

CANDIDATE'S
NAME

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BIOLOGY (PRINCIPAL)

UACE

June/July

Paper 1

2Hours 30Minutes

INSTRUCTIONS TO CANDIDATES

This paper consists of Sections A and B

*Answer **all** questions in both sections*

Write answers to Section A in the boxes provided and answers to section B in the spaces provided.

SECTION A (40 MARKS)

1. DNA replication is described as,
 - A. Conservative, because each new double helix consists of one parental and one newly-synthesised DNA strand.
 - B. Conservative, because each new double helix consists of two newly-synthesised DNA strands.
 - C. ***Semi-conservative, because each new double helix consists of one parental and one newly-synthesised strand.***
 - D. Semi-conservative, because each new double helix consists of two newly-synthesised DNA strands.
2. Bacterial cells reproduce by
 - A. ***Binary fission only***
 - B. Meiosis only
 - C. Binary fission and mitosis
 - D. Mitosis and meiosis
3. A lizard lying on a rock that is warmer than its body will
 - A. lose heat to the rock by convection
 - B. lose heat to the rock by conduction
 - C. gain heat from the rock by convection
 - D. ***gain heat from the rock by conduction***
4. If 30% of the bases in a DNA molecule are adenine, what percentage will be Guanine?
 - A. ***20***
 - B. 30
 - C. 60
 - D. 70
5. The first organisms on earth were
 - A. Eukaryotic and aerobic
 - B. Prokaryotic and aerobic
 - C. Eukaryotic and anaerobic
 - D. ***Prokaryotic and anaerobic***
6. Which of the following statements about fungal and bacterial cells is **most** accurate?
 - A. Neither fungal or bacterial cells have cell walls
 - B. Fungal cells have cell walls but bacterial cells do not
 - C. Fungal cells do not have cell walls but bacterial cells do
 - D. ***Both bacterial and fungal cells have cell walls***

7. Tail length in mice is a polygenic trait. This means that variation in tail length in a population of mice will be
 - A. discontinuously distributed and controlled by the alleles of multiple genes
 - B. discontinuously distributed and controlled by alleles of a single gene
 - C. continuously distributed and controlled by alleles of multiple genes**
 - D. continuously distributed and controlled by alleles of a single gene
8. The number of tRNA molecules needed to synthesise the first 24 amino acids of a polypeptide chain is
 - A. 8
 - B. 24**
 - C. 25
 - D. 72
9. In water melons, fruit bitterness is determined by two alleles of a gene, where an allele for bitter fruit is dominant over an allele for sweet fruit. A plant that is heterozygous for these two alleles is crossed with a plant with sweet fruit. The expected fruit phenotypes in the progeny of these plant is
 - A. All bitter fruit
 - B. 75% bitter fruit and 25% sweet fruit**
 - C. All sweet fruit
 - D. 50% bitter fruit and 50% sweet fruit
10. A pathogen that infected the plants has cells with a true nucleus, mitochondria and a cell wall made of chitin and is therefore?
 - A. Bacterium
 - B. Fungus**
 - C. Protest
 - D. Virus
11. Which of the following describes the adaptation by plants to high soil salinity?
 - A. Active uptake of salt into root cells so that water moves by osmosis from the soil into root cells.**
 - B. Active uptake of salt into root cells so that water moves by osmosis from root cells into the soil.
 - C. Exclusion of salt from root cells so that water moves by osmosis from the soil into root cells.
 - D. Exclusion of salt from root cells so that water moves by osmosis from the root cells into soil.
12. In DNA replication, the enzyme DNA polymerase
 - A. Unwinds the DNA double helix
 - B. Seals short stretches of nucleotides
 - C. Adds nucleotides to a DNA strand**
 - D. Adds RNA primers to a DNA strand
13. Some antibiotics kill bacteria by blocking ribosome function. This directly stops the bacteria from producing
 - A. DNA
 - B. mRNA
 - C. tRNA
 - D. Protein**
14. Spirogyra differs from Mucor in having
 - A. uninucleate gametangia**
 - B. multinucleate gametes
 - C. anisogamete
 - D. sexual reproduction
15. Conservation of organisms in their natural habitats is called?
 - A. Ex situ conservation

