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**BIOLOGY
HIGHER LEVEL
PAPER 1**

Monday 17 May 2010 (afternoon)

1 hour

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

1. The lengths of a sample of tiger canines were measured. 68% of the lengths fell within a range between 15 mm and 45 mm. The mean was 30 mm. What is the standard deviation of this sample?

- A. 5 mm
- B. 15 mm
- C. 7.5 mm
- D. 30 mm

2. Which of the following are features of prokaryotes and eukaryotes?

	70S ribosomes	80S ribosomes	Naked DNA	DNA associated with proteins
A.	prokaryote	eukaryote	prokaryote	eukaryote
B.	eukaryote	prokaryote	eukaryote	prokaryote
C.	eukaryote	prokaryote	prokaryote	eukaryote
D.	prokaryote	eukaryote	eukaryote	prokaryote

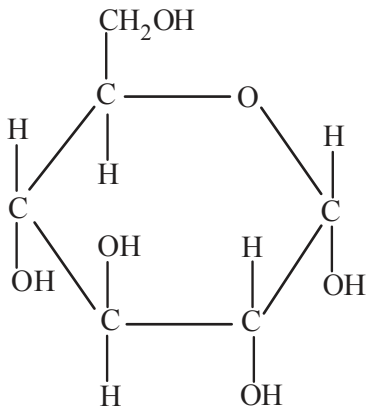
3. Which statement is part of the cell theory?

- A. Cells are composed of organic molecules.
- B. Cells have DNA as their genetic material.
- C. Cells have cytoplasm surrounded by a membrane.
- D. Cells come from pre-existing cells.

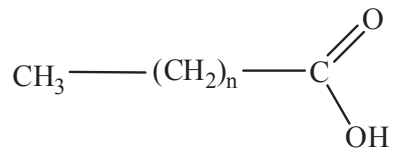
4. What route is used to export proteins from the cell?
- A. Golgi apparatus → rough endoplasmic reticulum → plasma membrane
 - B. Rough endoplasmic reticulum → Golgi apparatus → plasma membrane
 - C. Golgi apparatus → lysosome → rough endoplasmic reticulum
 - D. Rough endoplasmic reticulum → lysosome → Golgi apparatus
5. Which of the following take(s) place during either interphase or mitosis in animal cells?
- I. Re-formation of nuclear membranes
 - II. Pairing of homologous chromosomes
 - III. DNA replication
- A. I only
 - B. I and II only
 - C. II and III only
 - D. I and III only
6. Which substance in prokaryotes contains sulfur?
- A. DNA
 - B. Phospholipids
 - C. Proteins
 - D. Antibiotics

7. Which describes these molecules correctly?

I.

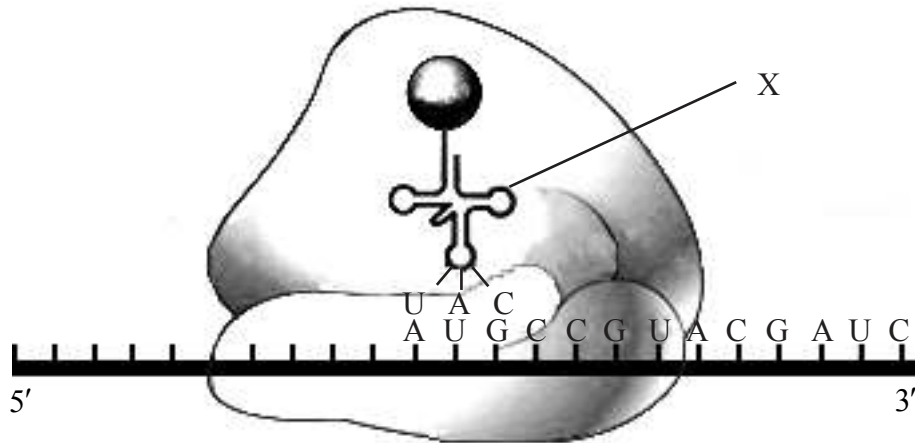


II.



