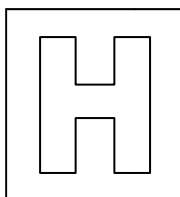


Candidate Name: _____

Class Adm No

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2015 Promotional Examination II

Pre-university 2

Biology Higher 1

8875/01

Paper 1 Multiple Choice

22 September 2015

1 hour

Additional Materials: Optical answer sheet

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write your name, Adm No. and class on all the papers you hand in.

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

Paper 1

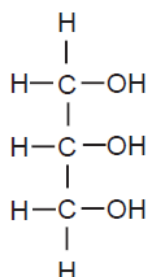
There are **thirty** questions in this paper. Answer **all** questions. For each question, there are four possible answers, **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Multiple Choice Answer Sheet.

Calculators may be used.

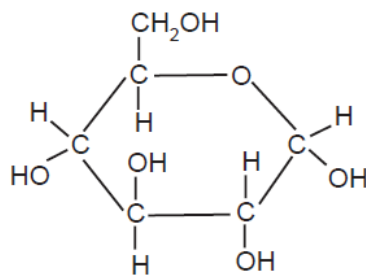
Answer **all** questions

1. Which of the following molecules contain glycosidic bonds?

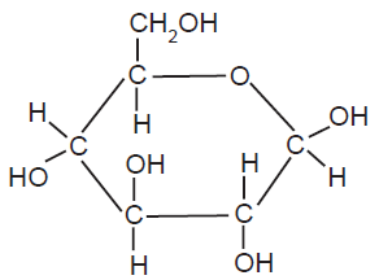
I



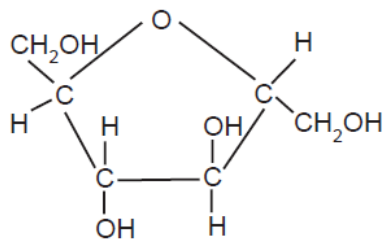
II



III

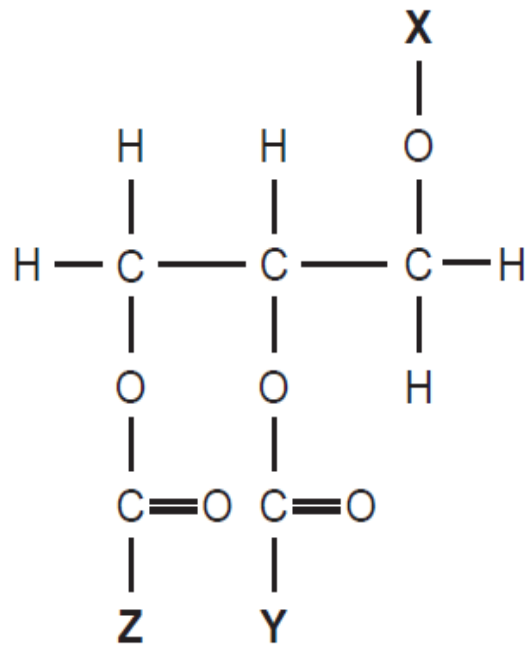


IV



- A** II and III only
B II, III and IV only
C All of the above
D None of the above

2. The diagram below shows a phospholipid molecule.



What are **X**, **Y** and **Z**?

	X	Y	Z
A	Hydrocarbon chain	Hydrocarbon chain	Phosphate-containing group
B	Hydrocarbon chain	Glycerol	Phosphate-containing group
C	Phosphate-containing group	Hydrocarbon chain	Hydrocarbon chain
D	Phosphate-containing group	Glycerol	Hydrocarbon chain

3. The R group of the amino acid Serine is $-\text{CH}_2\text{-OH}$. The R group of the amino acid Alanine is $-\text{CH}_3$.

