



TEMASEK JUNIOR COLLEGE
Preliminary Examinations 2015
Higher 1

BIOLOGY

8875/01

Paper 1 Multiple Choice

Thursday, 17 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, Centre number and index number 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**.

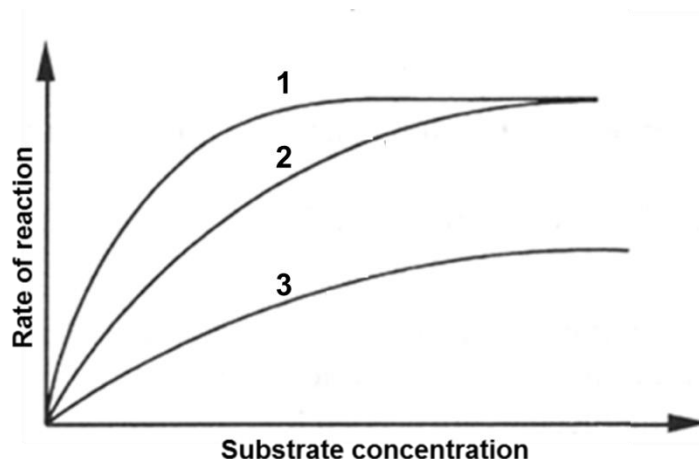
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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.

- 1 The curves show the rates of reaction of an enzyme with and without inhibitors.



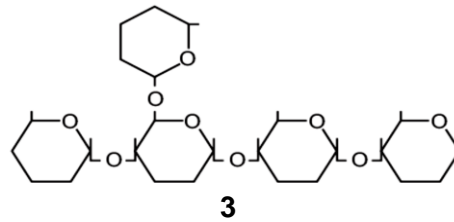
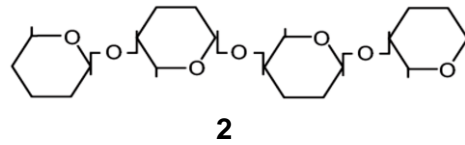
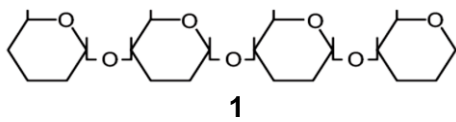
What do the curves show?

	Curve 1	Curve 2	Curve 3
A	competitive inhibition	non-competitive inhibition	normal activity
B	competitive inhibition	normal activity	non-competitive inhibition
C	normal activity	competitive inhibition	non-competitive inhibition
D	normal activity	non-competitive inhibition	competitive inhibition

- 2 Which type of enzyme converts a dipeptide into separate amino acids?

- A** dehydrogenase
- B** hydrolase
- C** oxidoreductase
- D** transferase

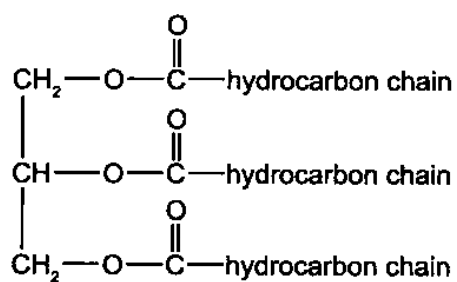
3 The figure below shows the structural formulae of three polysaccharides.



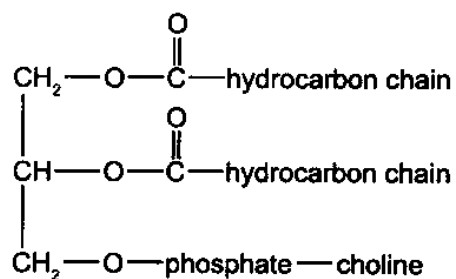
Which of the following is correct?

	1	2	3
A	amylose	cellulose	glycogen
B	amylose	amylopectin	cellulose
C	cellulose	amylose	amylopectin
D	glycogen	cellulose	amylopectin

- 4 The diagram shows the structure of two lipid molecules.