B. *In situ conservation*

- C. Both A and B
- D. None of the above

16. During muscular contraction, which of the following events occur?

- (i) H-zone disappears
- (ii) A-band widens
- (iii) I-band reduces in width
- (iv) Width of A-band is unaffected
- (v) M-line and Z-line come closer

- A. **(i), (iii), (iv) and (v)**
- B. (i), (ii) and (v)
- C. (ii), (iv) and (v)
- D. (i), (ii) and (iii)

17. Passage of ova through the female reproductive tract is facilitated by

- A. **ciliary movement**
- B. amoeboid movement
- C. flagellar movement
- D. cyclosis

18. A strand of DNA has the nucleotide sequence AGGTCT. The nucleotide sequence of the complementary strand of DNA is

- A. AGGTCT
- B. AGGUCU
- C. TCCUGC

D. *TCCAGA*

19. When the cells from a plant root are placed in a solution, they lose water to the solution. Relative to the cells, the solution is

- A. **hypertonic**
- B. hypotonic
- C. isotonic
- D. less concentrated

20. Figure 1 below shows a glandular tissue.

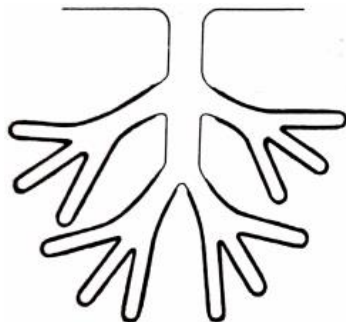


Fig 1

In which part of the mammalian body is the tissue likely to be?

- A. Skin
- B. **Mouth**
- C. Pancreas
- D. Small intestine

21. In protein synthesis, transcription is the process where by

- A. **DNA is copied into messenger RNA**
- B. DNA is copied into transfer RNA
- C. Messenger RNA is copied into transfer RNA
- D. Transfer RNA is copied into messenger RNA

22. Protists may have

- A. Mitochondria but not ribosomes or cell walls
- B. Ribosomes but not mitochondria or cell walls

C. Ribosomes and cell walls but not mitochondria

D. Mitochondria, ribosomes and cell walls

23. Two animal cells, **P** and **Q** were placed in a 0.5% sucrose solution. Initially both cells started to increase in size. However, cell **P** soon ceased to enlarge while cell **Q** increased in size until it burst. Which statement was true at the start of the experiment?

A. Cell **P** was hypotonic to the solution

B. Cell **P** was hypertonic to cell **Q**

C. Cell **Q** was hypotonic to cell **P**

D. Cell Q was hypertonic to cell P

24. The table below shows the production in two ecosystems in the temperate zone: a rain forest and field with an annual crop. All results are stated in MJ/m²/year.

	Rain forest	Field with an annual crop
Gross Primary production(GPP)	188	102
Respiration (autotrophs)	134	38
Respiration(heterotrophs)	53	3

Which of the following statements best explains a higher ratio of respiration by heterotrophic organisms to net primary production (NPP) in a rain forest than field with an annual crop?

A. The rain forest has a larger GPP and more consumers than the crop field.

B. The rain forest has a larger NPP and more consumers than the crop field.

C. The rain forest has smaller GPP and more consumers than the crop field.

D. The rain forest has smaller NPP and more consumers than the crop field.

25. How does water support a mangrove plant?

A. By transpiration, ensuring constant cycling of water throughout the plant.

B. By making the cells flaccid, enabling the mangrove plant to strengthen its structural rigidity.

C. By filling the stem with water, assisting the stem to resist gravitational as well as osmotic forces.

D. By making the cells turgid promoting rigidity of plant structures.

26. The main structural component of plant cell is;

A. Amylopectin

B. Glycogen

C. Cellulose

D. Glucose

27. A red pigment is extracted from a marine alga. Which of the following best supports the hypothesis that the pigment is involved in photosynthesis?

The red pigment....

A. Has an absorption spectrum similar to that of chlorophyll.

B. Is also found in land plants.

C. Has a molecular structure similar to that of chlorophyll.

D. Has an absorption spectrum similar to the photosynthetic action spectrum for that same marine alga.

28. Which of the following is also a common aquatic environmental pollutant?

A. Carbon monoxide

B. Methane

C. Sulphur dioxide

D. Nitrate fertilizers

29. Mammals A, B, C and D have their breathing rate, heart rate and body temperature shown in the table below.

Animals	Breathing rate(inhalation/min)	Heart rate (beats/min)	Body temperature(°C)
A	160	500	36.5
B	15	40	37.2
C	28	190	38.2
D	8	28	35.9

Which one of them would have the greatest surface area per unit volume?