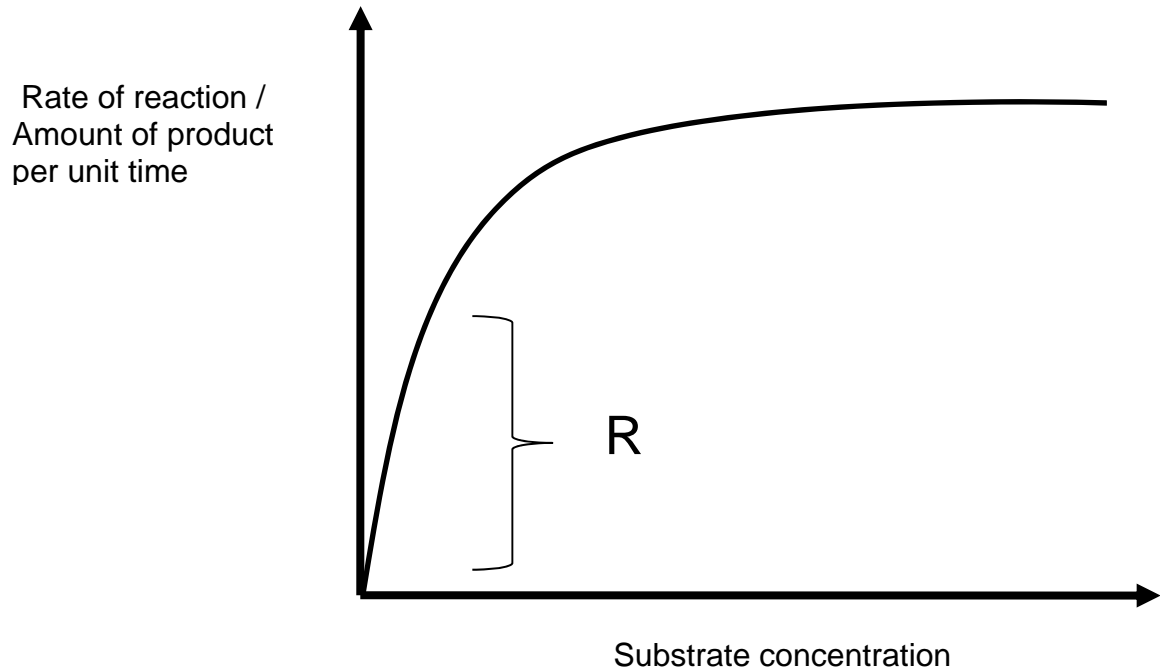
Where would these amino acids be mostly likely located within a globular protein in aqueous solution?

- A Serine would be in the interior, and alanine would be on the exterior of the globular Protein
- B Alanine would be in the interior, and serine would be on the exterior of the globular protein.**
- C Both serine and alanine would be in the interior of the globular protein.
- D Both serine and alanine would be in the interior and on the exterior of the globular protein.

4. Which set of statements correctly describes haemoglobin?

A	Four polypeptide chains, forming a globular chain	Iron ions can associate with oxygen forming oxyhaemoglobin	At 50% saturation, two oxygen molecules are transported by the molecule
B	Four polypeptide chains, each containing a prosthetic group	Iron ions can associate with oxygen forming oxyhaemoglobin	At 50 % saturation, two oxygen molecules are transported by the molecule
C	Four polypeptide chains, each containing a prosthetic group	Iron ions in the molecule can bind reversibly with oxygen	At 50% saturation, two oxygen atoms are transported by the molecule
D	Polypeptide chains produce a loose helical shape, which curls to form a spherical molecule	Iron ions can associate with oxygen forming oxyhaemoglobin	At 50% saturation, two oxygen molecules are transported by the molecule

5. The graph below shows the rate of an enzyme catalysed reaction occurring in lysosome with increasing substrate concentration. The reaction is carried out at 37°C and a pH of 4 for all substrate concentrations.

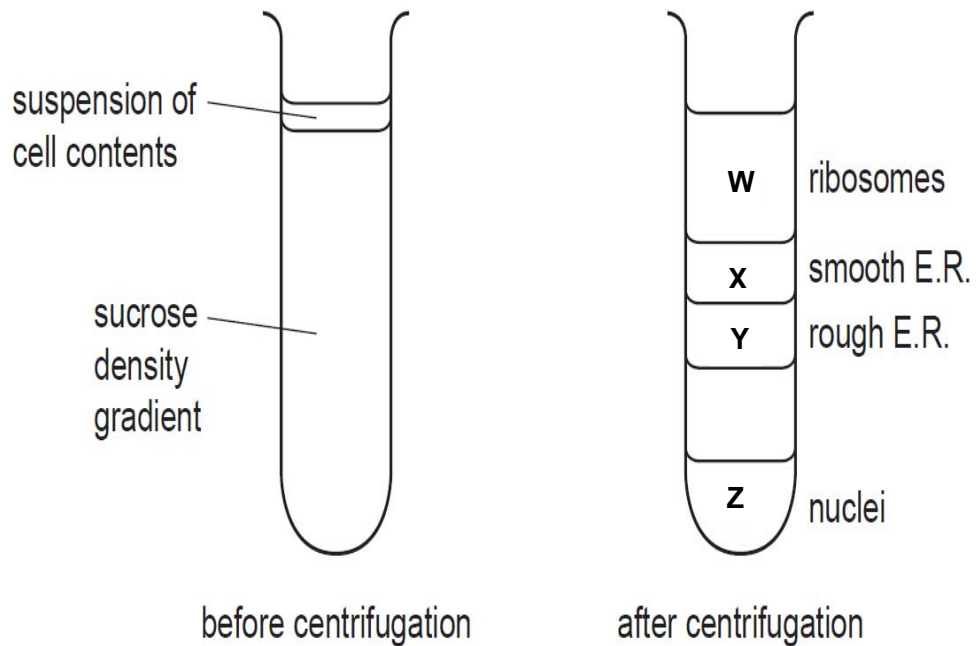


Which of the following(s) would result in a decrease in the rate of reaction at R?

