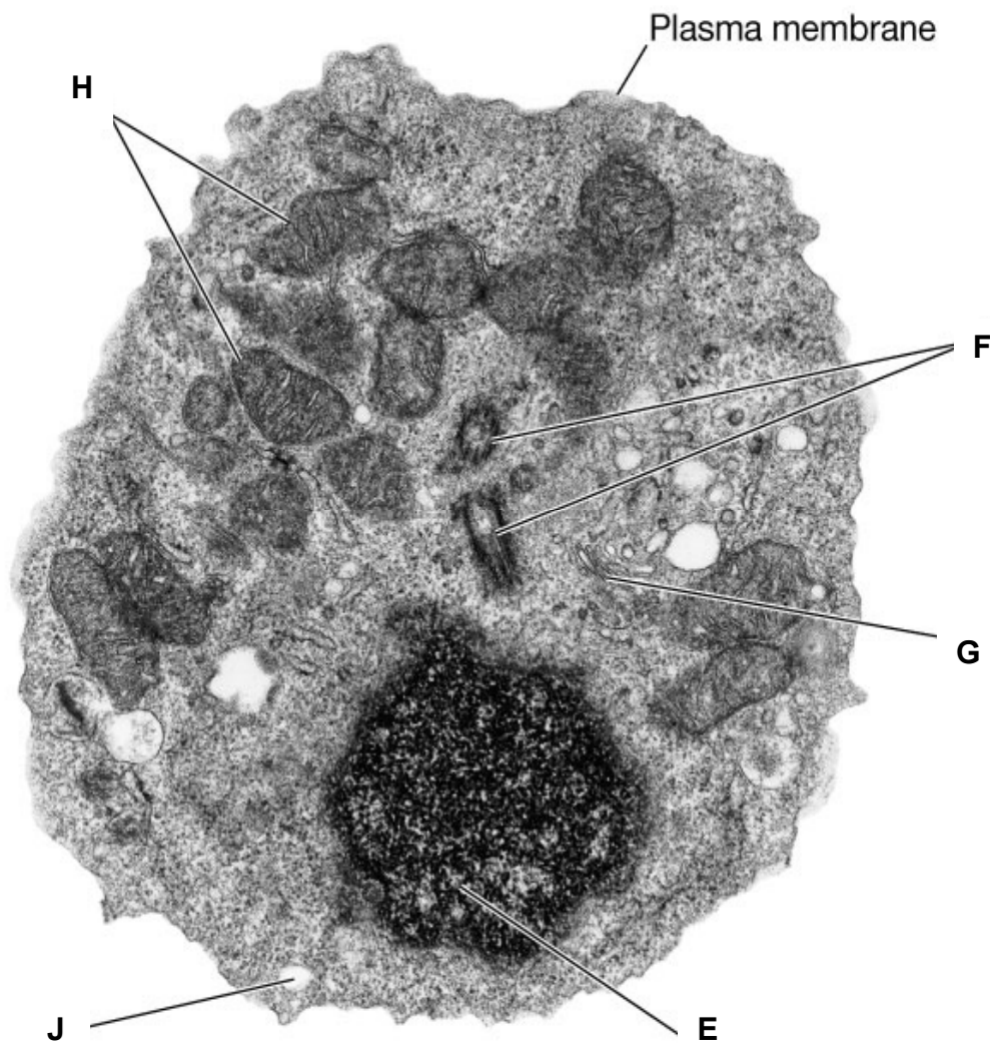
Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, PDG and identification number on the Answer Sheet.

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.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.

Calculators may be used.

1 An electron micrograph of a cell is shown below.



Match the organelles **E**, **F**, **G**, **H** and **J** associated with the cellular processes listed.

	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>	<b>J</b>
<b>A</b>	DNA replication	Digestion of materials	Organises the spindle fibre	Oxidative phosphorylation	Packaging of secretory products
<b>B</b>	Oxidative phosphorylation	Organises the spindle fibre	Digestion of materials	DNA replication	Packaging of secretory products
<b>C</b>	Organises the spindle fibre	Digestion of materials	Oxidative phosphorylation	Packaging of secretory products	DNA replication
<b>D</b>	DNA replication	Organises the spindle fibre	Packaging of secretory products	Oxidative phosphorylation	Digestion of materials

- 2 Which of the following are the most likely consequences for a 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 from the accumulation of worn-out organelles within itself.
  4. The cell is unable to reproduce itself.
  5. The cell is unable to export its enzymes or peptide hormones.
- A 1 and 5  
 B 2 and 3  
 C 1, 2, 3 and 4  
 D 1, 2, 3 and 5

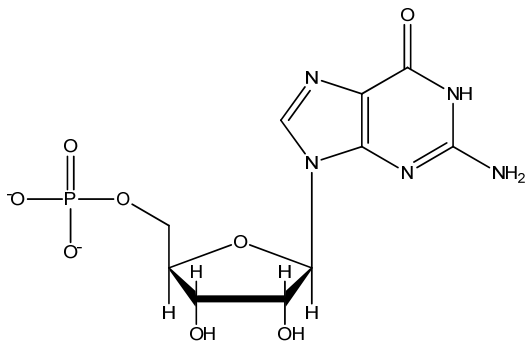
- 3 Three pure substances are analyzed. The table shows the elements that each contains.

	C	H	O	N	P	S
X	+	+	+	+	-	-
Y	+	+	+	-	-	-
Z	+	+	+	+	-	+

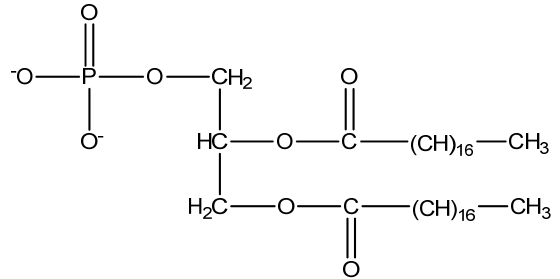
Which of the following combination best describes X, Y and Z?