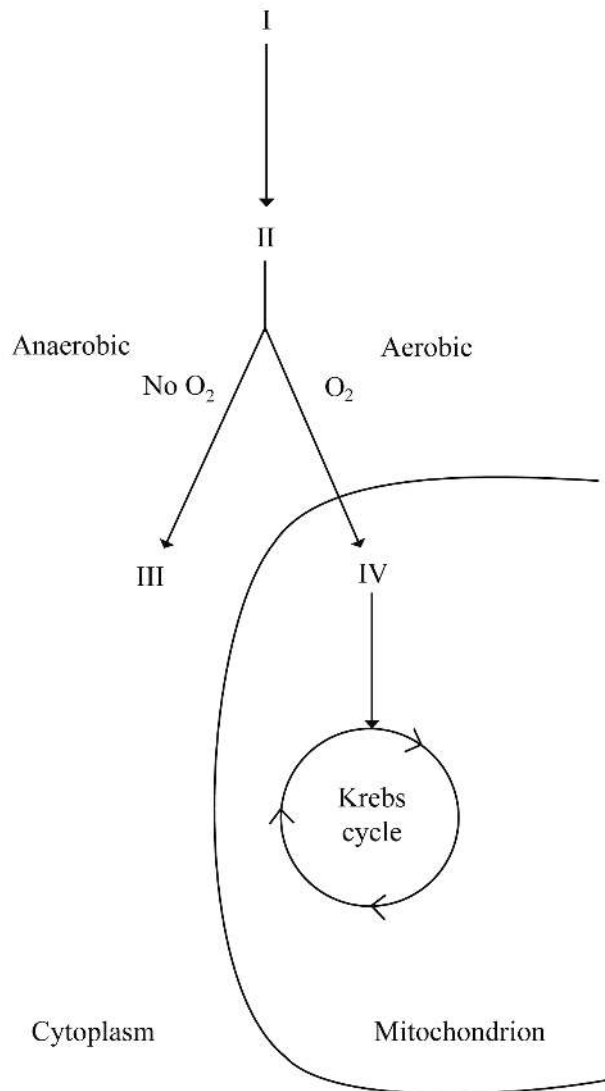
	I	II
A.	ribose	amino acid
B.	glucose	amino acid
C.	ribose	fatty acid
D.	glucose	fatty acid

8. What sequence of processes is carried out by the structure labelled X during translation?



- A. Combining with an amino acid and then binding to an anticodon
- B. Binding to an anticodon and then combining with an amino acid
- C. Binding to a codon and then combining with an amino acid
- D. Combining with an amino acid and then binding to a codon

9. The diagram below shows a biochemical pathway in a yeast cell. Which of the following correctly identifies a compound in the diagram?



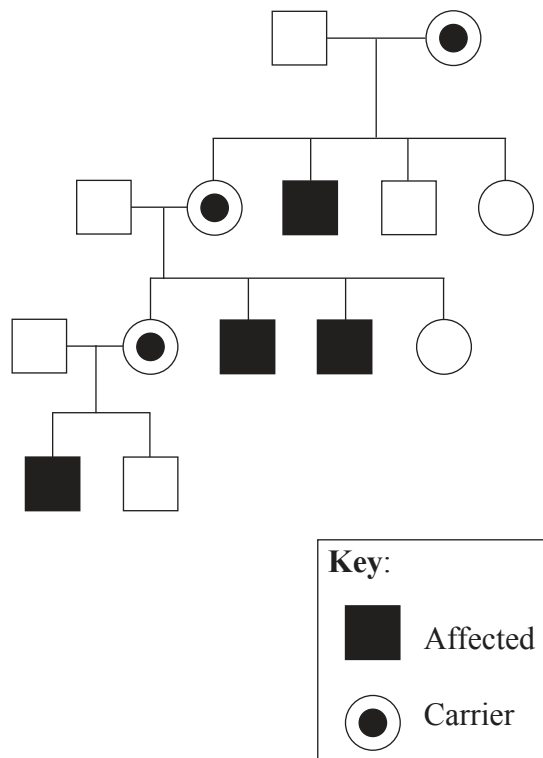
- A. I is fat.
- B. II is pyruvate.
- C. III is lactate.
- D. IV is carbon dioxide.