30. Which of the following would most easily cross a cell's phospholipid membrane?

- A. Water**
- B. Hydrogen ions
- C. Potassium ions
- D. Sodium ions

31. Just prior to cell division, the diploid human body cell contains-----chromatids.

- A. 23
- B. 46
- C. 69
- D. 92**

32. The subunits of nucleic acids which consists of a sugar, phosphate group, and nitrogen bases are referred to as a

- A. Nucleolus
- B. Histone
- C. Nucleotide**
- D. Phospho-carbohydrate

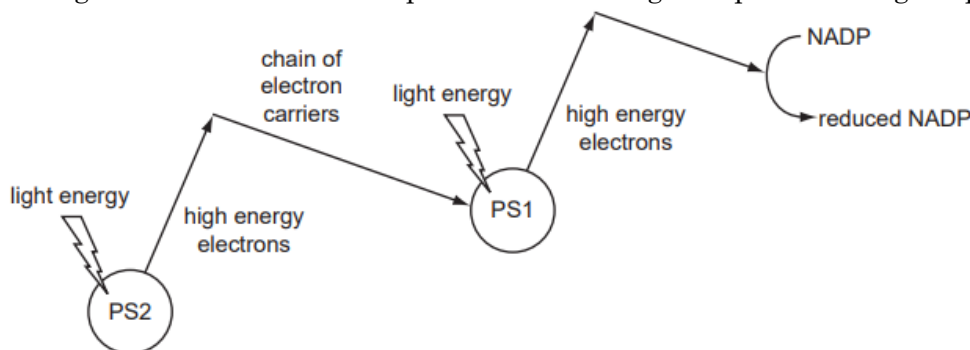
33. Equilibrium is reached in an aqueous solution when

- A. Random motion stops
- B. Water molecules and dissolved molecules are moving at the same rate
- C. The dissolved molecules or ions are equally distributed throughout the solution**
- D. There are the same number of water molecules as dissolved molecules.

34. Which cell organelle shows prokaryotic cell structure and has been proposed as providing evidence of endosymbiosis?

- A. Golgi apparatus
- B. Mitochondrion**
- C. Nucleolus
- D. Ribosome

35. The diagram shows some of the processes in the light-dependent stage of photosynthesis.



For the light- dependent stage to continue, photosystem two (PS2) must gain electrons. Where do these electrons come from?

- A. Electron carriers
- B. Reduced NADP

C. Photolysis

D. The formation of ATP

36. In mammals, why is glucose present in blood plasma but **not** normally in urine?

A. It is actively reabsorbed from the proximal convoluted tubule

B. It is oxidized to supply energy for ultrafiltration

C. It is stored in the medulla of the kidney

D. It is too large to filter through the glomeruli

37. If the magnification of a microscope is 50000 times and the diameter of the image viewed is 5mm, the actual diameter of the object is

A. $1 \times 10^4 \mu\text{m}$

B. $0.01 \mu\text{m}$

C. $0.1 \mu\text{m}$

D. $1.0 \mu\text{m}$

38. Which statement explains why cell membranes are described as having a 'fluid mosaic' structure?

A. Different types of membranes have different sets of proteins, each with a specific pattern

B. Phospholipids diffuse within their own monolayer with many of the membrane proteins also moving around

C. The fluidity of membranes changes, with cholesterol molecules maintaining stability

D. There are different kinds of transport protein scattered within the phospholipid bilayer, allowing facilitated diffusion and active transport

39. For what is the Lincoln index used?

A. to calculate species density in a defined area

B. to determine the biodiversity of an ecosystem

C. to estimate population size using mark-release-recapture

D. to measure species distribution along a transect

40. Which one of the following mechanical tissues is most important in providing support in young stems and leaves of plants?

A. Sclerenchyma

B. Collenchyma

C. Parenchyma

D. Tracheid

SECTION B (60 MARKS)

41. Figure 2 below shows a root hair cell in a section of a root surrounded by a soil solution of water potential, -300kpa. It rains, diluting the molecules dissolved in the water of the soil solution by three times.