- I Addition of co-factor
 - II Decrease in temperature to 27°C
 - III Increase in pH to 7
 - IV Addition of competitive inhibitor
- A** I and IV only
B II and IV only
C II, III and IV only
D I, II, III and IV

6. The isolation of specific organelles can be achieved by first lysing the cells and fractionating the cell lysate by density gradient centrifugation.

During density gradient centrifugation, the cell lysate is placed on top of a sucrose density gradient. The tube is then placed in a centrifuge and spun at high speed. The larger and denser particles will move towards the bottom of the tube faster than smaller and less dense particles as shown below.



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

- A W
- B X
- C Y
- D Z**

7. Which statements correctly describe the structure and function of prokaryotic ribosomes?

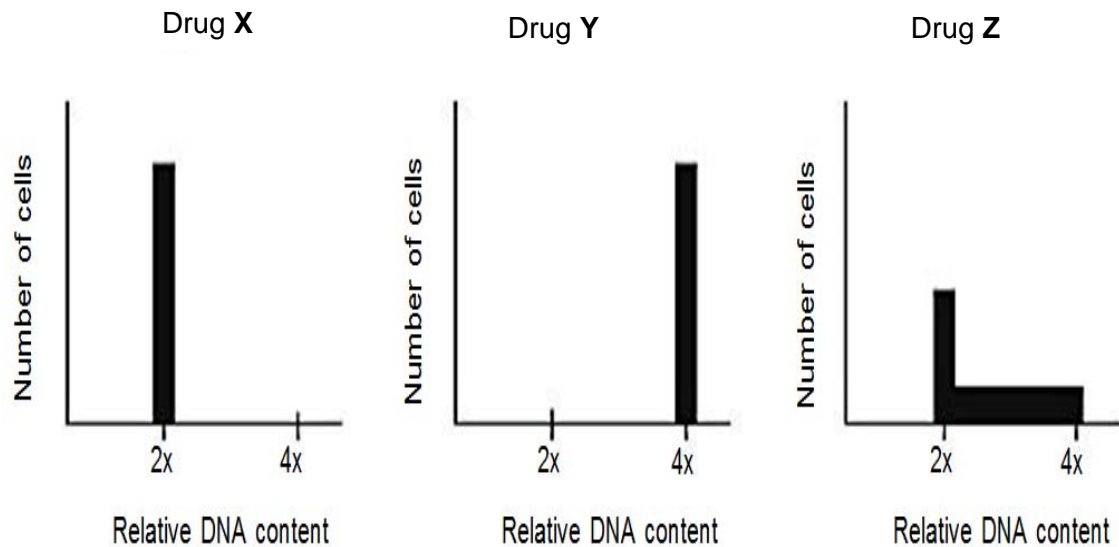
- I Prokaryote ribosomes are smaller than eukaryote ribosomes and sediment at 70S.
- II A prokaryote ribosome consists of two subunits, one of 50S and one of 30S.
- III In prokaryotes, ribosomes translate mRNA in the same cellular compartment in which it is transcribed.
- IV A prokaryote ribosome can accommodate only one aminoacyl-tRNA at a time.

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

8. Which types of genetic changes are least likely to have affected a proto-oncogene and a tumour suppressor gene in a cancer cell?

	Proto-oncogene	Tumour suppressor gene
A	Gene duplication	Chromosomal deletion
B	Chromosomal addition	Substitution mutation
C	Substitution mutation	Chromosomal translocation
D	Mutation resulting in a stop codon	Gene duplication

9. Three batches of cells at the start of G1 phase of the cell cycle were treated with three drugs **X**, **Y** and **Z**. Each batch has the same number of cells. Untreated cells are expected to complete interphase within 24 hours. The relative DNA content of the treated cells was measured after 24 hours. The three graphs show the results obtained.



What is the effect of each drug on the cells?

