

INNOVA JUNIOR COLLEGE  
JC2 PRELIMINARY EXAMINATION 2  
in preparation for General Certificate of Education Advanced Level  
**Higher 1**

CANDIDATE  
NAME

CLASS

INDEX NUMBER

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**BIOLOGY**

**8875/01**

Paper 1 Multiple Choice

**21 September 2015**

**1 hour**

Additional Materials:      Multiple Choice Answer Sheet

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**READ THESE INSTRUCTIONS FIRST**

Write your name and class on all the work you hand in.

Write in soft pencil.

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

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.

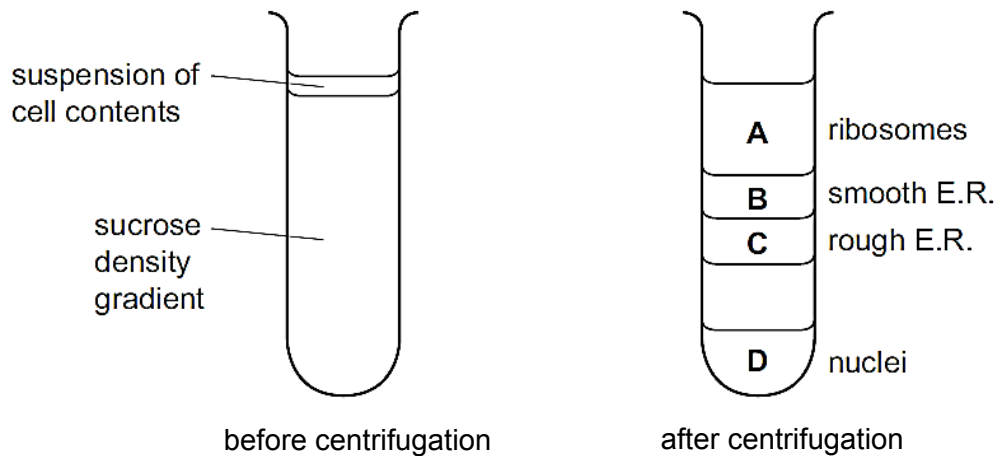
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This document consists of **14** printed pages.



- 1 In zonal centrifugation, the suspension of cell contents is placed on top of a sucrose density gradient. The tube is then placed in a centrifuge and spun at high speed. The heavier particles will move towards the bottom of the tube faster than lighter particles, as shown below.

If a sample of intact prokaryotes had been added to a suspension of eukaryotic cell contents, where would you expect them to be found?



- 2 Which one of the following sequences of cell structures correctly describes the pathway that leads to the production, transport, and secretion of the protein thyroxine by thyroid gland cells?

- A Nucleus → ribosomes → endoplasmic reticulum → Golgi body → cell membrane
- B Nucleus → ribosomes → vesicles → endoplasmic reticulum → cell membrane
- C Ribosomes → mitochondria → Golgi body → vesicles → cell membrane
- D Ribosomes → endoplasmic reticulum → nucleus → Golgi body → cell membrane

- 3 Which of the statements about polysaccharides can be used to describe both amylopectin and cellulose?

- 1 adjacent glucose molecules are rotated by 180°
- 2 contains 1,4 glycosidic bonds
- 3 polymer of α-glucose

