



VICTORIA JUNIOR COLLEGE
BIOLOGY DEPARTMENT
JC2 PRELIMINARY EXAMINATIONS 2015
Higher 1

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CANDIDATE NAME

CLASS

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BIOLOGY

8875/01

Paper 1 Multiple Choice

23 September 2015

1 hour

Additional Materials: Multiple Choice Optical Mark Sheet

READ THESE INSTRUCTIONS FIRST

Write in a soft pencil.

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

Write your name, Centre number and candidate number on the Answer Sheet in the spaces 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.

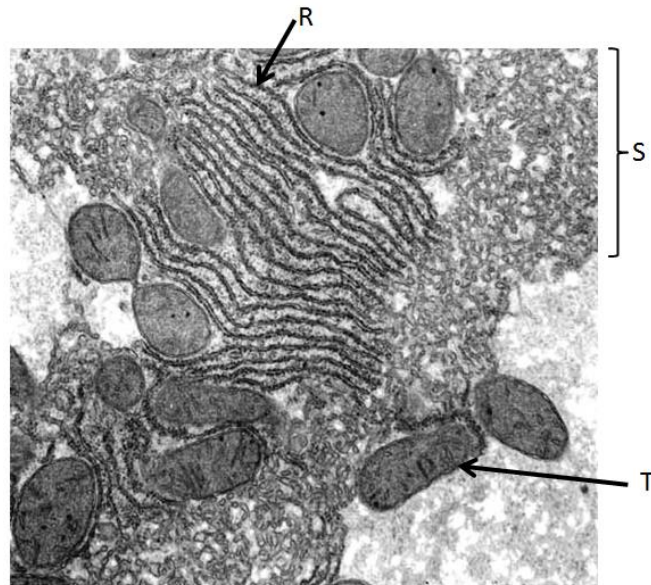
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
 Any rough working should be done in this booklet

This paper consists of **13** printed pages including cover page.

1 Which of the following can pass through the nuclear pores?

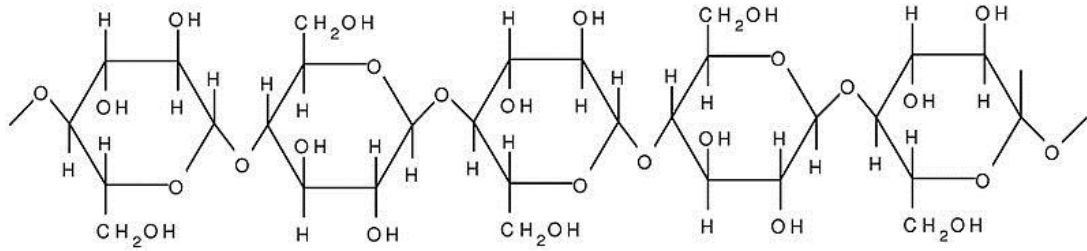
- A DNA and RNA
- B lipids and glycolipids
- C RNA and protein-carbohydrate complexes
- D proteins, RNA, and protein-RNA complexes

2 The figure below shows an electron micrograph of an eukaryotic cell. Which of the following shows the correct matching of functions of the structure **R**, **S** and **T**.



	R	S	T
A	Involved in proteins glycosylation	Site of lipid synthesis	To convert light energy to chemical energy
B	Site of protein synthesis	Site of detoxification reaction	Supplying cellular energy
C	Site of detoxification reaction	Involved in proteins glycosylation	Remove worn out organelles
D	Site of protein synthesis	Contains proteins to be secreted	Supplying cellular energy

3 The figure below shows a portion of a polymer



Which statement is true about the polymer?