	X	Y	Z
A	adenine	carbohydrate	fat
B	adenine	fat	an amino acid
C	an amino acid	fat	carbohydrate
D	fat	carbohydrate	an amino acid

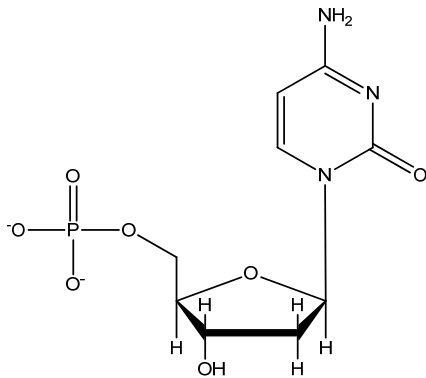
- 4 A student uses centrifugation to separate the various subcellular structures of human epithelial cells by size and density. Which of the following molecule(s) would you expect to find in the pellet containing the cell membrane?



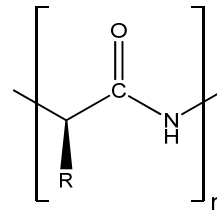
I



II



III

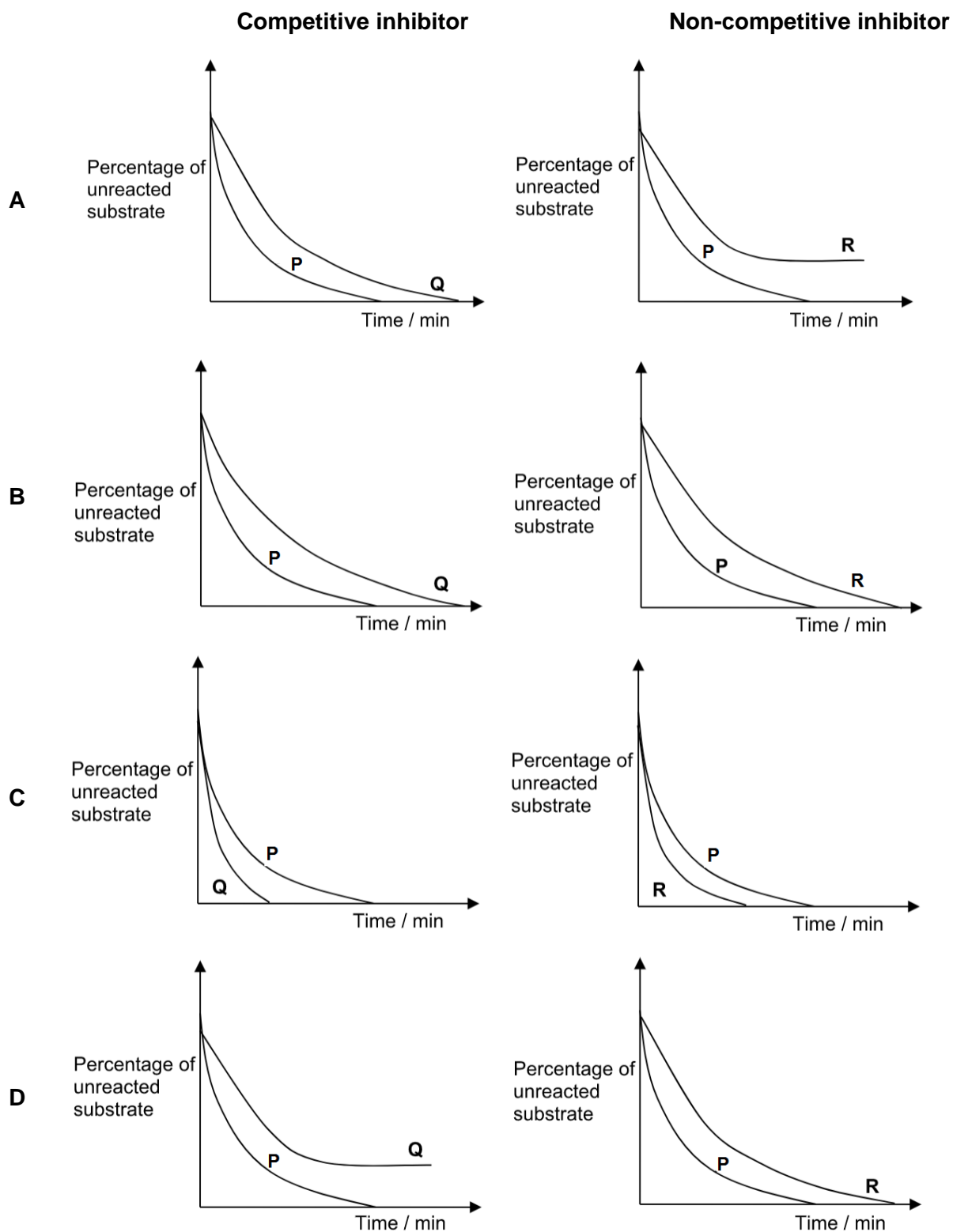


IV

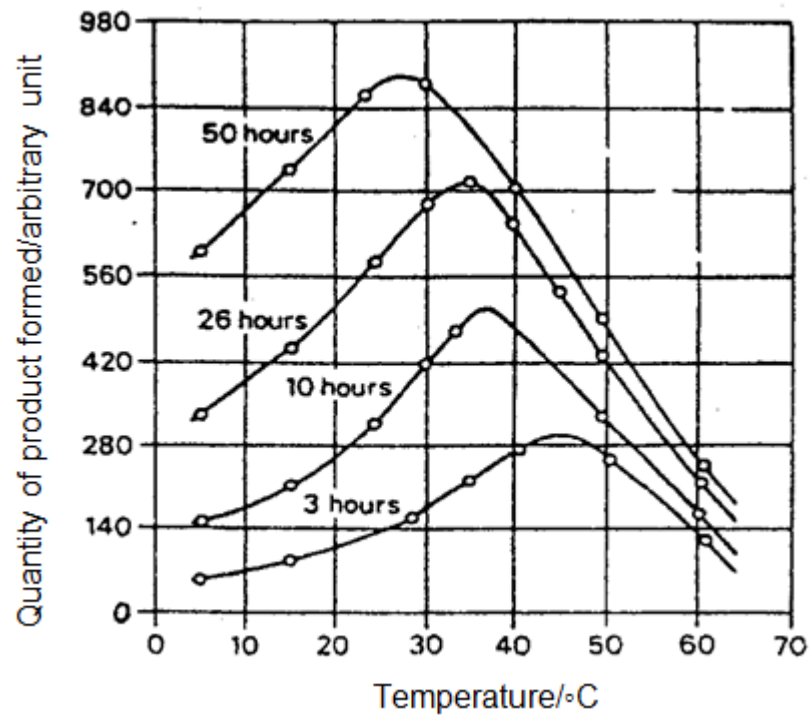
- A II only  
 B III only  
 C II and IV only  
 D I, III and IV only