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

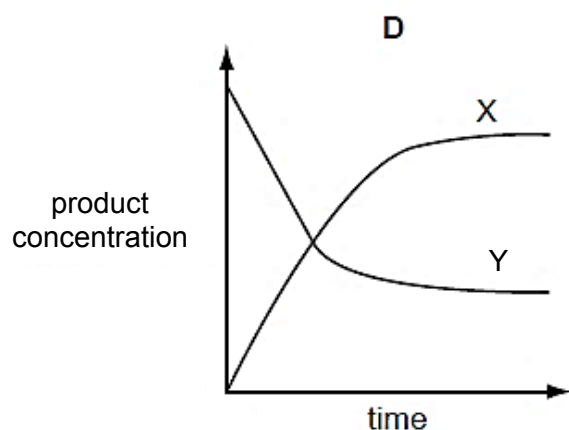
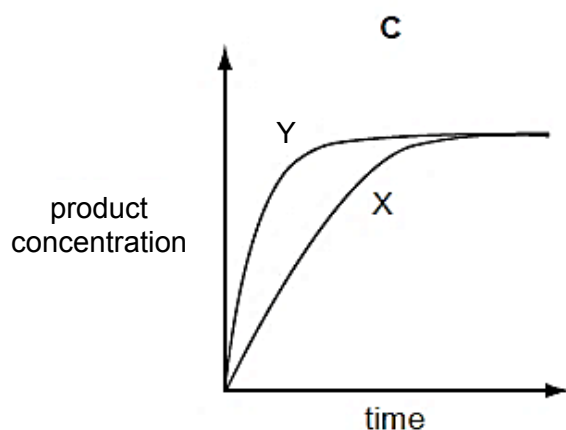
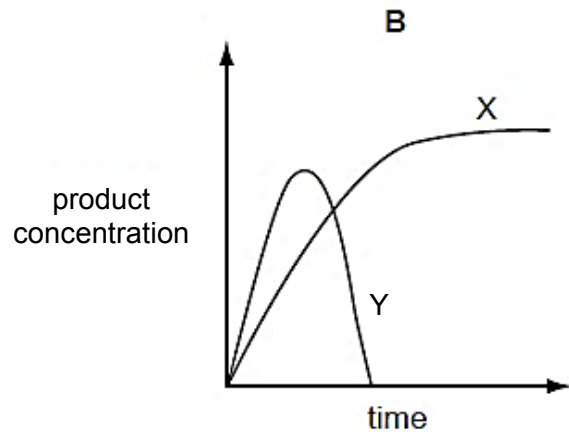
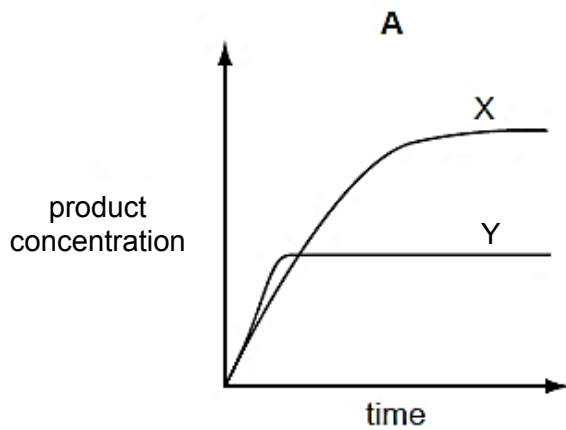
4 Which features of collagen result in it having high tensile strength?

- 1 covalent bonds form between adjacent molecules
- 2 each three-stranded molecule is held together by hydrogen bonds
- 3 every third amino acid in the polypeptide is small
- 4 the primary structure is held together by peptide bonds

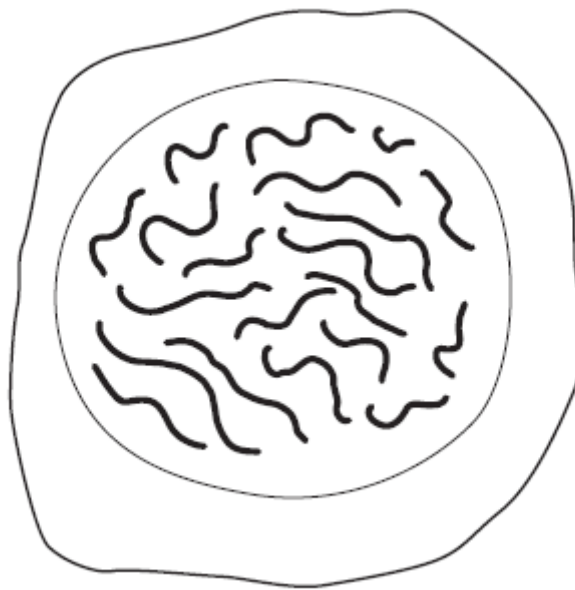
- A 1 and 2  
 B 1, 2 and 3  
 C 1, 3 and 4  
 D 2, 3 and 4

5 Two enzyme experiments were carried out. The first, experiment X, was carried out at a constant temperature of 37°C. During the second experiment, Y, the temperature was increased from 37°C to 80°C. All other factors were kept the same.

Which graph shows the results?



- 6 Which is correct for a non-competitive inhibitor of enzyme action?
- 1 Increasing the concentration of the enzyme's substrate will reduce its effect.
  - 2 It reduces the activation energy required for a reaction to take place.
  - 3 It reduces the maximum rate of reaction.
- A 1 only  
B 3 only  
C 1 and 3 only  
D 2 and 3 only
- 7 The diagram shows a cell of an organism during G1 phase of interphase.



How many chromosomes will there be in the cell when it enters prophase?