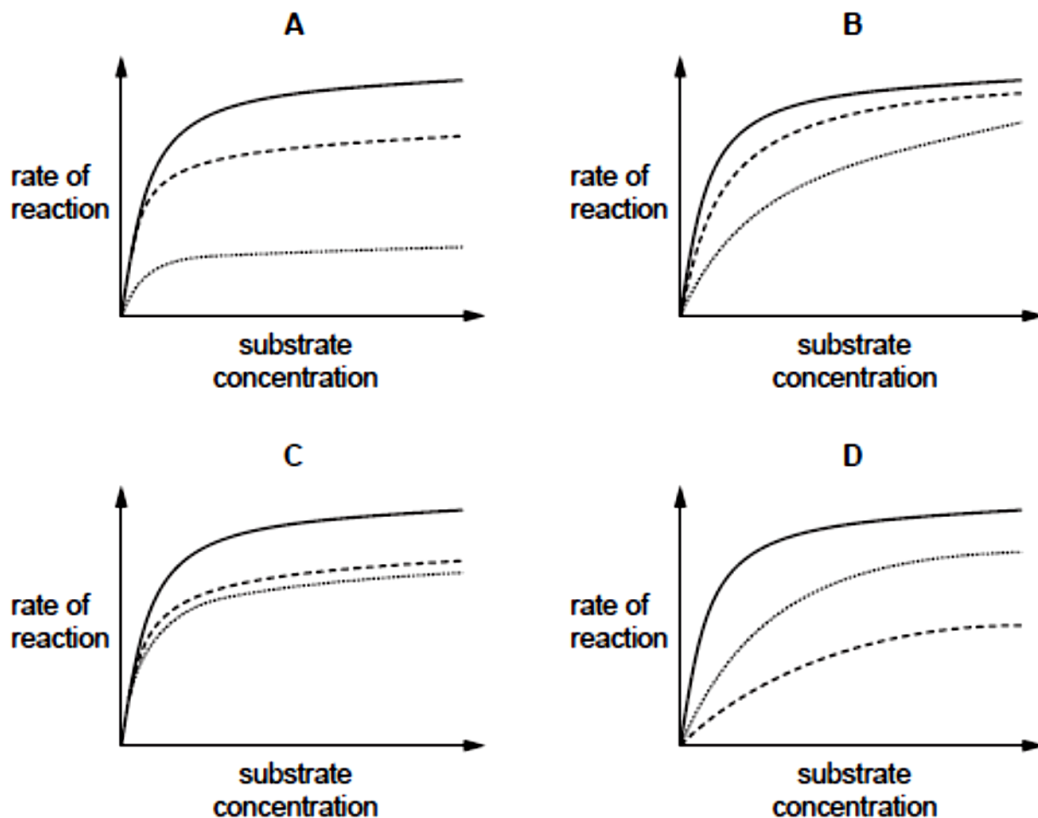
- A The polymer will assume a helical structure.
 - B The polymer can exist in both branched and unbranched forms.
 - C The orientation of the monomer will result in a straight chain polymer.
 - D The monomers are able to form α (1-6) glycosidic bonds with one another.
- 4 Which of the following statement describing the structures of proteins is **false**?
- A The sequence of amino acids can determine if a polypeptide strand would form α -helix or β pleated sheet.
 - B Haemoglobin is an example of a quaternary protein because of the non-covalent bonds that exist between its subunits.
 - C The shapes of tertiary proteins can be determined by the types of interaction between peptide bonds of amino acids far away from one another.
 - D Formation of intramolecular hydrogen bonds between peptide bonds is important to maintaining the shape of the secondary structures in proteins.
- 5 Which statement(s) about the fluid mosaic model of membrane structure is(are) correct?
- i. The less unsaturated the fatty acid chains of the phospholipids, the more fluid the membrane.
 - ii. The greater the amount of cholesterol, the less fluid the membrane is under high temperature.
 - iii. The longer the hydrocarbon tails of the phospholipids, the more fluid the membrane.
 - iv. The lower the temperature, the less fluid the membrane.
- A i and iii
 - B ii and iv
 - C ii, iii and iv
 - D i, ii and iii

- 6 When investigating enzyme-substrate interactions, which one of the following would be expected to always show a linear relationship under constant pH and temperature?