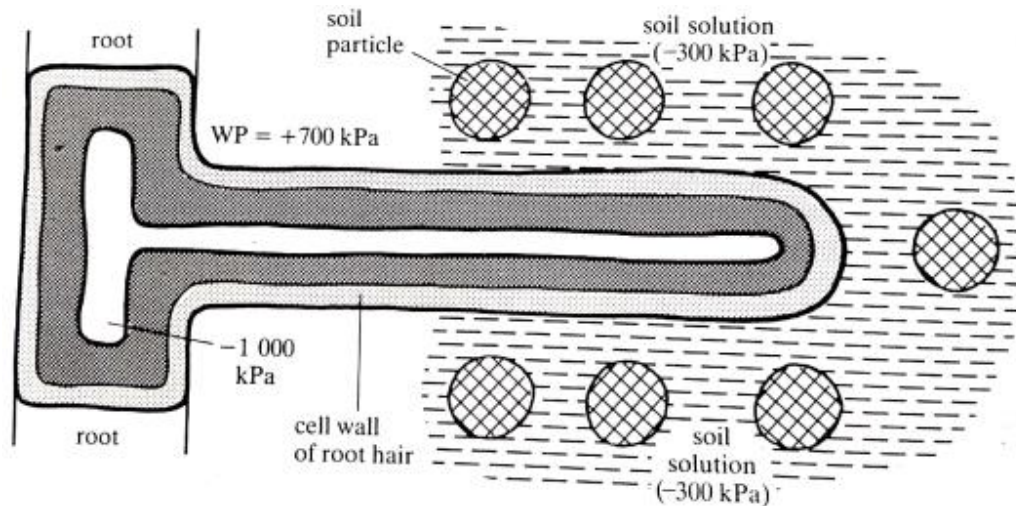


Fig 2

- (a) Calculate the;

- (i) change in the water potential of soil solution after raining. (01 mark)

$$\frac{-300}{3}; \checkmark = -100 \text{ kPa}; \checkmark \quad @ \frac{1}{2} \text{ mark}$$

- (ii) water potential gradient between the soil solution and cell,
Before raining. (01½ marks)

$$-300 - -1000; \checkmark \\ +700 \text{ kPa}; \checkmark \checkmark \quad @ \frac{1}{2} \text{ mark}$$

After raining.

$$-100 - -1000; \checkmark \\ +900 \text{ kPa}; \checkmark \checkmark \quad @ \frac{1}{2} \text{ mark}$$

(01½ marks)

- (b) Explain the difference in the effect of water potential gradients at the two conditions in a(ii) on the flow of water molecules between the root hair and soil. (02 marks)

Faster/more rapid osmotic uptake of water by root hair after raining; ✓ because of steeper water potential gradient; ✓ after raining than before raining; @ 1 mark

- (c) Predict the effect of the change in water potential in a(i) on the pressure potential of root hair cell. Explain your answer. (04 marks)

Increases the pressure potential of cell; ✓✓ much osmotic uptake of water expands the vacuole; ✓ turgor pressure is increased; ✓✓ pressing protoplast against cell wall; ✓✓ cell wall presses back the cell content; ✓ increasing pressure potential/cell wall pressure; @ ½ mark

42. (a) Of what advantage is maintenance of relatively small body size among locomoting organisms? (02 marks)

Reduced problems of support; ✓

Expends less energy during locomotion; ✓

@ 1 mark

(b) Explain how buoyancy can be achieved in chondrichthyes that lack swim bladders.

(03marks)

Having a larger ventral lobe than dorsal lobe of the caudal fin;✓✓ making the tail asymmetric/ forming a heterocercal tail;✓ which provides an upthrust;✓ allowing it to maintain its vertical position in water;✓ provided the fish keeps swimming;✓ @ ½ mark

(c) Describe the role of the following in bringing about contraction of a skeletal muscle fibre.

(i) Acetylcholine.