X



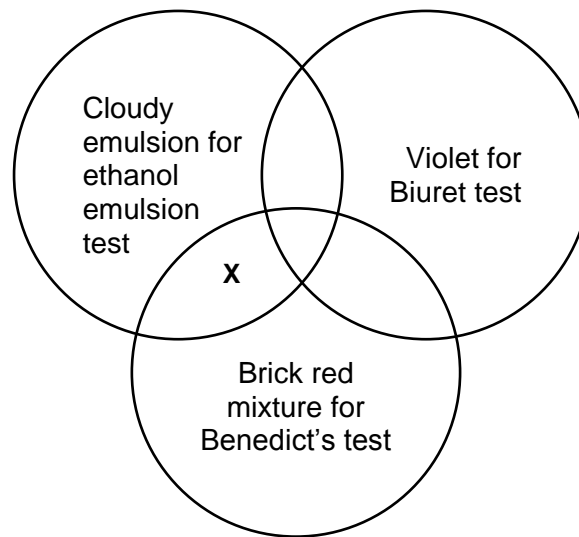
Y

Which of the following statements correctly describe the two lipid molecules?

- 1 Both molecules are esters of glycerol.
- 2 Both molecules are made by condensation reactions.
- 3 The hydrocarbon chains of molecule **X** and **Y** may be from saturated or unsaturated fatty acids.
- 4 The hydrocarbon chains of molecule **X** are always the same length.

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

- 5 Samples of a mixture of biological molecules were tested using Benedict's reagent, biuret solution and ethanol.



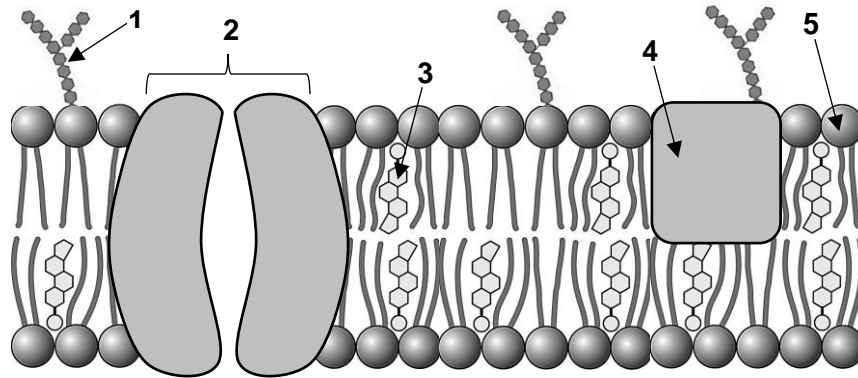
What does mixture **X** contain?

	Proteins	Lipids	Carbohydrates
A	✓	✗	✗
B	✗	✓	✓
C	✓	✓	✗
D	✓	✗	✓

- 6 How do channel proteins and carrier proteins differ from one another?

	Channel proteins	Carrier proteins
A	Are glycoproteins	Are lipoproteins
B	Transport molecules against their concentration gradient	Transport molecules down their concentration gradient
C	Transport molecules that bind to the channel protein	Transport molecules that do not bind to carrier proteins
D	Involved in facilitated diffusion	Involved in active transport

7 The diagram shows part of a cell surface membrane.



Which structures are correctly matched with their function?

	Regulates membrane fluidity	Recognizes self or non-self	Transports large ions and polar molecules
A	3	1	2
B	3	5	4
C	5	1	4
D	5	3	2

8 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 was applied to the roots of the plant.