10. Which of the following factors influence(s) the rate of oxygen production in photosynthesis?
- I. Temperature
 - II. Wavelength of light
 - III. Number of mitochondria
- A. I only
- B. I and II only
- C. II and III only
- D. I, II and III
11. In some people, hemoglobin always contains the amino acid valine in place of a glutamic acid at one position in the protein. What is the cause of this?
- A. An error in transcription of the hemoglobin gene
- B. An error in translation of the mRNA
- C. Lack of glutamic acid in the diet
- D. A base substitution in the hemoglobin gene
12. What is a suspected heterozygous individual crossed with in a test cross?
- A. Homozygous dominant
- B. Homozygous recessive
- C. Heterozygous dominant
- D. Heterozygous recessive

13. Which of the following genotypes is possible in the offspring of a homozygous male with blood group A and a female with blood group B?

- A. $I^A I^A$
- B. $I^A i$
- C. ii
- D. $I^B i$

14. What type of inheritance is shown in this pedigree chart?



- A. X-linked dominant
- B. Y-linked dominant
- C. X-linked recessive
- D. Y-linked recessive

15. What is a community?
- A. A group of organisms living and interacting in the same trophic level
 - B. A group of populations living and interacting in a food chain
 - C. A group of organisms of the same species living and interacting in an ecosystem
 - D. A group of populations living and interacting in an area
16. What are the units of a pyramid of energy?
- A. $\text{kJ m}^{-2} \text{yr}^{-1}$
 - B. $\text{kJ m}^{-1} \text{yr}^{-1}$
 - C. $\text{J m}^{-3} \text{s}^{-1}$
 - D. $\text{J m}^2 \text{s}^{-1}$
17. Population size is influenced by certain factors.
If I = immigration, E = emigration, N = natality, M = mortality and $(N + M) = (I + E) = 0$, which phase is this population in?
- A. Exponential phase
 - B. Transitional phase
 - C. Plateau phase
 - D. Growth phase
18. An animal has radial symmetry, a sac-like body with only one opening and tentacles with stinging structures. To which phylum does this animal belong?
- A. Annelida
 - B. Cnidaria
 - C. Mollusca
 - D. Porifera

19. Which of the following are used as evidence for evolution?

- I. Homologous structures
- II. Selective breeding of domesticated animals
- III. Overproduction of offspring

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

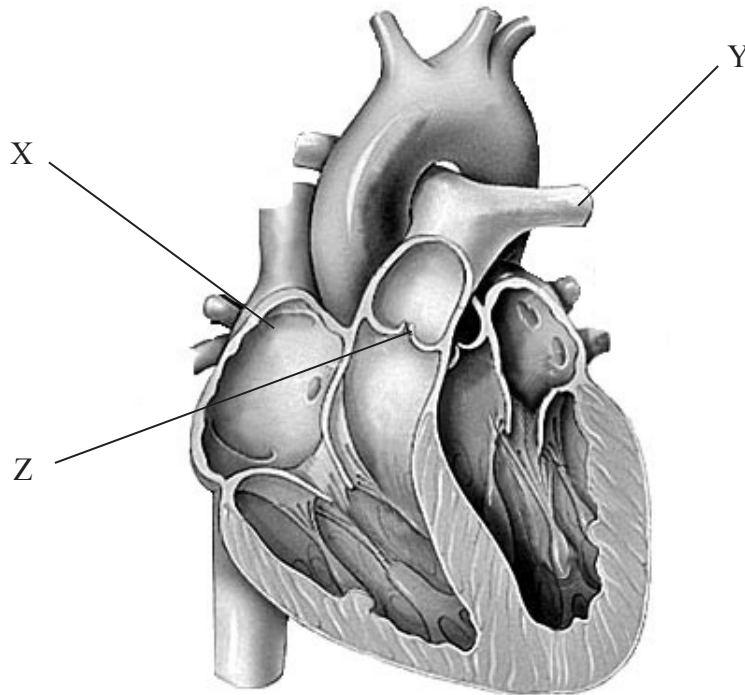
20. Which of the following is correct for lipase?

	Substrate	Source	pH optimum
A.	triglycerides	pancreas	pH = 8
B.	fatty acids	small intestine	pH = 7
C.	triglycerides	small intestine	pH = 9
D.	fatty acids	pancreas	pH = 9

21. What prevents antibiotics from being effective against viruses?

- A. Viruses have a high rate of mutation.
- B. Viruses have no RNA.
- C. Viruses have no metabolism.
- D. Viruses have a protein shell that protects them.