(03marks)

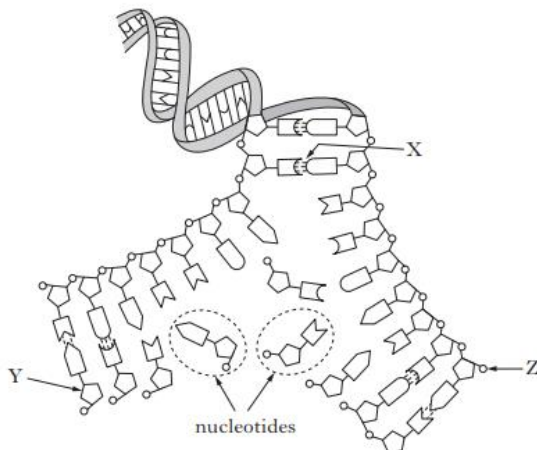
On attachment onto protein receptor molecule on folds of the muscle fibre membrane/sarcolemma/post synaptic membrane;✓ protein receptor changes shape;✓ increasing the permeability of the membrane to sodium ions/ Sodium ions diffuse into the sarcoplasm via opened sodium ion channels;✓ causing local depolarization of the sarcolemma;✓ @ 1mark

(ii) ATP.

(02marks)

*On hydrolysis,✓ provides energy for activating/cocking the myosin head;✓ and active transport/pumping of calcium ions from the sarcoplasm back to the sarcoplasmic reticulum and T system;✓ for the muscle fibre to relax;
On attachment on the myosin head;✓ myosin head detaches from the actin filament;✓ @ ½ mark*

43. The diagram below shows part of a DNA molecule during replication.



(a) Name

(i) the type of bond labeled X. (01 mark)

Hydrogen bond;✓

(ii) the enzyme that breaks bond in (i) during DNA replication. (01 mark)

Helicase enzyme;✓

(iii) molecules labeled Y and Z. (02 marks)

Y: Deoxyribose sugar; ✓ Deny Pentose sugar.

Z: Phosphate; ✓

(iv) **four** molecules not shown on the diagram which are essential for DNA replication.

(02 marks)

ATP;✓ (RNA) primer; ✓ DNA polymerase enzyme;✓ DNA ligase enzyme;✓ (single-stranded binding) proteins;✓ Topoisomerases enzymes;✓

Any four @ ½ mark

Deny Polymerase alone.

(b) Explain why DNA replication

(i) must take place before a cell divides.

(02 marks)

Ensures new cells/daughter cells produced;✓ have identical/exact copy of genetic instructions;✓ /are genetically identical/have a complete copy of the genomes to function properly; @ 1mark

Or To maintain the correct quantity/number complement of DNA/chromosomes;✓✓

(ii) is termed semi-conservative.

(02 marks)

*Half of the original parent molecule is retained/ 'conserved' in each of the new strands;
OR Each new DNA molecule consists of a single strand of old/ parent DNA and a single strand of new-replicated strand;✓✓*

44. (a) Table below shows the distribution of some modified parenchyma tissues in plants. Complete the table by filling the missing sites and modified parenchyma tissues.

(04 marks)

Modified parenchyma tissue	Location
Mesophyll tissue	<i>Between the upper and lower epidermis of leaf cells;✓</i>
<i>Epidermis;✓</i>	Covers the entire plant body
Companion cells	<i>Adjacent to phloem sieve tubes;✓</i>
Endodermis	<i>Around central vascular tissue/innermost layer of cortex of roots;✓</i>

@ 1mark

- (b) Describe the structural adaptations of the sclerenchyma fibres for their functions.

(04 marks)

Are living;✓can grow;✓and stretch;✓without imposing limitations on the growth of cells of leaves and young stems;✓

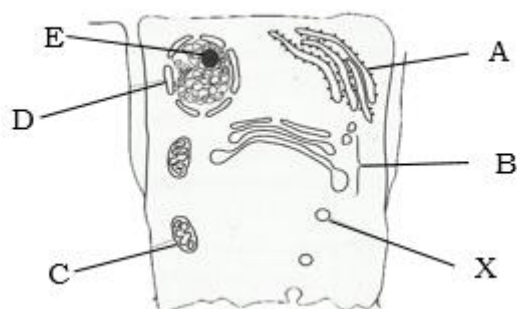
@ 1mark

- (c) Explain the importance of the collenchyma tissue in leaves and young plants.