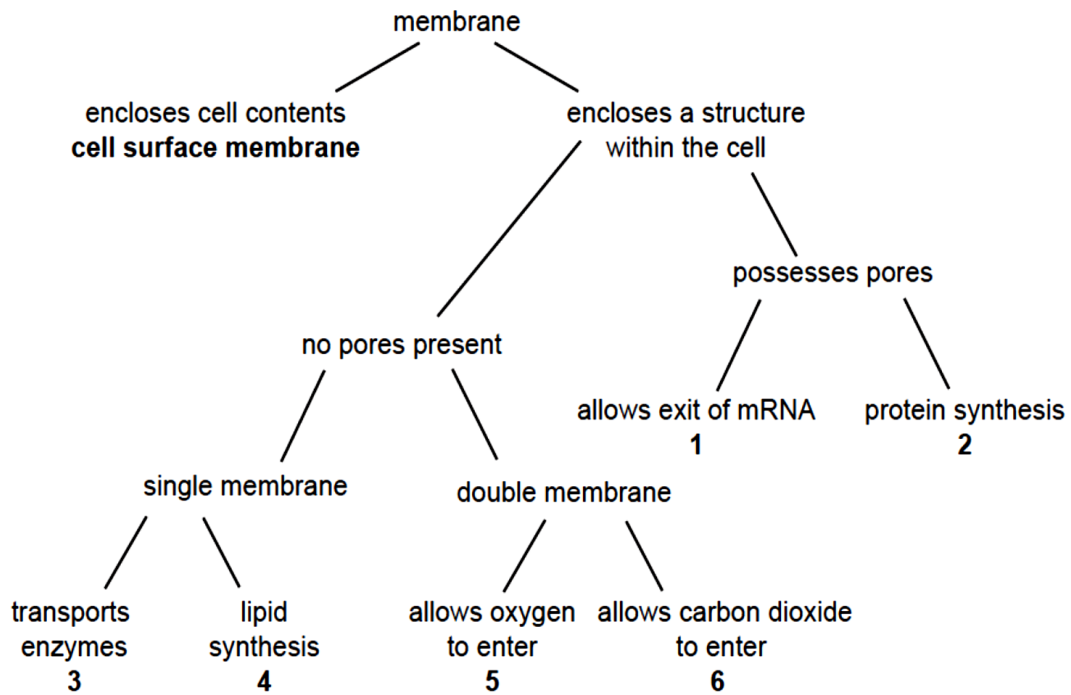
As the first step on finding out why the plant was not normally killed by its own toxin, he fractionated some plant cells and found that the toxin was in the fraction that contained the largest cell organelle. He also found that the toxin was no longer toxic after it was heated.

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

- 1 The toxin was stored in the central vacuole.
- 2 The toxin cannot cross the membrane of the organelle in which it is stored.
- 3 The toxin was stored in chloroplast.
- 4 The toxin is likely to be lipid-soluble.
- 5 The toxin may be an enzyme.

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

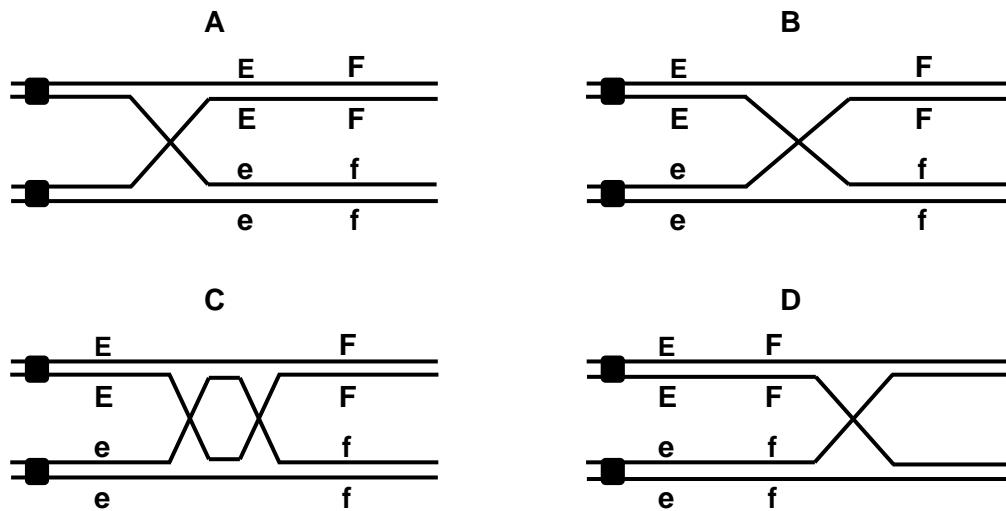
- 9 Membranes within and at the surface of cells have different roles. The flowchart shows a scheme to identify various membranes/ organelles within the cell, by describing the structure and function of the membranes/ organelles.



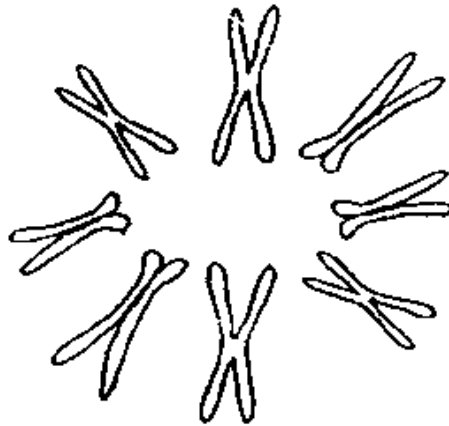
Which of the following outcomes correctly identifies the various membranes/ organelles?