- 5 Curve P represents the course of an enzyme-catalyzed reaction under optimum conditions. Curves Q and R show the action of the same enzyme on the same substrate but with the addition of a competitive and a non-competitive inhibitor respectively. Assume that the starting amount of enzyme and substrate is the same for all three curves.

Which of the following pairs of graphs correctly shows the effects of competitive and non-competitive inhibitors on the reaction?



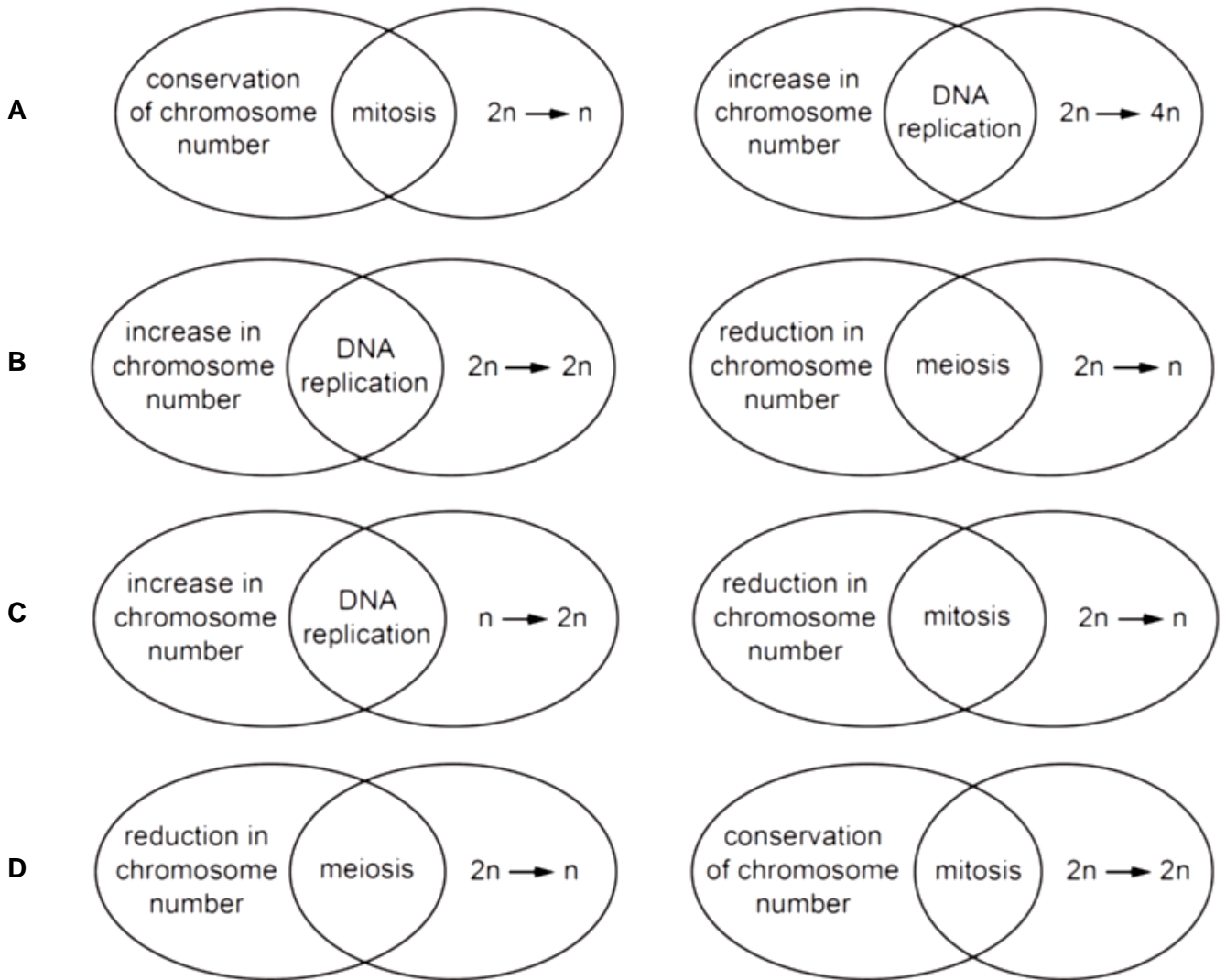
- 6 The graph below shows the quantity of the product formed when samples containing the same concentration of enzyme and substrate were kept at different temperature for four different durations.