- A 10  
B 20  
C 40  
D 46

- 8** Which features of mitosis ensure that the genetic constitution of the cell is maintained?
- 1 the position of the chromosomes on the equator of the spindle
  - 2 the longitudinal division of the centromeres
  - 3 the DNA of the parent cells replicates before mitosis begins
  - 4 the pulling apart of the chromatids to opposite poles
- A** 3 and 4  
**B** 1, 2 and 3  
**C** 1, 2, and 4  
**D** 1, 2, 3 and 4
- 9** What is the maximum number of hydrogen bonds in a length of DNA containing 700 nucleotides?
- A** 350  
**B** 700  
**C** 1050  
**D** 2100
- 10** During semi-conservative replication of DNA in eukaryotic cells, the following processes occur.
- 1 Free nucleotides are hydrogen bonded to those on the exposed strand.
  - 2 Hydrogen bonds are broken between the complementary base pairs.
  - 3 Covalent bonds form between adjacent nucleotides on the same strand.
  - 4 The DNA double helix is unwound.
- Which shows the correct order of some of the processes?
- A** 3 → 1 → 2 → 4  
**B** 3 → 2 → 4 → 1  
**C** 4 → 2 → 1 → 3  
**D** 4 → 1 → 2 → 3
- 11** Protein synthesis in cells is terminated when the ribosome
- A** reads a 'stop' codon on the mRNA molecule.  
**B** reads a 'stop' codon on the tRNA molecule.  
**C** reaches the polyA tail of the mRNA molecule.  
**D** brings in a 'stop' amino acid.

- 12 The table shows some of the mRNA codons for some amino acids:

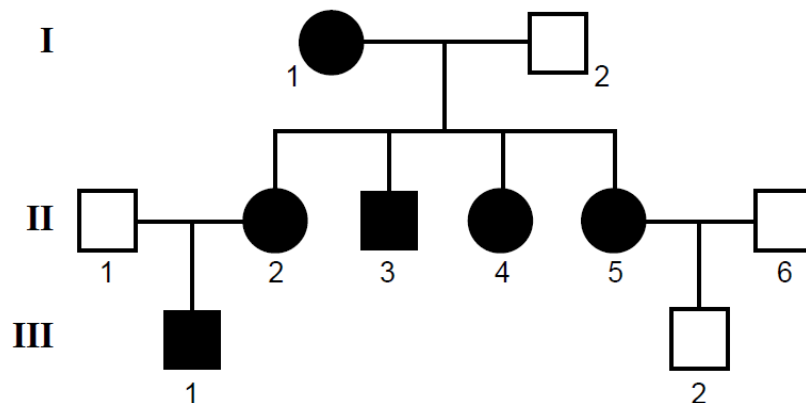
mRNA codon	amino acid
AUG	methionine
AAG	lysine
GGC, GGU	glycine
UUU, UUA	phenylalanine
AUA	isoleucine
UAA, UAG	--

A section of mRNA has the following codons:

<i>codon</i>	.....	51	52	53	54	55	.....
<i>mRNA codon</i>	.....	GGC	AAG	UUU	AUA	AAG	.....

Which one of the following changes to the mRNA section shown above would **not** result in the production of a different protein?

- A Deletion of the third U in codon 53.  
 B Insertion of U between codons 51 and 52.  
 C Substitution of U for the second A in codon 52.  
 D Substitution of U for C in codon 51.
- 13 Phenylketonuria (PKU) is inherited as an autosomal recessive condition. In the following pedigree, shaded individuals have this trait.



Which of the following can be best concluded from the pedigree?

- A I2 is heterozygous  
 B II1 is homozygous  
 C II5 is heterozygous  
 D III2 is homozygous

- 14 Two genes, Q and R affect the petals of a flower.

Gene Q has two alleles,  $Q^L$  and  $Q^A$ . The genotype  $Q^LQ^L$  produces large petals,  $Q^LQ^A$  produces small petals and  $Q^AQ^A$  produces no petals.

Gene R has two alleles. R produces red pigment, and dominant over r that produces no pigment.

Two plants, heterozygous for both genes are crossed. How many phenotypes are expected in the next generation?

- A 4
- B 5
- C 6
- D 7

- 15 Vitamin D resistant rickets is a sex-linked disease which results in impaired calcium absorption in the body. All female offspring of diseased males will get the disease.

A man without rickets marries a woman with rickets. The woman's mother did not have rickets. If this couple has a daughter, what is the probability that she will get rickets?