22. The diagram below shows the human heart. What structures are indicated by the labels X, Y and Z?



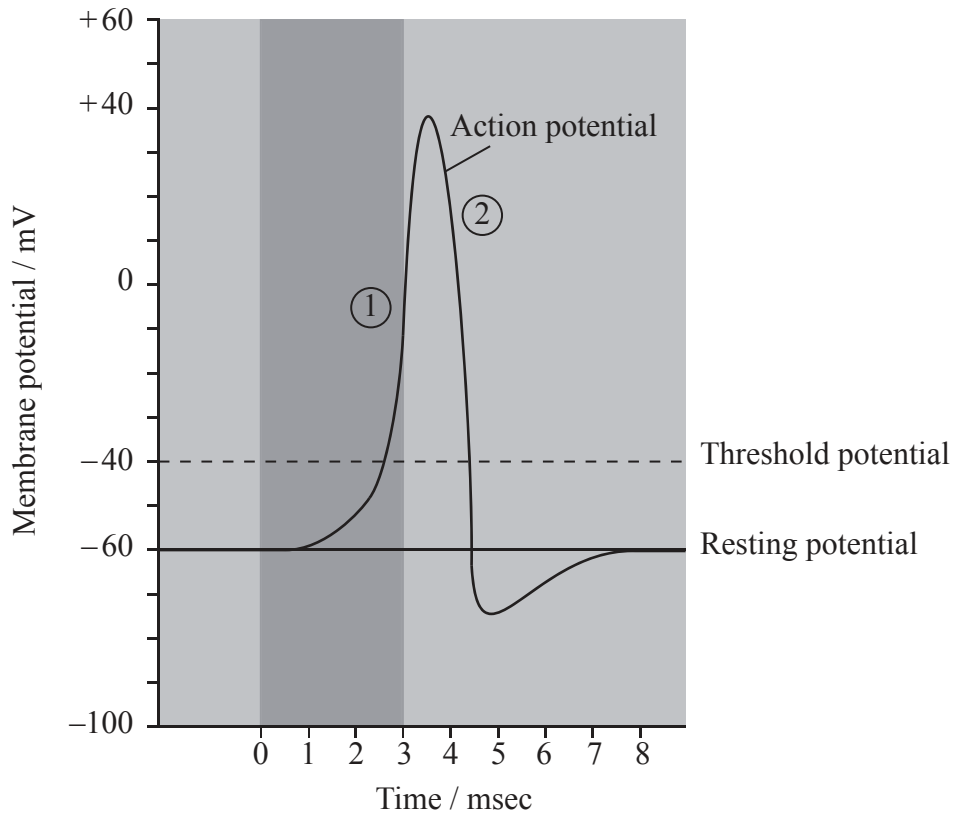
[Source: adapted from <http://whyfiles.org/102spareparts/images/heart2.gif>]

	X	Y	Z
A.	left atrium	aorta	semi-lunar valve
B.	left atrium	aorta	atrio-ventricular valve
C.	right atrium	pulmonary artery	atrio-ventricular valve
D.	right atrium	pulmonary artery	semi-lunar valve

23. Which muscles contract to cause air to pass into the lungs through the trachea?

- A. Internal intercostal muscles and diaphragm
- B. Internal intercostal muscles and abdomen wall muscles
- C. External intercostal muscles and diaphragm
- D. External intercostal muscles and abdomen wall muscles

24. The diagram below shows the changes in membrane potential during an action potential. What occurs at the stages labelled 1 and 2?



	1	2
A.	Na ⁺ ions diffuse in; inside becomes more positive	K ⁺ ions diffuse out; inside becomes more negative
B.	K ⁺ ions diffuse out; inside becomes more negative	Na ⁺ ions diffuse in; inside becomes more positive
C.	Na ⁺ ions diffuse out; inside becomes more negative	K ⁺ ions diffuse out; inside becomes more positive
D.	Na ⁺ ions diffuse in; inside becomes more positive	K ⁺ ions diffuse in; inside becomes more negative

25. What are the roles of testosterone in males?

- A. Stimulation of FSH production and growth in puberty
- B. Pre-natal development of genitalia and development of secondary sexual characteristics
- C. Development of genitalia and pre-natal secondary sexual characteristics
- D. Stimulation of FSH production and pre-natal development of secondary sexual characteristics