Which statement best explains why the optimum temperature is lowered if the duration of incubation is increased?

- A There is an increase in the denaturation of enzymes at high temperature.
- B The activation energy of the reaction is lowered at high temperature.
- C The product formed as an allosteric activator to enhance enzyme activity.
- D More substrates are converted into products for longer durations of incubation.

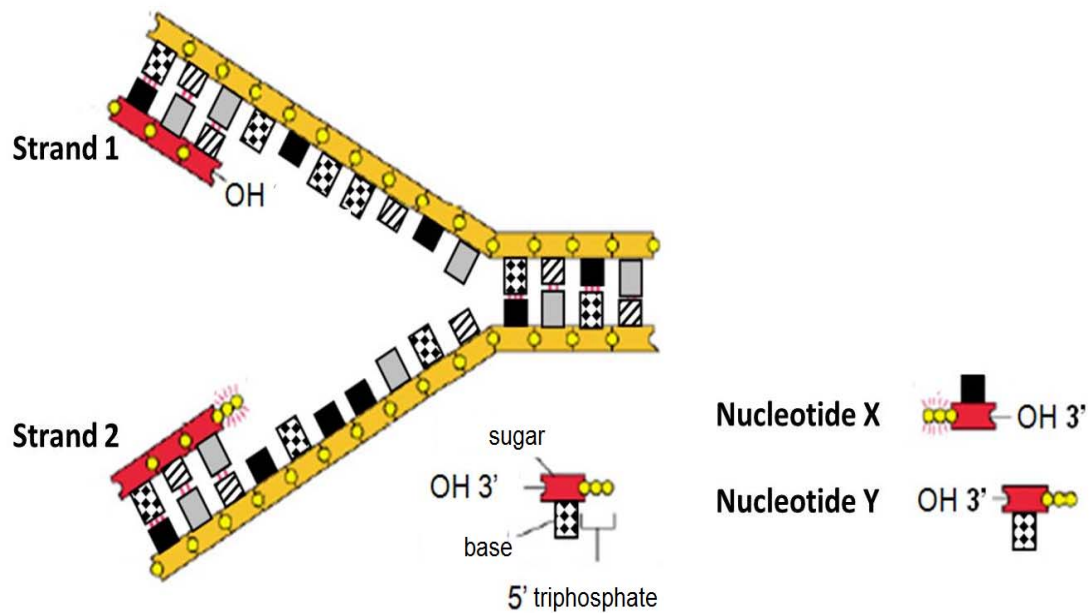
7 Which diagrams show the correct relationships?



8 The amount of DNA in a mammalian cell in early prophase I of meiosis is **X**. What is the amount of DNA in the same cell at G1 of interphase ?

- A 0.25X
- B 0.5X
- C X
- D 2X

9 DNA replication is illustrated in the following figure.

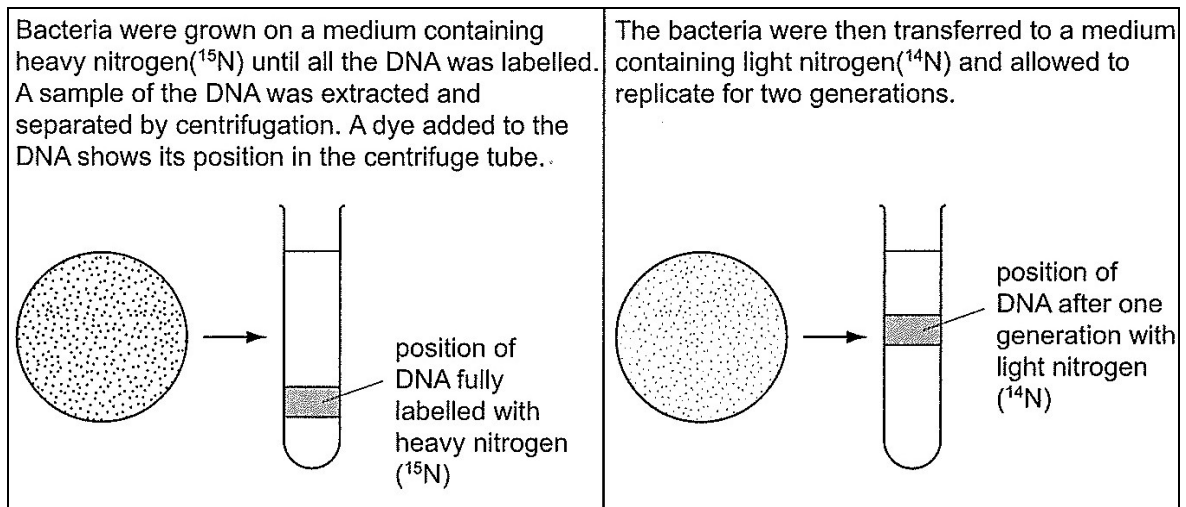


Which of the following correctly describes the addition of the next nucleotide in the DNA strands undergoing replication?