- A 0.00
- B 0.25
- C 0.50
- D 0.75

- 16 Which of the following statements best describe a gene?

- A A sequence of DNA nucleotides that code for protein.
- B A specific location on the chromosome.
- C It can be dominant, recessive or co-dominant.
- D The exons that are spliced to form the mature mRNA.

- 17 The concentration of carbon dioxide in a sample of air was found to be 280 ppm (parts per million). A controlled experiment was designed to measure the concentration of carbon dioxide in the air after it had flowed over the leaves of a green plant. Measurements were taken at a range of light intensities.

The following results were obtained:

light intensity (% of full sunlight)	concentration of CO <sub>2</sub> in air after flowing over leaves (ppm)
75	201
50	200
25	254
10	280

Which one of the following statements is **not** consistent with these results?

- A At the lower light intensities tested, the rate of photosynthesis is limited by light intensity.
- B In the dark, the concentration of carbon dioxide in the air after it had flowed over leaves would be at least 280 ppm.
- C At the higher light intensities tested, the rate of photosynthesis is affected by factors other than light.
- D At a light intensity of 10% of full sunlight, carbon dioxide concentration is the limiting factor.
- 18 The Calvin cycle can be divided into three phases, involving several reactions.
- 1 carbon dioxide uptake
  - 2 carbon reduction
  - 3 regeneration

Which row shows the phases where each of the reactions occurs?

	ATP hydrolysis	formation of NADP	formation of 3C sugar	use of RuBP
A	1	3	2	1
B	1, 3	2	1, 2	3
C	2	1, 2	2, 3	3
D	2, 3	2	2	1

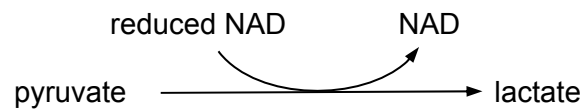


- 19** Six tubes containing preparations from animal tissue were set up as shown below.

Tube	Contents
1	Glucose + homogenised cells
2	Glucose + mitochondria
3	Glucose + cytoplasm lacking organelles
4	Pyruvate + homogenised cells
5	Pyruvate + mitochondria
6	Pyruvate + cytoplasm lacking organelles

After incubation, in which three tubes would carbon dioxide be produced?

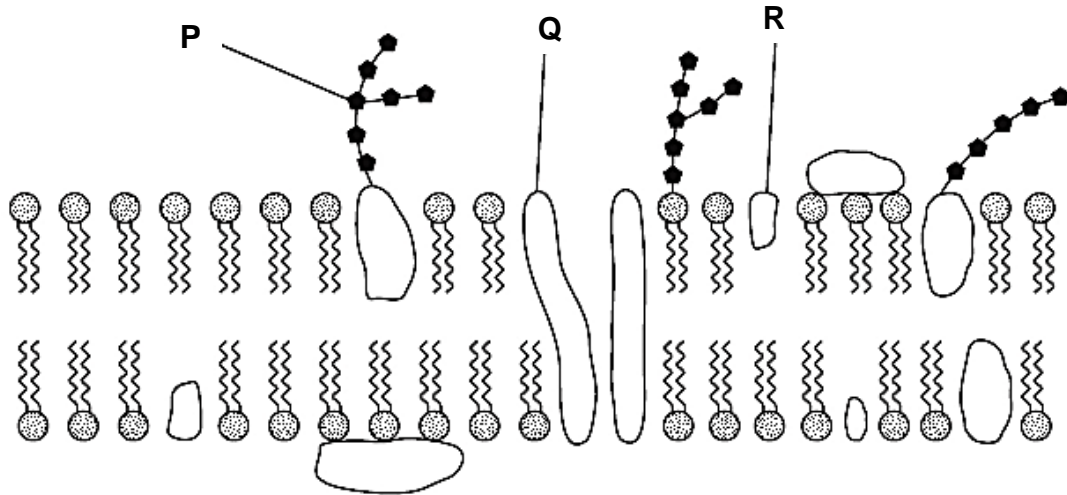
- A** 1, 2 and 3  
**B** 1, 4 and 5  
**C** 2, 4 and 6  
**D** 4, 5 and 6
- 20** Lactate dehydrogenase catalyses the following reaction:



What would be the effect of inhibition of lactate dehydrogenase in a mammalian cell under anaerobic conditions?