- A Amount of product against time, with the amount of substrate limited.
- B Rate of reaction against substrate concentration, with the amount of enzyme limited.
- C Rate of reaction against enzyme concentration, in the presence of excess substrate.
- D Rate of reaction against enzyme concentration, with the amount of substrate limited.

- 7 The graphs show the rate of reaction of an enzyme-catalysed reaction.

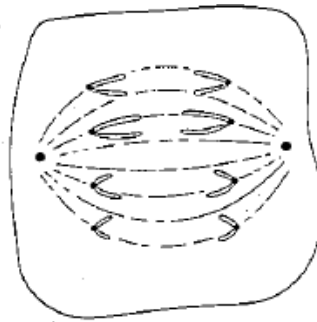
Which graph shows the effect of increasing the concentration of the substrate at two different concentrations of a competitive inhibitor?



Legend:

- No inhibitor
- - - - - Low concentration of inhibitor
- High concentration of inhibitor

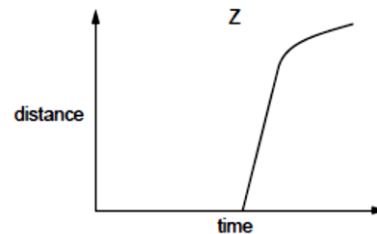
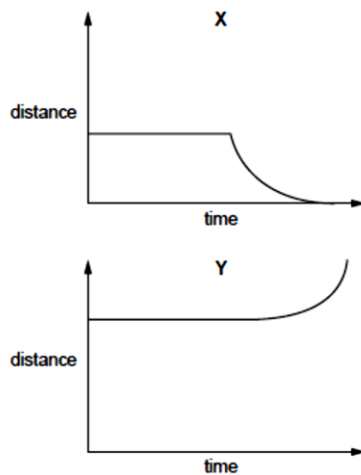
- 8 The diagram shows a cell undergoing nuclear division.



Which of the following options correctly describes the type of division the cell is undergoing and the number of chromosomes present before division?

	Type of nuclear division	Number of chromosomes
A	Mitosis	$2n = 8$
B	Meiosis	$2n = 8$
C	Mitosis	$2n = 16$
D	Meiosis	$2n = 16$

- 9 The graphs show various measurements taken from metaphase of mitosis onwards. The graphs are to scale when compared to one another.



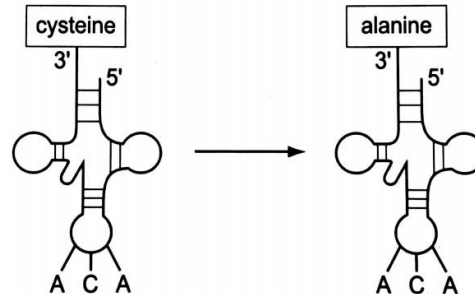
Which row correctly describes each graph?

	X	Y	Z
A	Distance between poles of spindle	Distance between sister chromatids	Distance of centromere from pole of spindle
B	Distance between poles of spindle	Distance of centromere from pole of spindle	Distance between sister chromatids
C	Distance of centromere from pole of spindle	Distance between poles of spindle	Distance between sister chromatids
D	Distance of centromere from pole of spindle	Distance between sister chromatids	Distance between poles of spindle

- 10 Which of the following statements about DNA replication is **true**?
- A During DNA replication, the synthesis of the leading strand occurs before that of the lagging strand.
 - B DNA polymerase III adds nucleotide pairs to the both the leading and lagging strands during elongation.
 - C During initiation, the enzyme helicase unzips and unwinds the DNA molecule for DNA replication to occur.
 - D DNA ligase catalyzes the formation of phosphodiester bonds between the 3' OH of the primer to the 5' phosphate group of the next Okazaki fragment.
- 11 The coding region of a gene is 102 nucleotides long, including both the start and stop codons. Which of the following would be the most likely effect of a single nucleotide deletion at position 76 in the coding region?
- A Only the active site would be affected.
 - B The entire amino acid sequence of the polypeptide would change.
 - C There would be changes in only the first 25 amino acids.
 - D There would be changes in only the last 8 amino acids.
- 12 An inversion will
- A always cause a mutant phenotype.
 - B interfere with translation of genes in the inverted region.
 - C cause a mutant phenotype if the inversion fall within a gene.
 - D halt transcription in the inverted region because the chromosome is now in the opposite arrangement.