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

- 10 The loci of two genes **E/e** and **F/f** are on the same chromosome. Which chromosomal event in meiosis increases genetic diversity in the next generation?



- 11 The diagram shows chromosomes at metaphase of mitosis.



Which of the following correctly describes the chromosomes shown?

	Number of chromosomes	Total number of DNA strands
A	4	8
B	4	16
C	8	16
D	8	32

- 12** In 1958, an experiment was carried out to investigate the way in which DNA replicates. *Escherichia coli* bacteria were grown in a medium containing $^{15}\text{NH}_4\text{Cl}$. After very many generations all the bacterial DNA contained ^{15}N and was described as 'heavy'.

The bacteria were then transferred to a medium containing $^{14}\text{NH}_4\text{Cl}$. Some of the bacteria were removed as soon as they had reproduced once (first generation). Further samples were removed after the second and third generations.

The bacterial DNA was then extracted from each sample, placed in a solution of caesium chloride and spun in a centrifuge. The percentage of ^{15}N (heavy) DNA in each sample was then calculated.

What will be the percentage of cells containing ^{15}N in the third generation?

	Percentage of DNA in the sample obtained from the third generation/ %		
	$^{14}\text{N}-^{14}\text{N}$	$^{14}\text{N}-^{15}\text{N}$	$^{15}\text{N}-^{15}\text{N}$
A	0	75	25
B	25	75	0
C	50	25	25
D	75	25	0

- 13** The following statements illustrate the processes that occur during translation, although not necessarily in this order.

- 1 The large subunit of the ribosome binds and forms the translation initiation complex.
- 2 The second amino acyl-tRNA complex now binds to mRNA at the "A" site of the ribosome.
- 3 The small ribosomal subunit, with initiator tRNA bound, binds to the 5' cap of the mRNA and scans for the first start codon.
- 4 Soluble protein called release factor recognises the stop codon and binds at the "A" site.
- 5 Formation of a peptide bond between the first and the second amino acids by peptidyl transferase.
- 6 The second amino acyl-tRNA complex moves from the "A" site to the "P" site.

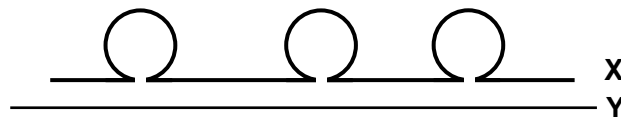
Using the information provided above, deduce the order in which these processes occur.

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

14 Which of the following correctly describes the mutation that gives rise to sickle cell anaemia?

- A Hydrophilic glutamic acid is changed to hydrophobic valine.
- B Hydrophilic valine is changed to hydrophobic glutamic acid.
- C Hydrophobic glutamic acid is changed to hydrophilic valine.
- D Hydrophobic valine is changed to hydrophilic glutamic acid.

15 The diagram below shows the result of hybridizing mature mRNA of ovalbumin to the ovalbumin gene.



Which of the following statement is correct?

	X	Y	Number of exons	Number of introns
A	Mature mRNA	DNA	3	4
B	Mature mRNA	DNA	4	3
C	DNA	Mature mRNA	3	4
D	DNA	Mature mRNA	4	3

16 Which of the following would cause phenotypic variation among organisms of the same genotype?

- A Mutation
- B Continuous variation within the species
- C Exposure to different environments
- D Different varieties of the same species