- A** A decrease in glycolysis, due to the lack of NAD.  
**B** A decrease in cell pH, due to the accumulation of lactic acid.  
**C** An increase in ATP production, due to increased amounts of reduced NAD.  
**D** An increase in the activity of Krebs cycle, due to increased amounts of pyruvate.

21 The diagram shows part of a cell surface membrane.



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

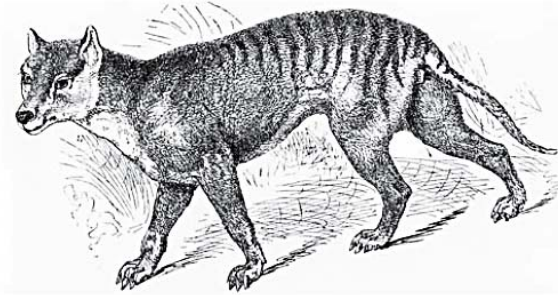
	regulates membrane fluidity	forms hydrogen bonds with water to stabilise membrane	transports ions and large polar molecules
<b>A</b>	P	R	Q
<b>B</b>	P	Q	R
<b>C</b>	Q	R	P
<b>D</b>	R	P	Q

22 What is the mechanism of natural selection?

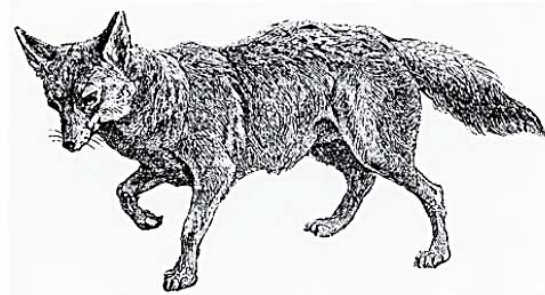
- A** Any individuals in a population can be selected entirely by chance.
- B** After a change in the environment the individuals will evolve adaptations to the new conditions.
- C** If an adaptation to the environment is useful, an individual will develop it and pass it on to its offspring.
- D** Variations amongst individuals of a population are selected by a changing environment.

- 23** The Tasmanian tiger (now extinct) and the American grey wolf evolved independently of each other, but show similar physical structures and hunting behaviours.

The similarities between the two organisms are most likely a result of



Tasmanian tiger



American grey wolf

- A** allopatric speciation.  
**B** convergent evolution.  
**C** genetic drift.  
**D** homology.
- 24** The table shows equivalent amino acid sequences of part of a protein from four species of animal.

species	amino acid sequence							
1	trp	met	val	glu	cys	asp	arg	leu
2	trp	val	met	glu	cys	asp	asp	ala
3	trp	val	val	glu	cys	asp	arg	leu
4	phe	trp	val	gly	cys	arg	asp	leu

Using the technique of molecular analysis, which pair of animals share the most recent common ancestor and which pair are least closely related?

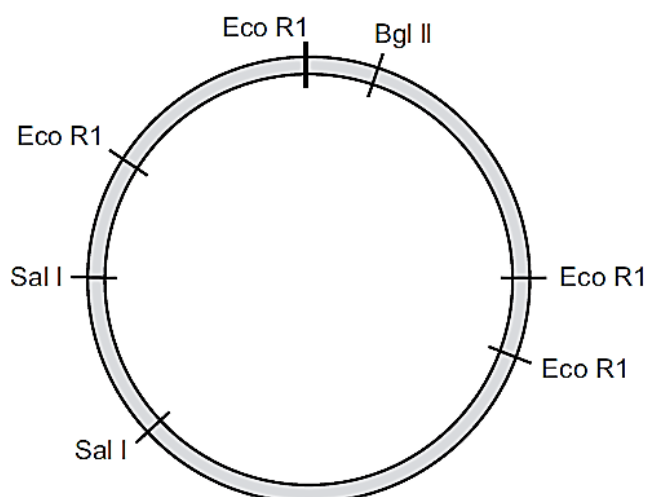
	most closely related pair	least closely related pair
<b>A</b>	1 and 2	1 and 4
<b>B</b>	1 and 3	1 and 4
<b>C</b>	1 and 3	2 and 4
<b>D</b>	2 and 3	3 and 4

- 25 Sharks and dolphins share similar features but also have essential differences.

	Differences		Similarities
Sharks	breathe with gills	fish	well-developed fin
Dolphins	breathe with lungs	mammals	streamlined body
			aquatic animals

The information in the table suggests that

- A different species will possess biological traits as a result of adaptation to similar ecological niches.
- B fish evolved from mammals.
- C sharks and dolphins are geographically isolated.
- D sharks act as a selective pressure on the dolphin.
- 26 The following diagram indicates the cutting sites of three different restriction enzymes on a particular bacterial plasmid.