- 13 Transfer RNA combined with an amino acid is called amino-acyl tRNA. It is possible to chemically convert the amino acid cysteine into the amino acid alanine whilst it is still attached to its tRNA.

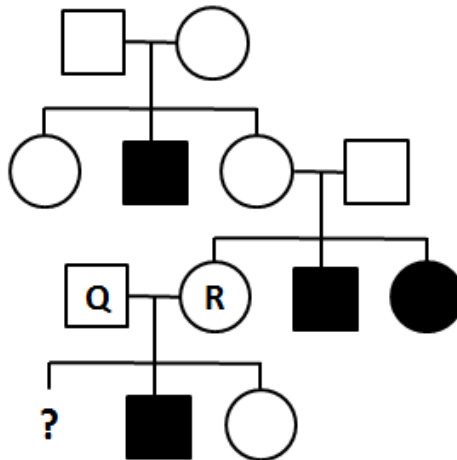
The altered amino-acyl tRNA still binds to UGU triplets on messenger RNA (mRNA), but now incorporates alanine into the resulting polypeptide instead of cysteine.



Which statement is **correct**?

- A A codon on the amino-acyl tRNA determines its specificity.
 - B Both the amino acid and the anticodon of an amino-acyl tRNA affect where it binds to mRNA.
 - C The amino acid of an amino-acyl tRNA does not influence its binding to mRNA.
 - D The codon-anticodon interaction is influenced by the amino acid on an amino-acyl tRNA.
- 14 Which of the following events regarding the inheritance of sex chromosomes may occur?
- i. A male having the same X chromosome as his paternal grandfather
 - ii. A male having the same X chromosome as his maternal grandmother
 - iii. A female having the same X chromosome as her maternal grandfather
 - iv. A female having the same X chromosome as her paternal grandfather
- A ii only
 - B i and iv only
 - C ii and iii only
 - D All of the above

- 15 Adducted thumb syndrome is a condition where affected individual will have malformation of the thumb and upper limbs. The figure below show a pedigree chart of a family with the history of adducted thumb syndrome



If individual Q and R give birth to a son, what is the possibility that their son will be affected by the condition?

- A 0.125
 - B 0.25
 - C 0.50
 - D 0.75
- 16 In horses, there are 3 coat colour patterns, *cremello*(beige), *chestnut* (brown) and *palomino* (golden with pale coloured mane and tail). When 2 *palomino* horses were crossed, they produce 25% *cremello*, 25% *chestnut* and 50% *palomino* horses. Which of the following statement is true about the cross?
- A The *cremello* offspring are all heterozygotes
 - B There are 3 alleles involved in the coat colour patterns of the horses
 - C All the *palomino* offspring are heterozygotes
 - D The allele that code for *chestnut* is recessive to the *cremello*

- 17 Incontinentia pigmenti is a condition that can affect the skin characterized by blistering rash at birth. The phenotypes of offspring from different couples were observed and recorded in the table below. Each couple in the table has 3 daughters and 2 sons

Couple	Couple's Phenotypes	Offspring's phenotypes
I	Unaffected father X Unaffected mother	No affected offspring
II	Affected father X Unaffected mother	All daughters are affected The sons are not affected
III	Unaffected father X affected mother	1 out of the 2 sons are affected 1 out of the 3 daughters are affected