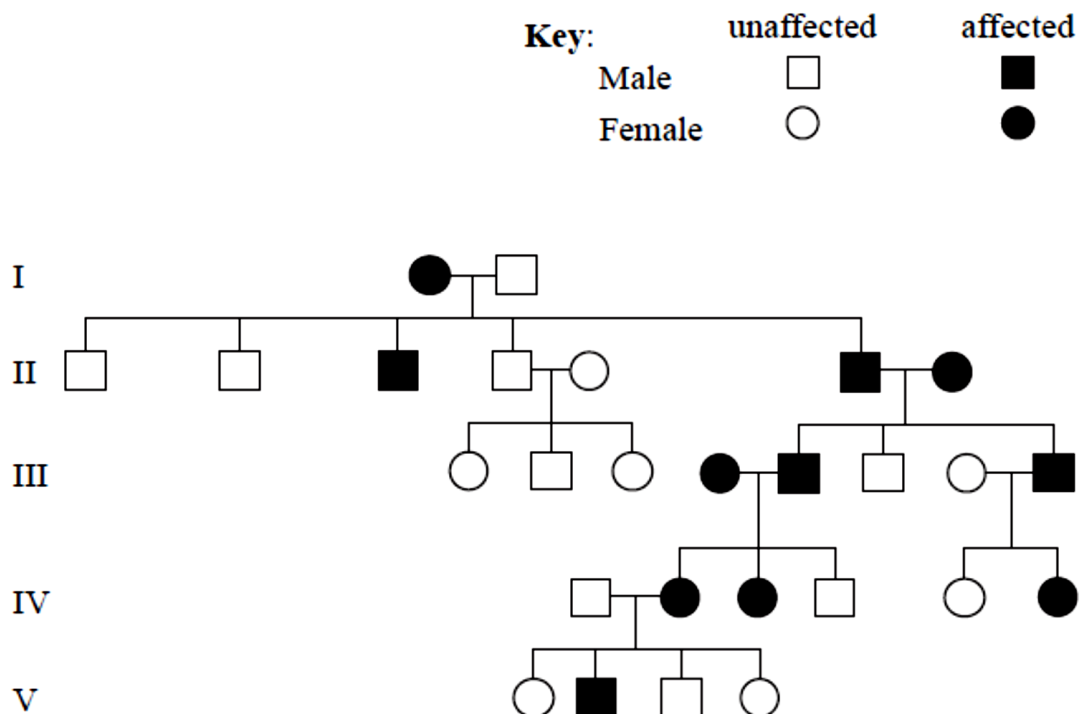
- 17 A cross between a fish with genes coding for abnormal fin and silver-colouration and another fish of unknown genotype was performed. The cross produced the following offspring.

1082 Normal fins, silver-coloured
 360 Abnormal fins, dull-coloured
 324 Normal fins, dull-coloured
 997 Abnormal fins, silver-coloured

Using the following symbols: **N** normal fins; **n** abnormal fins; **R** silver color; **r** dull color, what is the genotype of the unknown fish?

- A NnRr
- B NnRR
- C NNRr
- D NNrr

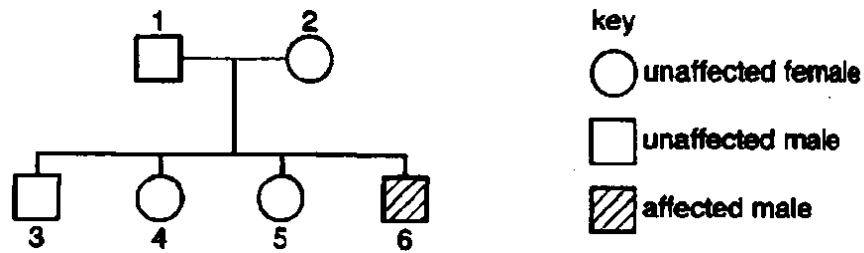
- 18 The pedigree chart below shows the inheritance of a genetic disease in a family.



What is the nature of the allele that causes this disease?

- A Dominant and sex linked
- B Dominant and non-sex linked
- C Recessive and sex linked
- D Recessive and non-sex linked

19 The diagram shows the inheritance of haemophilia in a family.



If daughter 4 married a normal male, what is the probability that their first child would suffer from haemophilia?

- A 0
- B 0.125
- C 0.25
- D 0.5

20 *Anolis sagrei*, a lizard native to Bahamas Island, spend most of their time on ground.

A predatory lizard, *Leiocephalus carinatus*, which is a ground dwelling predator of *Anolis sagrei* was introduced.

6 months later, most of the *A. sagrei* lizards found in the island have longer legs.

12 months later, most of the *A. sagrei* lizards found in the island have shorter legs and they spend more time in treetops.

Which of the following statement(s) is/are true?

- 1 Presence of *L. carinatus* caused *A. sagrei* to have shorter legs.
- 2 Having longer legs is advantageous to *A. sagrei* initially.
- 3 Staying in treetops helped *A. sagrei* to escape from *L. carinatus*.

- A 1 only
- B 1 and 2 only
- C 2 and 3 only
- D All of the above

- 21 The graph below shows the effect of using warfarin to eliminate rats. Warfarin is a blood anticoagulant and is present in rat poison.