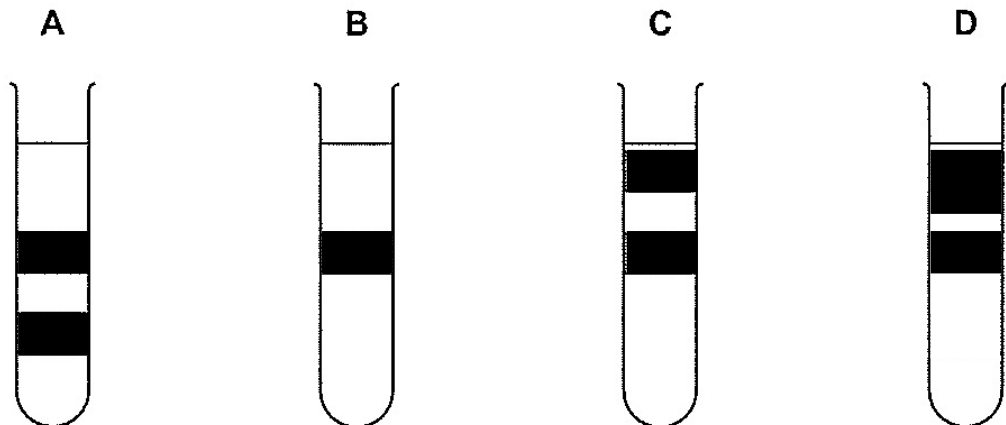
- A Nucleotide **X** will be added to the leading strand, which is strand 1.
- B Nucleotide **Y** will be added to the leading strand, which is strand 1.
- C Nucleotide **X** will be added to the lagging strand, which is strand 1.
- D Nucleotide **Y** will be added to the leading strand, which is strand 2.



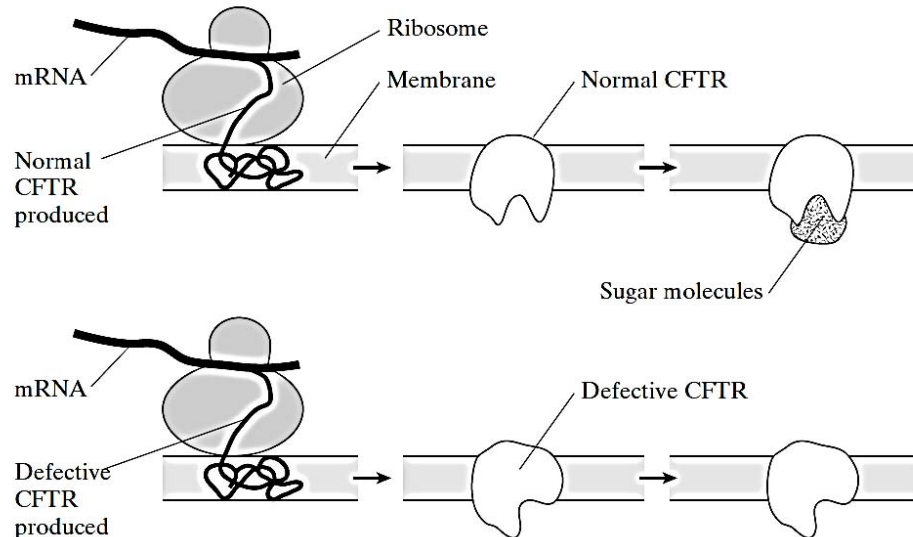
**10** The diagrams show an investigation into semi-conservative replication of DNA.



Which tube shows the position of the DNA after two generations of semi-conservative replication in light nitrogen ( $^{14}\text{N}$ )?



- 11** CFTR is a transmembrane regulator protein. It is made up of 1480 amino acids. People with cystic fibrosis produce a defective CFTR protein which is missing one amino acid from its structure. The diagram shows the synthesis of a normal and a defective CFTR in a cell. A normal CFTR protein molecule has sugar molecules attached to it which make it functional.



Which of the following statements are true?

1. 4440 is the number of bases on the template DNA which code for the amino acid sequence of a normal CFTR protein.
2. Cystic fibrosis is due to a chromosomal mutation known as a deletion.
3. The functional CFTR is a protein that undergone glycosylation.
4. The defective CFTR is not functional as the mutation in the DNA resulted in changes in its tertiary structure.

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

- 12** An antibiotic, edeine, was isolated. It inhibits protein synthesis but has no effect on either DNA synthesis or RNA synthesis. When added to a translation mixture containing fully intact organelles, edeine stops protein translation after 10 seconds.

Analysis of the edeine-inhibited mixture by centrifugation showed that no polyribosomes remained by the time protein synthesis had stopped. Instead, all the mRNA accumulated, together with small ribosomal subunit and initiator tRNA.

What step in protein synthesis does edeine inhibit?

- A** It blocks translocation of the ribosome along the mRNA.
  - B** It interferes with chain termination and release of peptide.
  - C** It prevents formation of the translation initiation complex.
  - D** It inhibits binding of amino-acyl-tRNAs to the A site of the ribosome.
- 13** Seeds from a pure breeding plant were planted in identical pots of compost and watered regularly. Sets of ten pots were placed in different light conditions and left until the first leaves had developed.

The table shows the mean height for the young stems, mean length of first leaf and the colour of the leaves.

	no light	dim light	bright light
mean height / cm	8	6	4
mean leaf length / cm	1.5	1.4	1.4
colour of leaves	pale yellow	pale green	dark green

Which explains the effect of light on the phenotype of the young plants?

- A** The activity of genes involved in chlorophyll synthesis and stem growth varies with light intensity.
- B** The activity of genes involved in stem and leaf growth is decreased by light
- C** The genes involved in chlorophyll synthesis and stem growth are activated by light.
- D** The genes involved in chlorophyll synthesis and stem growth are inactivated by light.

- 14** Fruit flies (*Drosophila*), homozygous for long wings, were crossed with fruit flies homozygous for vestigial wings. The  $F_1$  and  $F_2$  generations were raised at three different temperatures.

At each temperature, the  $F_1$  generation all had long wings.

The table shows the results in the  $F_2$  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?