	Drug X	Drug Y	Drug Z
A	blocks G1 phase	blocks S phase	blocks G2 phase
B	blocks G2 phase	blocks S phase	blocks G1 phase
C	blocks S phase	blocks G1 phase	blocks G2 phase
D	blocks G1 phase	blocks G2 phase	blocks S phase

10. The table shows the results of an analysis of percentage concentration of three bases in nucleic acids from four sources. Three of the sources are DNA and one is RNA.

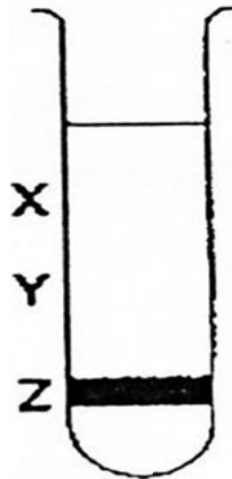
Source	Adenine	Cytosine	Guanine
W	18.9	31.9	30.2
X	25.5	24.6	23.8
Y	18.8	26.7	31.4
Z	30.4	18.5	18.7

Which source is RNA?

- A Source W
 - B Source X
 - C Source Y**
 - D Source Z
11. Which statements about the genetic code are correct?
- I The genetic code has redundancy and is degenerate.
 - II There is only one codon for the amino acid methionine.
 - III Codons act as 'stop' and 'start' signals during transcription and translation.
 - IV Prokaryotes generally use the same genetic code as eukaryotes.
- A I and II only
 - B I, II and III only
 - C I, II, and IV only**
 - D I, II, III and IV

12. A culture of bacteria had all its DNA labelled with the heavy isotope of nitrogen, ^{15}N . The culture was then allowed to reproduce using nucleotides containing normal ^{14}N . The DNA was examined using a centrifuge after one generation and again after two generations.

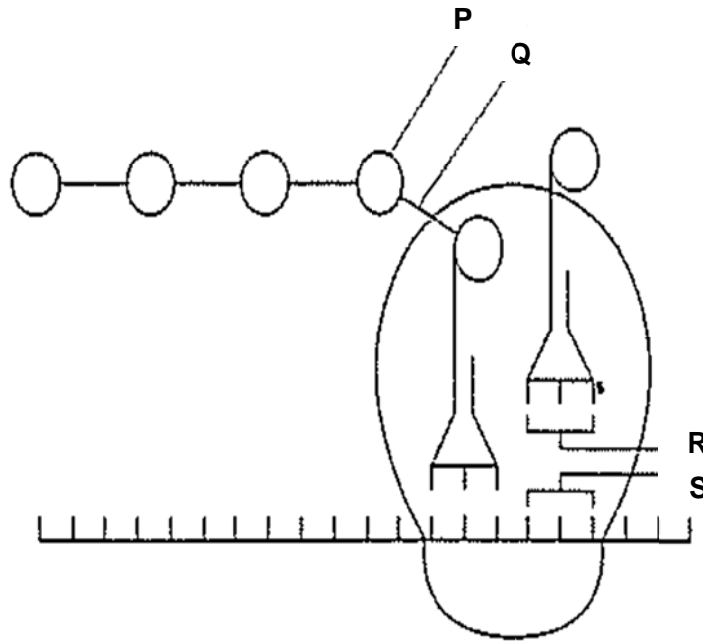
The diagram shows the position of the DNA band at **Z** in the centrifuge tube when the DNA was first labelled.



In which pattern would the DNA be found after the first and second cell generations?

	After first generation	After second generation
A	Half at X and half at Y	Quarter at X and at Z and half at Y
B	Half at X and half at Z	Quarter at X and at Z and half at Y
C	All at X	Half at X and half at Y
D	All at Y	Half at X and half at Y

13. The diagram below shows the process of translation in a prokaryotic cell.



Which correctly identifies **P**, **Q**, **R** and **S**?

	P	Q	R	S
A	N-formyl methionine	peptide bond	anticodon	codon
B	glutamic acid	hydrogen bond	codon	anticodon
C	valine	peptide bond	anticodon	codon
D	ribose	hydrogen bond	codon	anticodon

14. Which of the following statement(s) are correct?

- I A mutation in an allele occupying a gene locus may result in a change in the individual's phenotype.
- II Gene mutations always give rise to recessive alleles.
- III Chromosomal mutations can give rise to new alleles.
- IV Aneuploids have extra chromosomes in their genome.

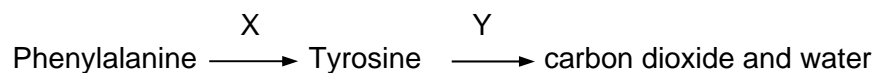
A I only

B I and IV only

C I, III and IV only

D II, III and IV only

15. The following reaction sequence occurs in humans.



Genetic disease P is caused by an enzyme deficiency in step X and genetic disease Q is caused by an enzyme deficiency in step Y. Both conditions are rare and are caused by recessive alleles.