Which of the following best explains the effect of warfarin on rats?

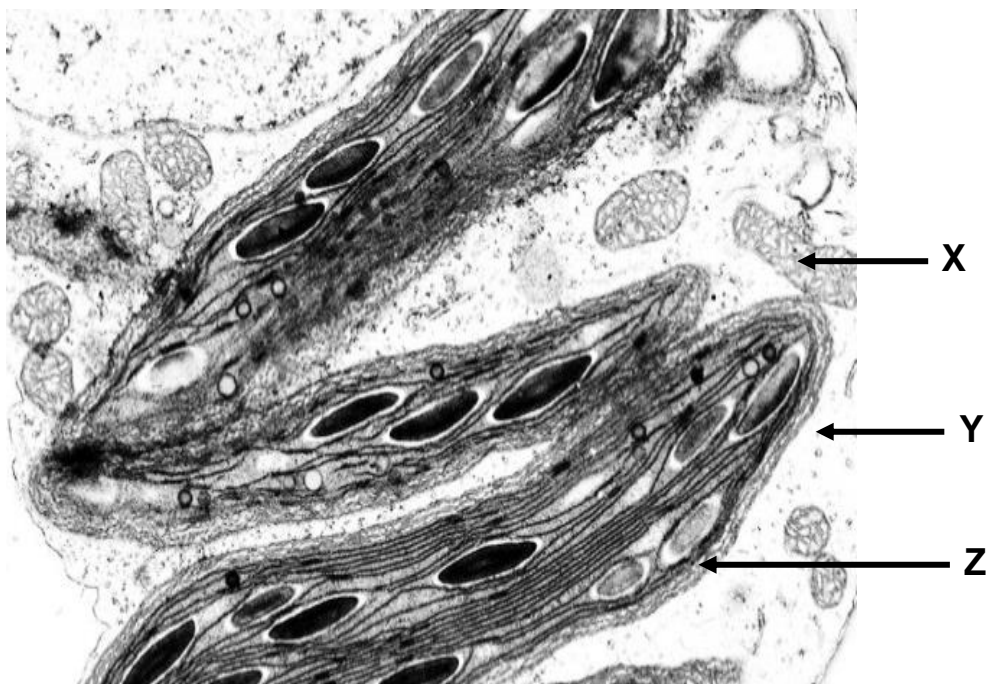
- A The proportion of rats that are resistant to warfarin increases over generations.
 B Rats acquired immunity to warfarin with repeated exposure.
 C The number of mutant rats increases over generations.
 D Repeated exposure to warfarin caused the rats to become more resistant.
- 22 The α , β and γ globin chains of human, chimpanzee, gorilla and gibbon haemoglobin were analysed. The number of differences in the amino acid sequences in comparison with the human molecules is shown in the table.

species	Number of differences in amino acid sequence from human molecules		
	α globin	β globin	γ globin
chimpanzee	0	0	1
gorilla	1	1	1
gibbon	3	3	2

What do the differences suggest?

- A Humans and gorillas are more closely related than humans and gibbons.
 B Humans and gibbons do not share a common ancestor.
 C Gibbons are the ancestor of gorillas and chimpanzees are the ancestor of humans.
 D Humans and gibbons are more closely related than humans and chimpanzees.

23 The diagram shows the ultrastructure of a plant cell.



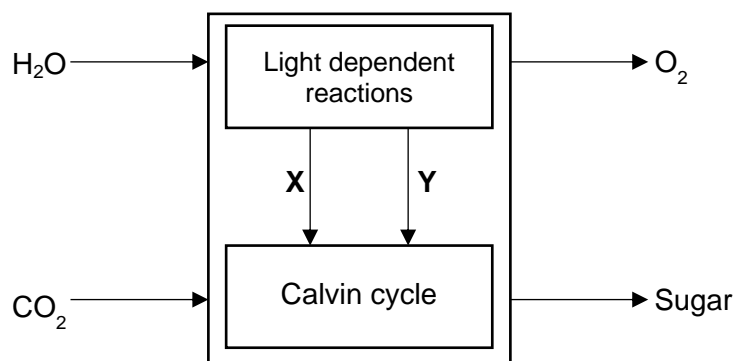
Which of the following row is correct?