26. What is the reason for Okazaki fragments being formed during DNA replication?
- A. To enable replication of the 3' → 5' (lagging) strand
 - B. To form the template for the RNA primers
 - C. To initiate replication on the 5' → 3' (leading) strand
 - D. To help the DNA helicase unwinding the DNA helix

27. Which is correct for the non-competitive inhibition of enzymes?

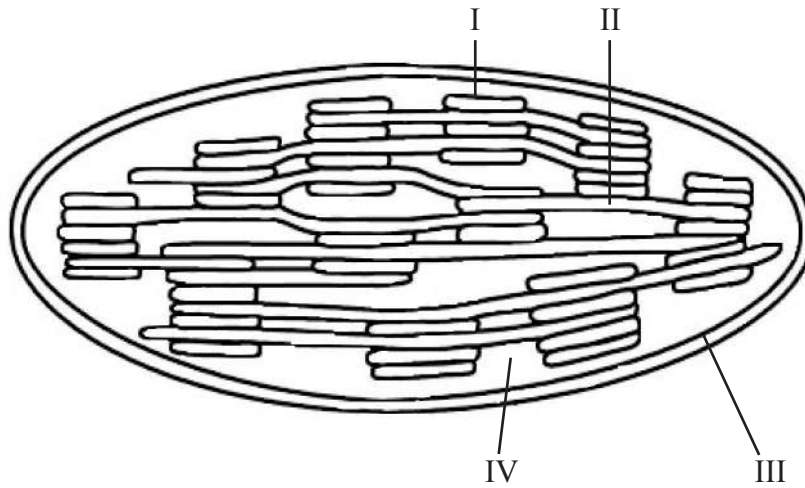
	Inhibitor resembles substrate	Inhibitor binds to active site
A.	yes	yes
B.	yes	no
C.	no	yes
D.	no	no

28. What is removed during the formation of mature RNA in eukaryotes?
- A. Exons
 - B. Introns
 - C. Codons
 - D. Nucleosomes

29. During glycolysis a hexose sugar is broken down to two pyruvate molecules. What is the correct sequence of stages?

- A. Phosphorylation → oxidation → lysis
- B. Oxidation → phosphorylation → lysis
- C. Phosphorylation → lysis → oxidation
- D. Lysis → oxidation → phosphorylation

30. Where are the light-dependent and light-independent reactions taking place in the diagram below?

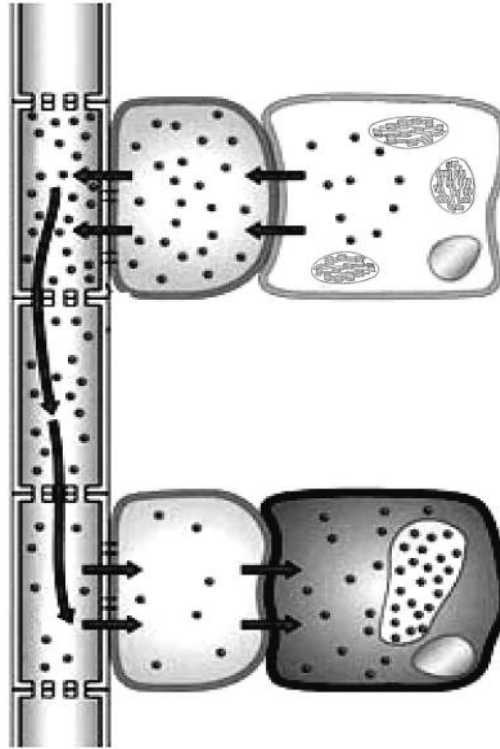


	Light-dependent	Light-independent
A.	I	IV
B.	II	III
C.	III	II
D.	IV	I

31. What are differences between monocotyledonous and dicotyledonous plants?

	Monocotyledonous	Dicotyledonous
A.	parallel venation; floral organs in multiples of 4 or 5	net-like venation; floral organs in multiples of 3
B.	net-like venation; floral organs in multiples of 3	parallel venation; floral organs in multiples of 4 or 5
C.	net-like venation; floral organs in multiples of 4 or 5	parallel venation; floral organs in multiples of 3
D.	parallel venation; floral organs in multiples of 3	net-like venation; floral organs in multiples of 4 or 5

32. The diagram below shows part of the vascular system of a dicotyledonous plant. Which process is indicated by the arrows?