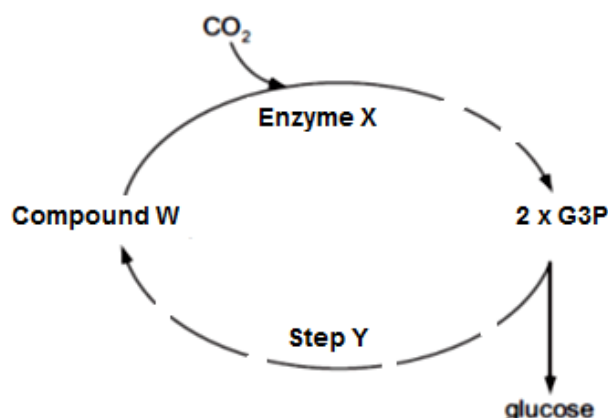
Which of the following conclusion can you derived from the information given?

- A Incontinentia pigmenti is a sex-linked recessive condition.
 - B The unaffected mother in Couple II is heterozygote.
 - C Couple I are both homozygous dominant for incontinentia pigmenti.
 - D The affected mother in Couple III is heterozygote.
- 18 The colour of body fat in the rabbits is controlled by a single gene with 2 alleles in a dominant and recessive fashion. The allele G codes for white body fat while g codes for yellow body fat. However, when rabbits are fed on a xanthophyll (photosynthetic pigment) free diet, it results in homozygous recessive rabbits producing white body fat.

Which of the following options show the correct combination of parental genotypes and corresponding offspring's phenotypes under different conditions?

	Parental Genotype	Type of Diet	Offspring phenotype
A	Gg X gg	Xanthophyll free	All white
B	gg X Gg	Standard	3 yellow: 1 white
C	GG X gg	Xanthophyll free	1 white : 1 yellow
D	Gg X Gg	Standard	All white

- 19 The figure below summaries some key reactions which occur in the Calvin cycle. Note that the dashed lines would indicate that there is more than one reaction present.



Using the figure above and your knowledge of Calvin cycle, determine which one of the following statements below is **true**?

- A Compound W is expected to accumulate if carbon dioxide concentration increases under low light intensity.
 - B Enzyme X is expected to accumulate when carbon dioxide concentration decreases
 - C Increase in temperature under high light intensity will increase the activity of enzyme X until the optimum temperature.
 - D ATP from substrate level phosphorylation is required for Step Y to proceed and Compound W to be formed.
- 20 Below are some statements about anaerobic respiration in yeasts and animal cells.
- i. Pyruvate acts as the alternative hydrogen acceptor.
 - ii. Carbon dioxide is produced.
 - iii. Oxidation of reduced coenzyme occurs
 - iv. ATP is synthesised.

Which statements apply to animal cells and yeast cells?

	Animal cells	Yeast
A	i, ii and iii	iii and iv
B	i, iii and iv	ii, iii and iv
C	ii, iii and iv	i, ii, iii and iv
D	i, ii and iii	ii and iii

- 21** Cyanide is a poison that blocks the passage of electrons along the electron transport chain.

Assuming that all other conditions are optimal, in which of the following combinations of cellular fractions and substances or conditions will cyanide have an effect?

- A** Cytoplasm lacking in organelles incubated with pyruvate.
- B** Cytoplasm lacking in organelles incubated with lactate.
- C** Mitochondria suspension incubated with fructose 1,6 bisphosphate.
- D** Chloroplast suspension illuminated by light.

- 22** Natural selection acts

- A** directly on an individual's genetic make-up, thereby changing the survival probability of the individual.
- B** on individuals by changing their genes so they are better able to adapt to their environment.
- C** on the structures, physiologies and behaviours expressed by individuals in a population to change allele frequencies.
- D** on phenotypes of individuals so that they change to adapt to their environment and pass on these changes to their offspring.

- 23** Which statement(s) are correct interpretations of Darwinian evolutionary theory?

- i. Advantageous behaviour acquired during the lifetime of an individual is likely to be inherited.
- ii. In competition for survival, the more aggressive animals are more likely to survive.
- iii. Species living in a stable environment will not evolve any further.
- iv. Variation between individuals of a species is essential for evolutionary change.