How many fragments of DNA would be obtained if the plasmid was completely digested with the restriction enzyme *Eco R1*?

- A 2
- B 3
- C 4
- D 7

**27** What are the advantages and limitations of the polymerase chain reaction?

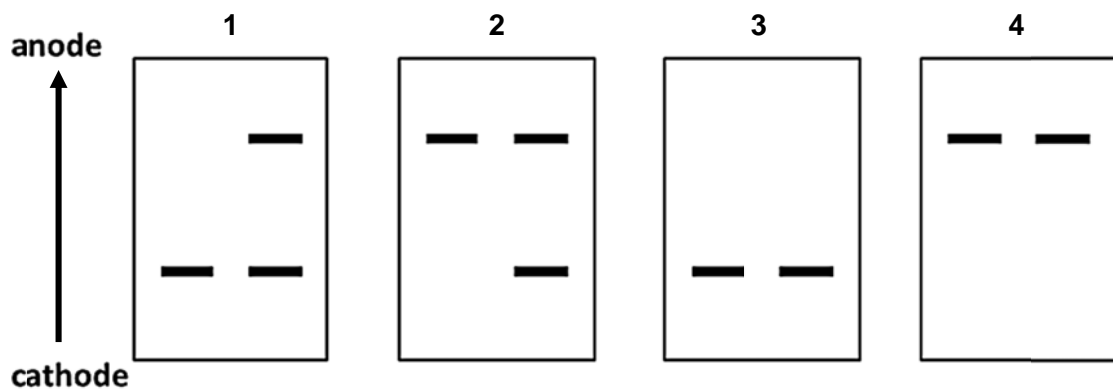
- 1 The length of DNA to be amplified is approximately 5kb.
- 2 The amount of DNA required is small.
- 3 There is an exponential increase in the DNA content during each cycle.
- 4 Specific primers are required for specific target sequences.

	Advantages	Limitations
<b>A</b>	1 and 2	3 and 4
<b>B</b>	1 and 3	2 and 4
<b>C</b>	2 and 3	1 and 4
<b>D</b>	2 and 4	1 and 3

**28** Cystic fibrosis (CF) is an autosomal recessive genetic disorder. An individual must have two copies of the mutated CFTR gene to express the disease phenotype. One of the most common CF-causing mutation resulted in a loss of an amino acid, phenylalanine.

The DNA sequence for the CF locus from two phenotypically normal offspring were separated by gel electrophoresis.

Which is the corresponding banding pattern obtained?



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

- 29** Which of the following statements regarding embryonic stem cells and hematopoietic stem cells is true?
- A** As embryonic stem cells develop, they turned into hematopoietic stem cells as they lose their ability to differentiate into all types of cells.
  - B** Both stem cells are derived from the zygotic stem cells with the hematopoietic stem cells having a lowered telomerase activity compared to the embryonic stem cells.
  - C** Embryonic stem cells have more genes than hematopoietic stem cells and thus are able to form more types of cells.
  - D** Under normal conditions, embryonic stem cells express more of their genes compared to the hematopoietic stem cells.
- 30** Which of the following statements below best represent a social implication of genetically modified (GM) crop plants?
- A** There is evidence that genes for herbicide resistance have spread from GM oilseed rape to nearby weed species although there is no evidence that these hybrids have persisted in the environment.
  - B** In some countries, government regulations have been put in place to prevent farmers planting GM crops close to non-GM and organic crops to prevent GM pollen from reaching the crops.
  - C** In some studies, the number of beneficial insects has been reduced in areas where insect resistant GM Bt corn has been grown, however in other studies, there has been no effect or the number of beneficial insects has increased.
  - D** Pressure placed by people on a multinational GM seed company has caused them to pledge that they will never develop a 'suicide' gene that prevents farmers from growing seed collected from last year's crop.

**2015 JC2 Prelim 2**  
**8875 H2 Biology**  
**Paper 1**  
**Suggested Answers**

Qn	Ans
1	D
2	A
3	A
4	B
5	A
6	B
7	B
8	D
9	C
10	C

Qn	Ans
11	A
12	A
13	A
14	C
15	C
16	A
17	B
18	D
19	B
20	A

Qn	Ans
21	D
22	D
23	B
24	C
25	A
26	C
27	C
28	C
29	A
30	B