[FREEMAN, SCOTT, BIOLOGICAL SCIENCE, 3rd Edition, copyright 2008, p.828. Reprinted by permission of Pearson Education, Inc., Upper Saddle River, NJ]

- A. Passive translocation in the phloem of sucrose from the sink to the source
 - B. Active translocation in the phloem of sucrose from the source to the sink
 - C. Passive translocation in the xylem of sucrose from the sink to the source
 - D. Active translocation in the xylem of sucrose from the source to the sink
33. What controls the flowering process in long-day plants?
- A. P_{fr} is converted by red light to P_r which acts as a promoter of flowering.
 - B. P_r is converted by red light to P_{fr} which acts as an inhibitor of flowering.
 - C. P_r is converted by red light to P_{fr} which acts as a promoter of flowering.
 - D. P_{fr} is converted by red light to P_r which acts as an inhibitor of flowering.

34. A test cross resulted in these recombinants:

$$\frac{tB}{tb} \quad \frac{Tb}{tb}$$

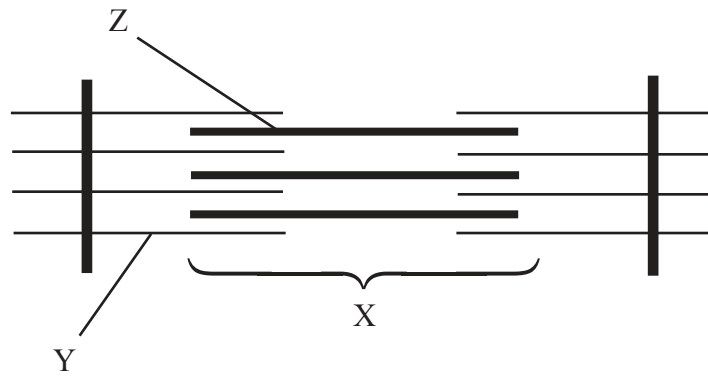
Which of the following was the parental test cross?

- A. $\frac{TB}{tb} \times \frac{tb}{tb}$
- B. $\frac{TB}{tB} \times \frac{tb}{Tb}$
- C. $\frac{Tb}{tB} \times \frac{tb}{tb}$
- D. $\frac{TB}{tb} \times \frac{TB}{tb}$

35. What occurs during the blood clotting process?

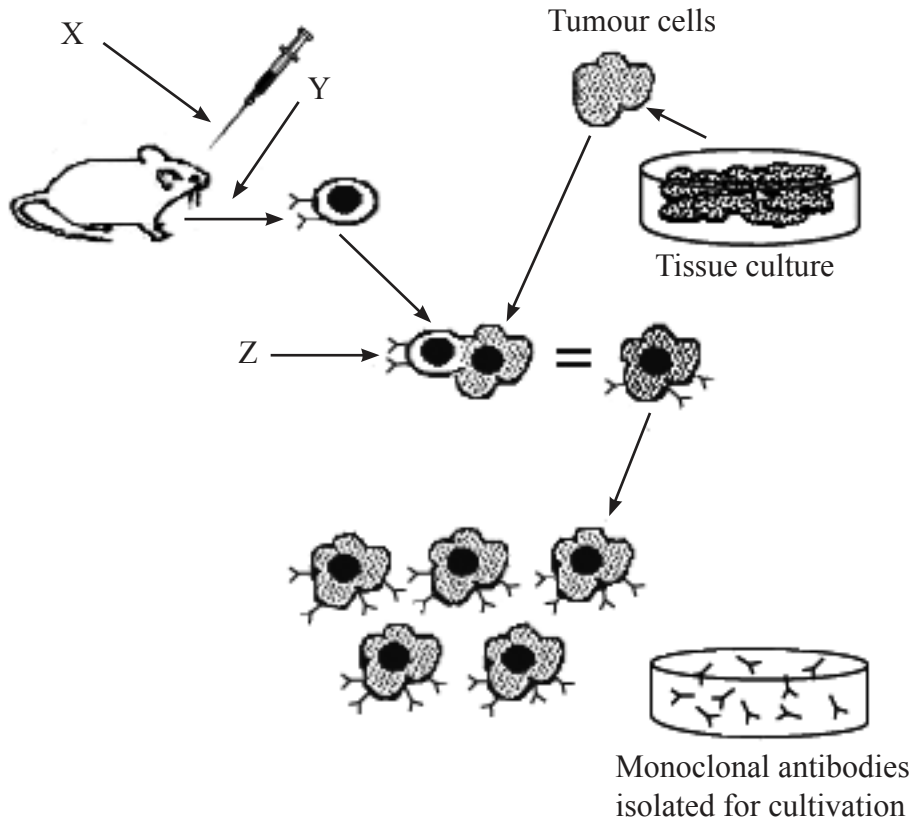
- A. Prothrombin is converted into thrombin which acts on fibrinogen.
- B. Prothrombin is converted into thrombin which acts on fibrin.
- C. Fibrinogen is converted into fibrin which acts on prothrombin.
- D. Fibrinogen is converted into fibrin which acts on thrombin.