- A** iv
- B** ii and iii
- C** iii and iv
- D** i, ii and iv

- 24** Why is genetic variation important to evolution?

- A** Genes cannot mutate unless there are variations.
- B** Only heterozygous individuals are selected in natural populations.
- C** Individual variability provides the raw material for natural selection to act on.
- D** None of the above. Genetic variation is not important to evolution.

- 25 In a cloning experiment, the gene for bovine somatotropin (bST) located in cattle genome (Fig. a) was inserted into a plasmid (Fig. b) for expression.

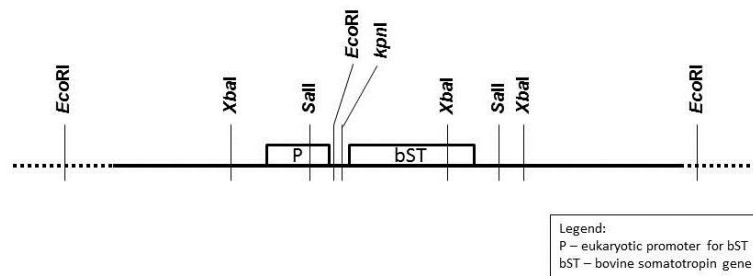


Fig. a

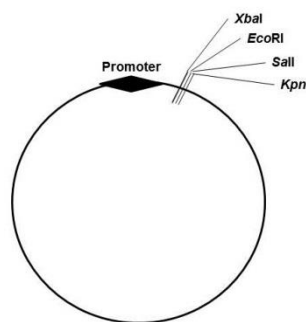


Fig. b

Which of the following combinations of restriction enzymes can be used to create a recombinant plasmid to express the bST protein in the bacteria cells?

- i. *XbaI*
- ii. *SalI*
- iii. *EcoRI*
- iv. *KpnI*

- A i and ii
- B ii and iii
- C i and iv
- D ii and iv

- 26 Which one of the following statements regarding polymerase chain reaction is **false**?

- A Taq polymerase is chosen for use because of its heat-stable property.
- B Amplification of the DNA products requires DNA primers to be added for initiation.
- C Initiation of the amplification need not start at the promoter region of the gene.
- D The amount of products formed by PCR is not limited by the nucleotides added into reaction mixture.

27 Which of the following option correctly matches the function with the added chemical?

	Chemical	Function
A	Ethidium bromide	To visualize DNA bands after gel electrophoresis under white light
B	DNA ladder	Known DNA fragments which can hybridize to gel bands to indicate their sizes.
C	Agarose gel	Provides a buffer for electrical current to flow through.
D	Loading dye	Adds weight to the DNA fragments so that they can settle into the wells.

28 Which of the following characteristics is not desirable in the use of plasmids as vectors?

- A Ability to control their own replication
- B More than one plasmid can be taken up by each bacteria
- C Contains a wide range of restriction sites for the various restriction enzymes
- D Contains relevant eukaryotic promoters for the expression of inserted genes of interest

29 All the following statements about stem cells are **true except**

- A cord blood stem cells are multipotent.
- B cord blood from the newborn is a source of adult stem cells.
- C adult somatic cells can be reprogrammed to behave like embryonic stem cells.
- D cord blood stem cells will give rise to blood cells while embryonic stem cells will not.

30 Efforts to develop salt-tolerant crop varieties using selective breeding techniques have been unsuccessful. Recently, plant biologists have developed a genetically engineered tomato plant that can thrive in salty water. This genetically modified plant produces significantly higher levels of a naturally occurring transport protein. This transport protein moves salt, in the form of sodium ions into the central vacuoles of leaf cells specifically.

Which statement correctly describes the benefit of genetic engineering of this tomato plant?

- A Improving crop yield through maximizing the use of land.
- B Improving crop quality since the fruit will be juicy due to influx of water via osmosis.
- C Improving crop yield by changing the way the plant uses its energy resources.
- D Improving crop quality since the tomato fruit can supplement salt loss to sweating.