A man with genetic disease P marries a woman with genetic disease Q.

Which phenotypes would be expected for their children?

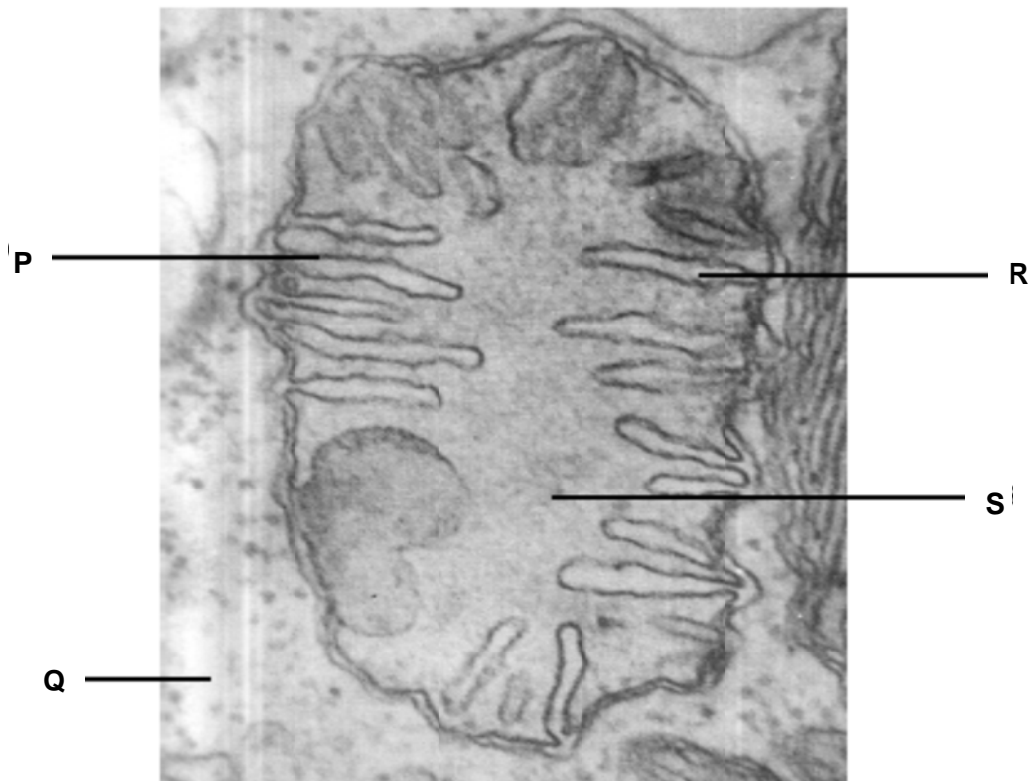
A All have neither genetic disease

B All have genetic disease P only

C All have genetic disease Q only

D All have both genetic diseases

16. The figure below shows an electron micrograph of part of a liver cell.



Which combination of processes correctly corresponds with structures **P**, **Q**, **R** and **S**?

	Breakdown of fructose-6-phosphate	Oxidative phosphorylation only	Temporary lowering of pH	Formation of water
A	Q	R	S	P
B	R	S	P	Q
C	S	P	Q	R
D	Q	P	R	S

17. Oligomycin is a chemical that targets the inner mitochondrial membrane to uncouple oxidative phosphorylation from electron transport. It allows protons to cross the inner mitochondrial membrane and thus dissipates the proton gradient.

Which of the following is true of a cell treated with Oligomycin?

	Ability to use glucose	Ability to use oxygen	Ability to produce carbon dioxide	ATP yield
A	Yes	Yes	No	Decreases
B	Yes	Yes	Yes	Decreases
C	Yes	No	Yes	Increases
D	No	Yes	No	Increases

18. Which of the following statements are false?

- I Both the mitochondria and the chloroplast are responsible for the production of cellular ATP.
- II Photosystem I can operate independently from photosystem II.
- III At low light intensities, energy for triose phosphate production is supplied by ATP produced by respiration.
- IV Proton motive forces can only be generated in the presence of light.

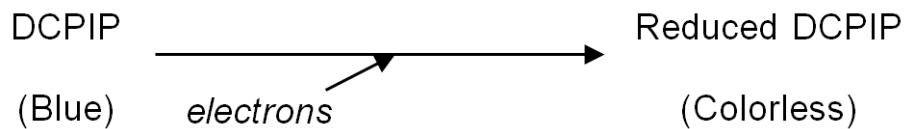
- A** II and III only
- B** I, II and IV only
- C** I, III and IV only
- D** All of the above.