(02 marks)

Primary cellulose cell walls are heavily thickened;✓with deposits of lignin;✓having a great tensile strength;✓and compressional strength;✓for support;✓Ends of fibre cells tapered;✓and interlocked with another;✓increasing their combined

45. The diagram below is a cell.



- (a) Name the structure labeled A to E. (02½ marks)

A: *Rough Endoplasmic reticulum;✓*

B: *Golgi body/Golgi apparatus/Golgi complex;✓*

C: *Mitochondrion;✓*

D: *Nuclear envelope/nuclear membrane;✓*

E: *Nucleolus;✓*

@ ½ mark

(b) i) Give the appropriate letters to identify two structures that would be absent in a prokaryotic cell. (01mark)

C;✓ and D;✓ @ ½ mark

(ii) Explain the functional relationship between structures A, B and X. (02½ marks)

Proteins are synthesized in (80s) ribosomes of rough endoplasmic reticulum/A;✓ vesicles carrying these proteins bud/pinch off;✓ forming membrane bound cisternae of the Golgi apparatus/body/complex/B;✓ inside which proteins are modified;✓ vesicles/X bud off cisternae containing modified proteins;✓ @ ½ mark

Ignore details of post translational modification in the Golgi apparatus.

(c) How is the structure of organelle C related to its functions? (04 marks)

- *Highly folded inner membrane; to increase surface area for electron transport chain;✓*
- *Narrow intermembrane space; allows proton gradient to be rapidly established for chemiosmosis to occur;✓*
- *Matrix contains ribosomes and circular DNA for protein synthesis; reducing on importation of proteins from the cytoplasm;✓*
- *Matrix contains enzymes that catalyze reactions of the Krebs cycle;✓*
- *Stalked particles/granules on the inner membrane with chemiosmotic channels for diffusion of protons into the matrix emitting energy for phosphorylation;✓*
- *Impermeable inner membrane to hydrogen ions/protons; allows accumulation of hydrogen ions into the intermembrane space;✓*
- *Thin outer membrane; reduces the distance over which materials pass in and out of the membrane;✓*
- *Inner membrane contains protein molecules that actively pump protons into the intermembrane space; ✓*
- *Double membrane isolates the mitochondrion from interference by the processes in the cytoplasm;✓ @ 1mark*

45. An atheroma is an abnormal reversible accumulation of cellular material and debris within the inner walls of an artery.

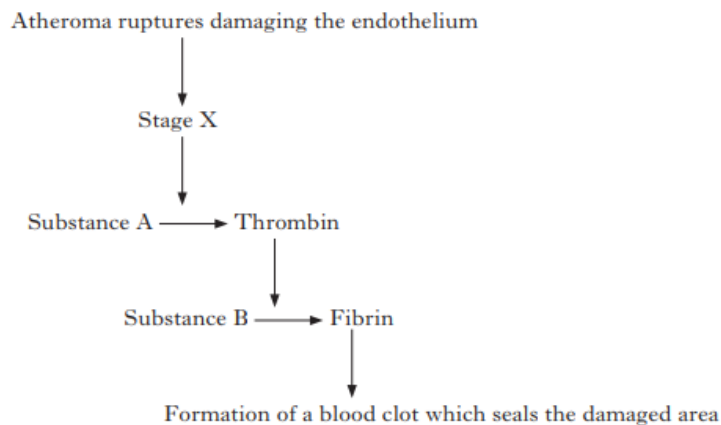
(a) (i) Name **two** substances which may accumulate in an artery resulting in the formation of an atheroma. (02 marks)

*Fatty material/ lipids/cholesterol/fat;✓
Calcium;✓
Fibrous material;✓
Dense Plaque
Any two @ 1mark*

(ii) Predict the effect of an atheroma on the blood pressure in an artery. Explain your answer. (02 marks)

*Increases/raises blood pressure;✓ owing to reduced diameter/narrowing of lumen of artery; ✓ and reduced elasticity of the muscular wall of the artery;✓
@ 1mark
Max 2 marks*

- (b) The flow diagram below shows the cascade of reactions involved in the formation of a blood clot in an artery on rupture of an atheroma.



- (i) State what happens during stage X. (01 mark)

Clotting factors are released/produced;✓

- (ii) Name substances A and B. (02 marks)

A: Prothrombin;✓

B: Fibrinogen;✓

- (c) A blood clot can break away from its site of formation and enters the general circulation.

- (i) Name this type of blood clot. (01 mark)

Embolus;✓ Deny Embolism

- (ii) Describe how movement of a blood clot can lead to a heart attack. (02 marks)

Blocks coronary artery/blood vessel supplying heart muscle;✓ suddenly impeding blood flow to heart muscle;✓ depriving the heart muscle of oxygen and nutrients;✓ @ 1mark

END

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