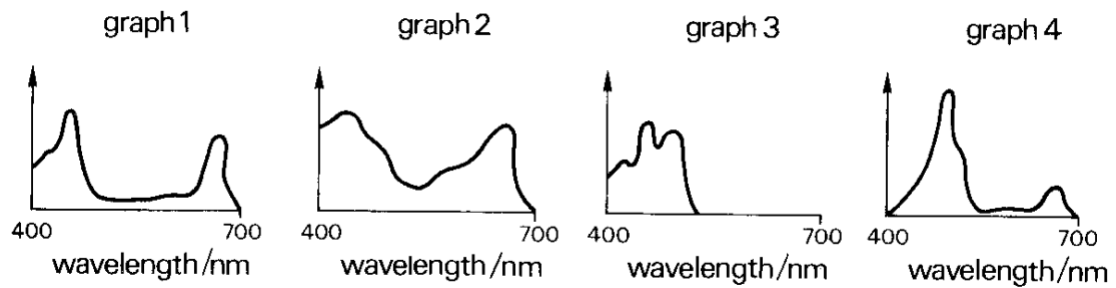
- A** Heterozygous flies have vestigial wings only at 21°C or below but have long wings at 31°C or above.
  - B** Long wing and vestigial wing illustrate codominance at 26°C.
  - C** Long wing is dominant at higher temperatures but vestigial wing is dominant at lower temperatures.
  - D** Vestigial wing is recessive but causes a vestigial wing phenotype only at lower temperatures.
- 15** In rabbit, there are two alleles for fur colour, grey and white, and two alleles for fur length, short and long. Two pure-breeding rabbits were mated, and the  $F_1$  offspring all had grey and long hair. When the  $F_1$  offspring were selfed, they produced the following numbers of  $F_2$  offspring:

grey and long haired:	92
grey and short haired:	32
white and long haired:	28
white and short haired:	13

Which of the following are true?

1. The genes for fur colour and fur length assort independently.
  2. The probability of producing pure-bred offspring is 1 in 16.
  3. The original pure-breeding parents must be only grey and long haired, and white and short haired.
  4. The two traits show sex-linked inheritance.
- A** 1 only.
  - B** 2 and 3
  - C** 1 and 3
  - D** 2, 3 and 4

- 16 Three of the graphs below show the absorption spectra of photosynthetic pigments. One graph shows the action spectrum of photosynthesis for a plant containing the pigments.



All the x axes show wavelength. Three of the y axes show light absorption. One y axis shows the rate of photosynthesis.

Which of the following identifies the four graphs?

Absorption spectra				
	Chlorophyll a	Chlorophyll b	Carotenoids	Action spectrum
<b>A</b>	1	4	3	2
<b>B</b>	2	1	3	4
<b>C</b>	3	2	4	1
<b>D</b>	4	2	1	3

**17** The blue dye DCPIP can be converted to colourless DCPIP as shown below:



A suspension of chloroplasts was made by grinding fresh leaves in buffer solution and centrifuging the mixture. Tubes were then prepared and treated in the following ways.

Tube	Contents	Treatment	Colour	
			At start	After 20 minutes
1	1 cm <sup>3</sup> chloroplast suspension + 5 cm <sup>3</sup> DCPIP	Illuminated strongly	Blue green	Green
2	1 cm <sup>3</sup> buffer solution + 5 cm <sup>3</sup> DCPIP	Illuminated strongly	Blue	Blue
3	1 cm <sup>3</sup> chloroplast suspension + 5 cm <sup>3</sup> DCPIP	Left in the dark	Blue green	Blue green

Which one of the following statements is a possible conclusion for the observation above?

- A** Photolysis of water produces oxygen which oxidizes DCPIP.
- B** Respiration consumes oxygen from the suspension, hence DCPIP is partially reduced.
- C** Light reaction which occurs in the chloroplasts yield free electrons which reduce DCPIP.
- D** Either strong illumination or the buffer solution used in the extraction of chloroplasts could oxidize DCPIP.

**18** Below are some statements about anaerobic respiration in yeasts and animal cells.

1. Pyruvate acts as the alternative hydrogen acceptor.
2. Carbon dioxide is produced.
3. Oxidation of reduced coenzyme occurs
4. ATP is synthesized.

Which statements apply to animal cells and yeast cells?

	Animal cells	Yeast
<b>A</b>	1, 2 and 3	3 and 4
<b>B</b>	1, 3 and 4	2, 3 and 4
<b>C</b>	2, 3 and 4	1, 2, 3 and 4
<b>D</b>	1, 2 and 3	2 and 3

**19** Two test tubes containing the following contents are shown below:

**Tube 1:**

Radioactive glucose solution + yeast cells suspension + oxygen + antimycin

**Tube 2:**

Radioactive glucose solution + yeast cells suspension + oxygen

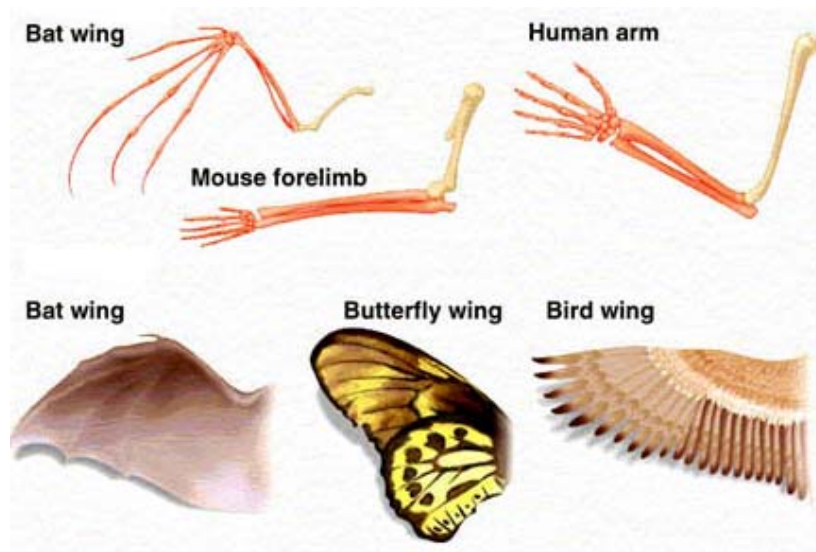
Radioactive glucose has all its six carbons made of radioactive  $^{14}\text{C}$ . The initial radioactivity measured for the glucose in each test tube is 60 arbitrary units.