19. What happens to the reduced NADP molecules in cell metabolism?

- A They act as reducing agents during light dependent reactions in the chloroplast.
- B They are oxidised in thylakoid membrane for ATP formation.
- C They are oxidised in the Calvin cycle when reacting with 1,3-Bisphosphoglycerate.**
- D They are oxidised in the inner mitochondrial membrane when oxidative phosphorylation.

20. 2,6-dichlorophenolindophenol (DCPIP) is a blue colourless reduced DCPIP by accepting electrons, as

2013 Prelim RI



In an experiment, green chloroplast extract was first mixed with DCPIP and the extract turned blue-green. After exposure to 2 hours of light in the presence of fixed volumes of carbon dioxide and water, the extract became completely green again.

Which of the following shows a likely combination of products that was being formed towards the end of the experiment?

	O ₂	ATP	reduced NADP
A	+	+	-
B	-	+	+
C	+	-	-
D	-	-	+

21. Many types of evidence, including homology, can provide evidence in support of Darwin's theory of natural selection.

Which statement does not provide support?

- A The allele for sickle cell haemoglobin that gives resistance to malaria is more frequent in malarial areas.
- B The distribution of the variants of the A blood group antigen reflects human migration patterns.**
- C The homozygous condition for an allele coding for a non-functional blood clotting protein is rare.
- D The molecular structure of ATP is almost identical in all eukaryotes.

22. Bacteria in the genus *Wolbachia* infect many insect species, including butterflies and mosquitoes. In butterflies, these bacteria may be passed from one generation to the next in eggs and they selectively kill developing male embryos.

In Samoa in the 1960s, the proportion of male blue moon butterflies fell to less than 1% of the population. However, by 2006, the proportion of males was almost 50% of the population.

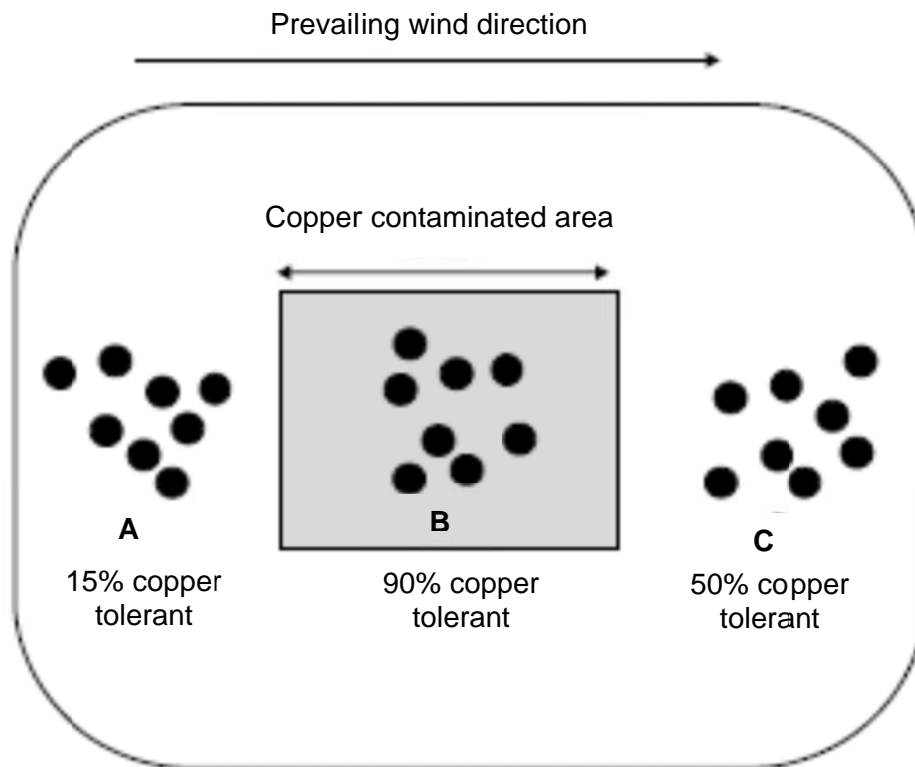
Resistance to *Wolbachia* is the result of the dominant allele of a suppressor gene.

Which statements correctly describe the evolution of resistance to *Wolbachia* in the blue moon butterfly population?

- I *Wolbachia* exerts selection pressure.
- II When infected with *Wolbachia*, male embryos that are homozygous for the recessive allele of the suppressor gene do not survive.
- III All male embryos that carry the dominant allele of the suppressor gene pass that allele to their offspring.
- IV The frequency of the dominant allele of the suppressor gene rises in the butterfly population.