36. What is indicated by the letters X, Y and Z?



	X	Y	Z
A.	sarcomere	myosin filaments	actin filaments
B.	sarcomere	actin filaments	myosin filaments
C.	dark band	myosin filaments	actin filaments
D.	dark band	actin filaments	myosin filaments

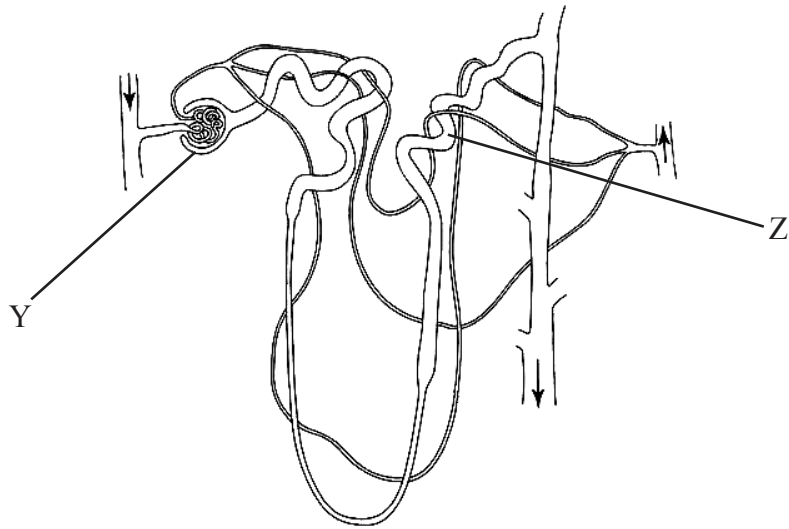
37. The diagram below shows some stages in the production of monoclonal antibodies. What are stages X, Y and Z?



[Used with the permission of Access Excellence @ the National Health Museum]

	X	Y	Z
A.	injection of antibody	isolation of B-cell	fusion between B-cell and tumour cell resulting in plasma cell
B.	injection of antibody	isolation of T-cell	fusion between T-cell and tumour cell resulting in plasma cell
C.	injection of antigen	isolation of T-cell	fusion between T-cell and tumour cell resulting in hybridoma cell
D.	injection of antigen	isolation of B-cell	fusion between B-cell and tumour cell resulting in hybridoma cell

38. In the diagram of the nephron below, what structures are indicated by the letters Y and Z?



[Source: adapted from http://ex.susd.org/sjones/SGHL12007_files/image005.jpg]

	Y	Z
A.	glomerulus	collecting duct
B.	Bowman's capsule	collecting duct
C.	Bowman's capsule	distal convoluted tubule
D.	glomerulus	distal convoluted tubule

39. What are the roles of the following structures in the production of semen?

	Epididymis	Seminal vesicle	Prostate gland
A.	production of a fluid containing alkaline minerals	production of fructose	maturation of sperm
B.	maturation of sperm	production of a fluid containing citric acid	production of fructose
C.	maturation of sperm	production of fructose	production of a fluid containing alkaline minerals
D.	production of a fluid containing alkaline minerals	maturation of sperm	production of fructose

40. What is the role of HCG in early pregnancy?

- A. It prevents the degeneration of the corpus luteum.
 - B. It initiates the development of the uterus lining.
 - C. It inhibits the production of estrogen.
 - D. It stimulates the degeneration of the corpus luteum.
-