Antimycin is an electron transport chain inhibitor.

If the gaseous product and the aqueous products are tested using a radioactive meter after all the glucose has been metabolized, what would be the final observed readings?

	Tube 1 (radioactivity measured/ arbitrary units)		Tube 2 (radioactivity measured/ arbitrary units)	
	aqueous products	gaseous products	aqueous products	gaseous products
<b>A</b>	0	60	40	20
<b>B</b>	20	40	0	60
<b>C</b>	40	20	0	60
<b>D</b>	40	20	60	0

- 20** 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.



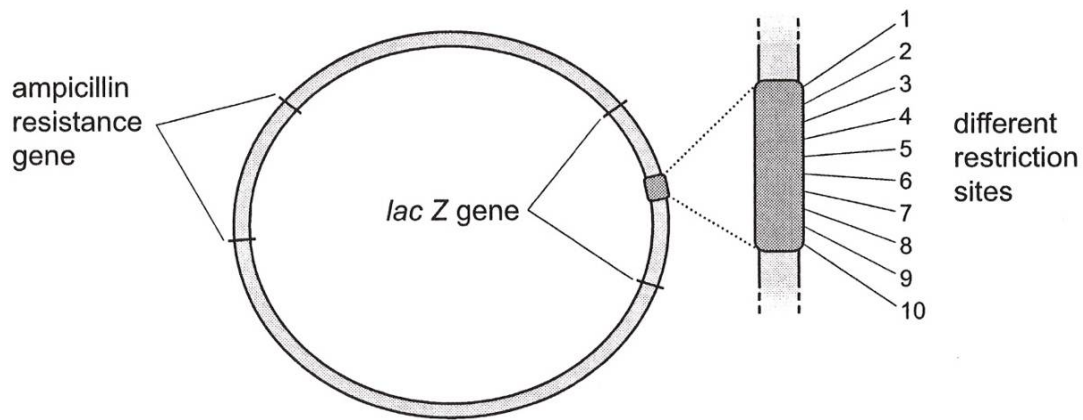
Which of the following are correct conclusions made from the diagram provided?

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



- 21** A large population of a certain species of freshwater fish lives in a South America lake. If there are no mutations and all immigration into the population is prevented, which one of the following statements best expresses the probable future of the population?
- A** All evolution will promptly cease because without mutation, there will be no raw material for evolution.
  - B** The population will begin to decrease in size after three to four generations because of excessive inbreeding that will result from the absence of immigration.
  - C** The population will continue to evolve as selection acts on the different allelic combinations formed during meiosis.
  - D** The population will cease to evolve and it may survive for a long time as there is no selection.
- 22** What explains why genetic variation is important in selection?
- A** An increase in genetic variation in a population improves the chance of successful breeding
  - B** It allows those organisms with the best genotype to survive.
  - C** It gives alternative alleles that increase the gene pool of a species.
  - D** It results in different phenotypes that allow adaptation to occur.

- 23** The diagram shows the plasmid pUC18. Bacteria containing this plasmid produce blue colonies when grown in the presence of *X-gal*. Bacteria containing a genetically engineered recombinant pUC18 plasmid produce white colonies.



Some of the features of this plasmid are:

1. It is small and replicates to form about 500 copies per host cell.
2. It contains restriction sites for 10 different restriction enzymes.
3. It contains a gene giving resistance to the antibiotic ampicillin.
4. It contains the *lac Z* gene which allows the metabolism of *X-gal* to produce a blue colour.

A gene of interest was inserted into one of the restriction sites to form a recombinant plasmid. Bacteria were transformed with this recombinant plasmid and identified using a selective agar medium.

Which selective growth medium would identify the bacteria containing the recombinant plasmids?

- A** A medium containing agar.
- B** A medium containing ampicillin.
- C** A medium containing ampicillin and *X-gal*.
- D** A medium containing *X-gal*.

- 24** The *F8* gene is over 185 000 base pairs long and codes for Factor VIII, which is used during blood clotting.

People with a mutation of the *F8* gene have the condition haemophilia and are treated using a recombinant Factor VIII, synthesised by mammalian cells.

*Escherichia coli* cells cannot be used to synthesise the recombinant Factor VIII as they cannot add carbohydrate to protein.

What can be deduced using only this information?

- A** Different mutations of the *F8* gene will lead to different severities of haemophilia.
  - B** Human factor VIII is a glycoprotein.
  - C** Human factor VIII is composed of 61 667 amino acids.
  - D** The *F8* gene is located on the X chromosome.
- 25** If a researcher began with a PCR on a sample that contained three copies of double stranded DNA, and each step in PCR takes 1 minute, how many copies would be present after 1 hour 21 minutes?