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

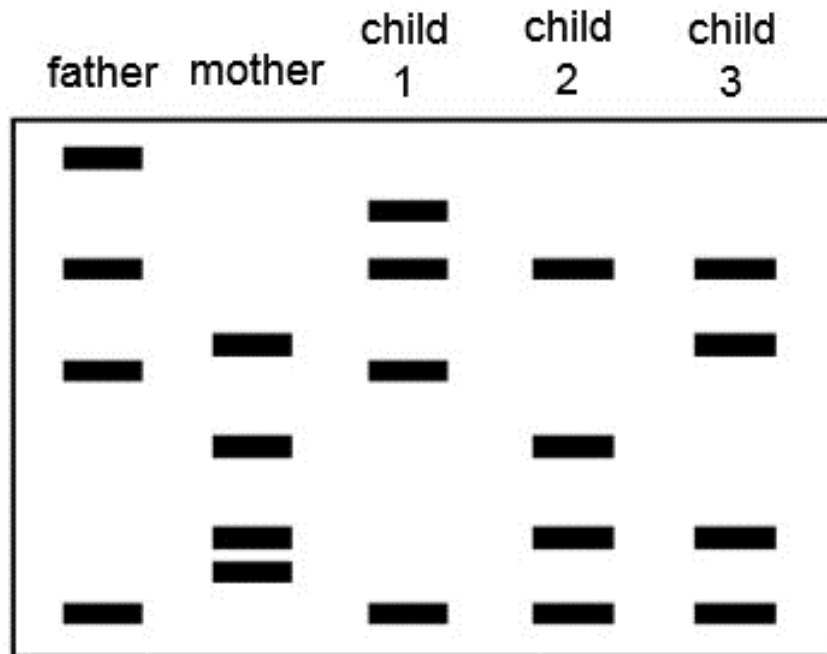
23. The figure below shows an aerial view of a region which included a section of copper contaminated soil (shaded grey on the diagram). The black circles represent populations of grass growing in areas **A**, **B** and **C**. The figure also includes the percentage of copper resistant grass in areas **A**, **B** and **C**. Tolerance to copper in the soil is genetically determined.



Which of the following is an appropriate conclusion?

- A** All grass in the copper contaminated area would be homozygous at the gene locus for copper tolerance
- B** High levels of copper tolerance would be a selective advantage for all grass in areas **A**, **B** and **C**
- C** The difference in copper tolerance between populations in areas **A** and **C** is the result of mutation.
- D** Gene flow is occurring between populations in areas **B** and **C**

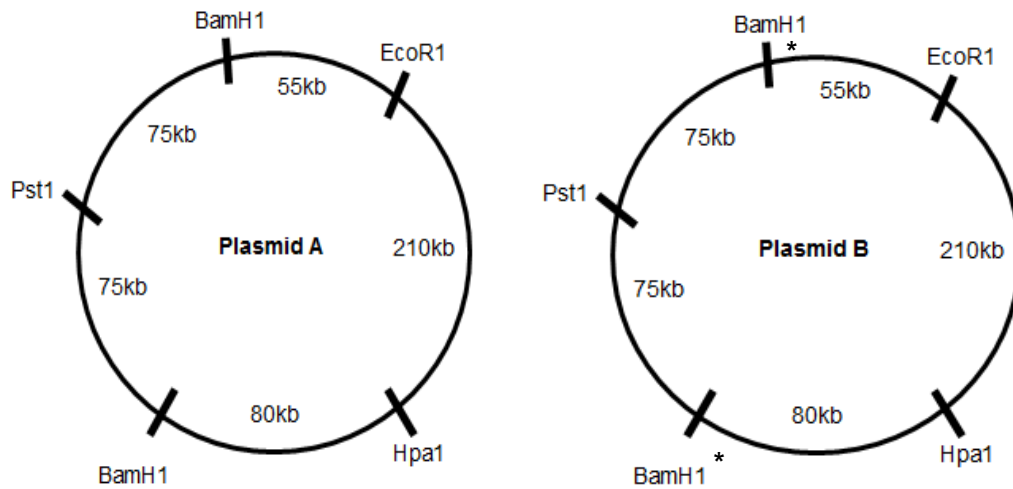
24. DNA fingerprinting is often used to confirm the identity of an individual. The diagram shows a small section of the gel electrophoresis results from a DNA fingerprinting analysis of a family.



Which of the children is least likely to be the offspring of both parents?

- A** Child 1
- B** Child 2
- C** Child 3
- D** All three children are the biological offspring of both parents.