	Site of ATP synthesis	Site of carbohydrate synthesis
A	X	Z
B	Z	X
C	X, Y	X
D	X, Y, Z	Z

24 How many molecules of NADH and FADH_2 will be produced given **two** molecules of pyruvate?

- A 3 NADH, 1 FADH_2
- B 4 NADH, 1 FADH_2
- C 6 NADH, 2 FADH_2
- D 8 NADH, 2 FADH_2

- 25** The diagram below shows the processes that occur in the chloroplast during photosynthesis.



What are **X** and **Y**?

	X	Y
A	ATP	NADH
B	ATP	NADPH
C	Protons	Electrons
D	FADH ₂	NADH

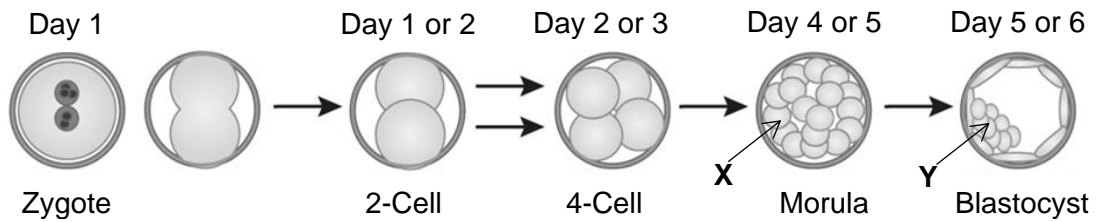
- 26** Human growth hormone is produced by genetic engineering in several stages. Some of these stages are listed.

- 1 Clone a human growth hormone gene next to a sheep's promoter
- 2 Obtain milk from female transgenic sheep and purify hormone from the milk
- 3 Inject the recombinant DNA into the egg cells of a female sheep
- 4 Splicing of DNA into host plasmids
- 5 Use of specific restriction endonuclease to cut host plasmid with specific 'sticky ends'

What is the correct order?

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

27 The figure below shows several stages in the development of an embryo.



Which of the following statement is true about the cells labelled **X** and **Y**?

- A **X** is a pluripotent cell while **Y** is a multipotent cell.
- B **X** is a totipotent cell while **Y** can divide to give multipotent cells.
- C Both **X** and **Y** are totipotent.
- D **X** can divide to give totipotent cells while **Y** can divide to give pluripotent cells.

28 The dashed lines in the template sequence represent a long sequence of bases to be amplified.

Template

5' ATTCGGA CTTG - - - - - GTCCAGCTAGAGG 3'

3' TAAGCCTGAAC - - - - - CAGGTCGATCTCC 5'

Which of the following sets of primers can be used in the PCR for the amplification of the DNA sequence?

- A 5' TCCGAAT 3' & 5' CTAGAGG 3'
- B 5' ATTCGGA 3' & 5' CCTCTAG 3'
- C 5' CCTGAAC 3' & 5' GCTGGAC 3'
- D 5' AUUCGGA 3' & 5' CCUCUAG 3'

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

	Bt corn		Golden rice		GM salmon	
	<i>effect</i>	<i>possible consequence</i>	<i>effect</i>	<i>possible consequence</i>	<i>effect</i>	<i>possible consequence</i>
A	improve quality	become weeds	improve yield	become weeds	improve yield	displace native species
B	improve yield	become weeds	improve quality	cause allergies	improve yield	displace native species
C	improve yield	become weeds	improve yield	cause allergies	improve quality	cause allergies
D	improve yield	become weeds	improve quality	become weeds	improve yield	cause allergies

- 30 Some of the goals and benefits of Human Genome Project (HGP) are listed below.
- 1 Prescribe the right drug, in the right dosage and combination to each individual based on the genotype of the individual
 - 2 Develop computer programs or software to analyze the data from HGP
 - 3 Design drugs based on the primary structure and the 3D shape of the target proteins
 - 4 Develop genetic tests to screen for carriers of genetic disorders
 - 5 Develop more efficient methods for DNA sequencing and sequence analysis
 - 6 Create a genetic linkage map and physical map of the human genome

Which row correctly identifies the goals and benefits of HGP?

	Goals	Benefits
A	1, 3, 4	2, 5, 6
B	1, 4, 5	2, 3, 6
C	2, 3, 6	1, 4, 5
D	2, 5, 6	1, 3, 4

END OF PAPER

TJC Prelim 2015
H1 Biology Paper 1 (8875/01) Answers

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