- A**  $2^{27}$
- B**  $4^{27}$
- C**  $2^{3 \times 27}$
- D**  $3 \times 2^{27}$

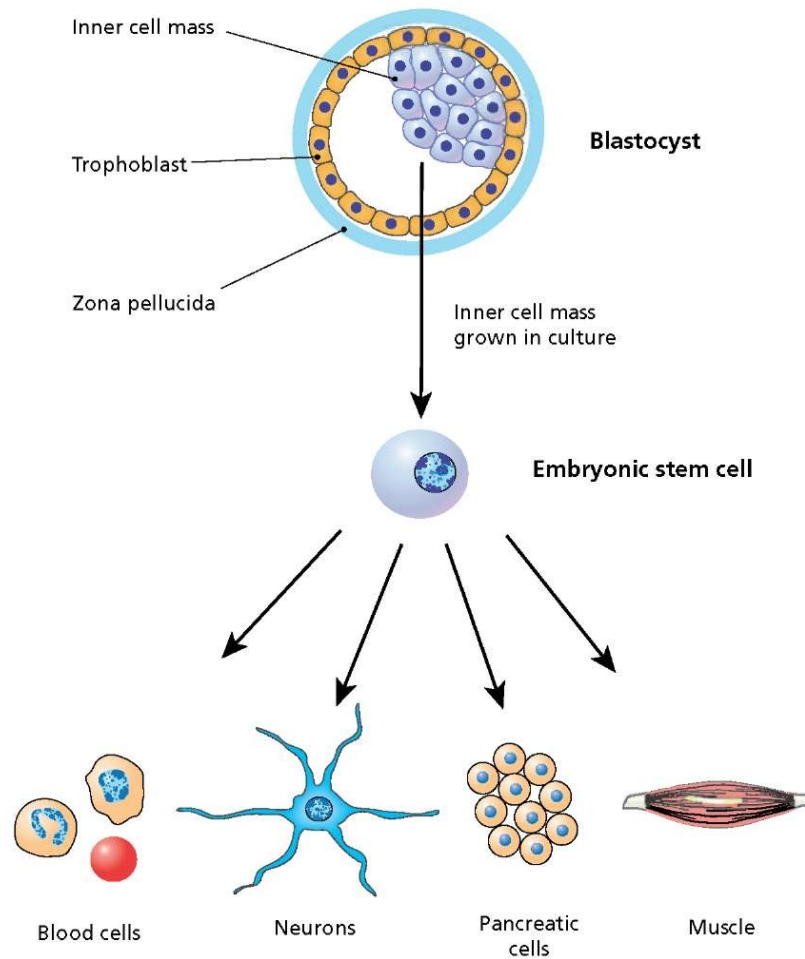
- 26** Some of the steps involved in DNA analysis are listed below:

- 1 transfer segments of DNA to nitrocellulose membrane
- 2 extraction of DNA
- 3 gel electrophoresis
- 4 treating DNA with restriction enzymes
- 5 autoradiography
- 6 hybridise with probe

The correct sequence is

- A**  $2 \rightarrow 4 \rightarrow 3 \rightarrow 1 \rightarrow 6 \rightarrow 5$
- B**  $4 \rightarrow 2 \rightarrow 3 \rightarrow 1 \rightarrow 6 \rightarrow 5$
- C**  $4 \rightarrow 2 \rightarrow 1 \rightarrow 3 \rightarrow 6 \rightarrow 5$
- D**  $2 \rightarrow 4 \rightarrow 3 \rightarrow 1 \rightarrow 5 \rightarrow 6$

- 27 Which of the following features of the embryonic stem cells and specialized cells shown in the diagram are true?



	Embryonic stem cells	Specialized cells
<b>A</b>	Embryonic stem cells display greater plasticity when grown in culture than when in blastocyst.	The blood cells are genetically different from the embryonic stem cells but have shorter telomeres.
<b>B</b>	Embryonic stem cells are pluripotent and are capable of transdifferentiating (convert one cell type to another) into many different cell types.	The pancreatic cells are genetically identical to the embryonic stem cells but with a different set of genes expressed.
<b>C</b>	Embryonic stem cells are multipotent and are capable of differentiating into limited range of cell types.	The blood cells are genetically different from the embryonic stem cells because different genes are expressed.
<b>D</b>	Embryonic stem cells are pluripotent and are capable of differentiating into many different cell types.	The pancreatic cells are genetically identical to the embryonic stem cells but have shorter telomeres.

- 28** In bone marrow, multipotent stem cells can be distinguished from precursors of blood cells which are synthesising proteins by the chromatin and organelles that they contain.

What are the features seen in cells that are synthesizing large quantities of protein?

	Chromatin	Ribosomes	Golgi size
<b>A</b>	clumped	few	large
<b>B</b>	clumped	many	small
<b>C</b>	dispersed	few	small
<b>D</b>	dispersed	many	large

- 29** Which uses of information from the human genome project are generally considered to be unethical?

- 1 an insurance company only giving cheap rates to people with genetic predispositions to fewer diseases
- 2 genetic archaeologists identifying the earliest forms of genes to show evolutionary relationships
- 3 cytologists developing tests for only some defective genes
- 4 doctors only giving specific drugs to block the actions of faulty genes to carriers of those genes
- 5 genetic counsellors giving specific lifestyle information only to people genetically predisposed to risks
- 6 parents choosing embryos for implantation only after prenatal tests for acceptable genes

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

- 30** *Bt* gene from *Bacillus thuringiensis* may be inserted into cotton plant cells to produce *Bt* cotton plants. Insecticide use and yield in India were compared for *Bt* cotton hybrid (*XBt*), the same hybrid X but without the *Bt* gene (*X\_*), and another hybrid widely grown in that particular locality (Y). This process was repeated at more than 150 locations. The table below shows the results:

hybrid	<i>XBt</i>	<i>X_</i>	Y
mean number of sprays against insects that eat the cotton	0.6	3.7	3.6
mean number of sprays against sap sucking insects	3.6	3.5	3.5
yield / kg ha <sup>-1</sup>	1500.0	830.0	800.0

The following are the conclusions that are drawn from the data:

1. All insect pests are killed when they consume the *Bt* crop.
2. *Bt* cotton reduces the amount of pesticide used.
3. Both yield and quality of cotton from *XBt* crop improved.
4. *Bt* cotton increases cost effectiveness.
5. Both *X\_* and Y hybrids contain susceptible genes to the pest.
6. *Bt* toxin is not found in the plant sap.

Which of the conclusions stated are **correct**?

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

**H1 Bio P1 2017 Answers**

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