25. The figure below shows 2 plasmids (**A** and **B**) and the respective restriction sites of various restriction enzymes. In plasmid **B**, mutations were deliberately introduced and affected restriction sites were denoted by *.



A student added different combination of restriction enzymes to each plasmid in a tube. Each tube was then left to incubate at 37°C for about 15 minutes. The results are shown in table below.

Tube number	Components	Fragment sizes / kb
Tube 1	Plasmid A + 2 restriction enzymes	80, 150, 265
Tube 2	Plasmid B + 2 restriction enzymes	155, 340

Which were the enzymes that were added to **Tube1** and **Tube 2**?

	Tube 1	Tube 2
A	HpaI and EcoRI	EcoRI and HpaI
B	BamHI and PstI	PstI and EcoRI
C	BamHI and HpaI	HpaI and PstI
D	BamHI and EcoRI	HpaI and BamHI

26. Which of the following is not a goal of the human genome project?

- A To know what are the genes that make up a *Homo sapien*.
- B To elucidate the genetic basis of diseases by constructing the physical map of human genome.
- C To determine the nucleotide sequences of chromosome 1 – 23 as well as the X and Y chromosome and store this information in publically accessible databases.
- D To create health databases of populations.**

27. Which of the following processes of PCR and DNA replication is not true?

	PCR	DNA replication
A	Taq polymerase does not contain 3' to 5' exonuclease.	DNA polymerase III contains 3' to 5' exonuclease.
B	Taq polymerase synthesises the daughter strand in the 5' to 3' direction.	DNA polymerase III synthesises the daughter strand in the 5' to 3' direction.
C	RNA primers were synthesized synthetically.	RNA primers were synthesized by primase.
D	DNA strands separate after the breaking of hydrogen bonds after the temperature was raised to 90°C	DNA strands separate after the breaking of hydrogen bonds by helicase

28. What is NOT a possible issue of concern over the creation of genetically modified farmed animals?

- I Genetic engineering may result in the creation of new proteins that are harmful to the organisms that produce or consume them.
- II Cross species gene transfer may compromise the genome integrity of the species involved.
- III Over production of certain gene products may cause undue stress to the genetically modified farmed animals.
- IV Some genetically modified food products may not be acceptable to certain groups of people.

- A I and IV only
- B II & III only
- C I, III and IV only
- D None of the above**

29. Developing fish eggs can be treated to produce a diploid egg. In salmon, such eggs have been fused with haploid salmon sperm to give infertile triploid salmon.

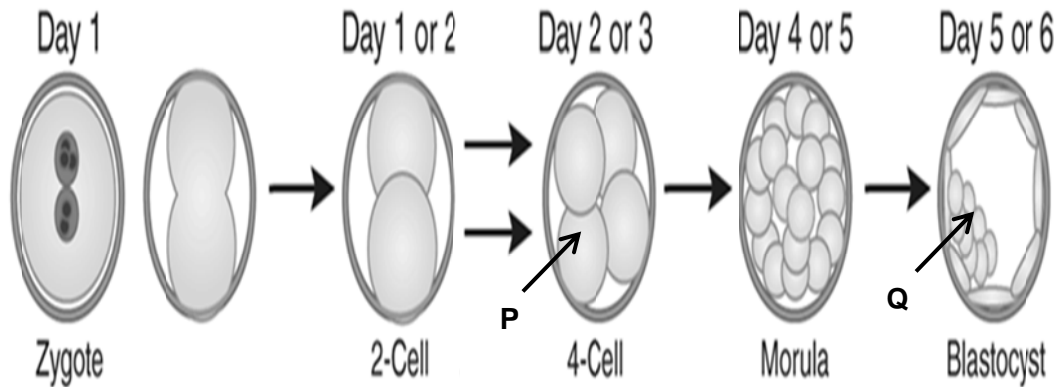
Reproductive organ tissue from diploid tuna was transplanted into newly hatched triploid salmon. This tissue matured as the latter grew and successfully produced viable tuna sperm or eggs which resulted in young tuna.

Which of the following fishes could be seen as genetically modified?

- I Salmon providing eggs for treatment
- II Tuna providing reproductive organ
- III Young triploid salmon
- IV Young tuna

- A III only**
- B I & III only
- C III and IV only
- D None of the above

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



Which of the following statements are true about the cells labelled **P** and **Q**?

- A **P** is a pluripotent cell while **Q** is a multipotent cell.
- B **P** is a totipotent cell while **Q** can give rise to multipotent cells.**
- C **Q** will develop into the entire fetus including its placenta.
- D **P** will give rise to pluripotent cells but **Q** can only give rise to totipotent cells.

End Of Paper