Name:.....

Signature:.....**Personal No**.....

P530/1
BIOLOGY
Paper 1
Dec, 2020
2 ½ hours

INTERNAL MOCK EXAMINATIONS
Uganda Advanced Certificate of Education

BIOLOGY
(THEORY)
Paper 1

2 Hours 30 Minutes

INSTRUCTIONS TO CANDIDATES:

*This paper consists of Sections **A** and **B***
*Answer **all** questions in both Sections.*
***SECTION A**: Write answers to this section in the boxes provided.*
***SECTION B**: Answers to this section must be written in the spaces provided and not anywhere else. No additional sheets of paper should be attached or inserted.*

FOR EXAMINER'S USE ONLY		
Section	***Qn No.***	***Marks***
A:	***1-40***	
B:	***41***	
	42	
	43	
	44	
	45	
	46	
	Total	

SECTION A: (40 MARKS)

*Write the letter to the correct answer in the boxes provided. Each question in this section carries **one** mark.*

1. Why could only 4% of the energy from sunlight be fixed by producers during photosynthesis?

A. A lot of energy is lost as energy passes from one trophic level to the next in food chains.
B. A lot of sunlight reflects off clouds, is absorbed by pond water or does not strike chloroplasts.
C. Some energy passes from dead plants to decomposers such as bacteria and fungi.
D. Some parts of plants are not eaten or cannot be digested by herbivores.

2. Which statement explains why the circumference (girth) of a tree is less in the middle of the day than at night?

A. Mineral uptake by the root hair cells decreases during the night because root pressure has decreased.
B. Stomata close during the night and there is a build-up of water in the vascular tissue within the stem.
C. The phloem sieve tubes fill with dissolved solutes because the translocation rate is reduced at night.
D. There is less tension in the xylem vessels at night because the rate of transpiration is at a minimum.

3. Antibodies can act in a number of ways to protect the body from pathogenic bacteria. Which event will not occur following antigen-antibody binding?
A. agglutination of bacteria to reduce their spread
B. increased susceptibility to phagocytosis
C. neutralisation of toxins to make them harmless
D. secretion of histamine to produce an allergic reaction

4. What are always present in prokaryote cells?
A. capsules
B. pili
C. flagella
D. ribosomes

5. 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

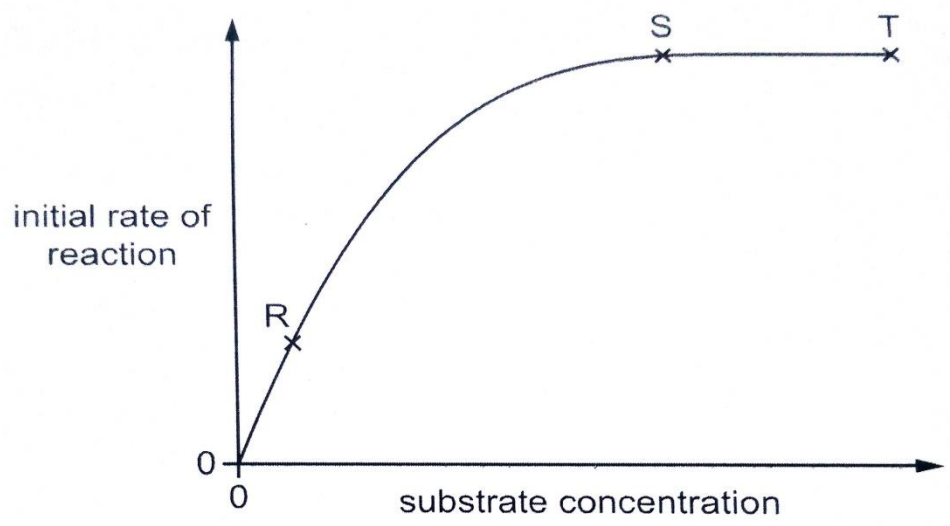
6. Which level of protein structure maintains the globular shapes of enzymes?

A. primary
B. secondary
C. tertiary
D. quaternary

7. A length of double-stranded DNA contains 120 nucleotides and codes for polypeptide X. What is the maximum length of polypeptide X?

A. 20 amino acids
B. 40 amino acids
C. 60 amino acids
D. 120 amino acids

8. The graph below shows the effect of substrate concentration on the initial rate of an enzyme-catalysed reaction. The enzyme concentration is constant.



Which statement about the graph is correct?

A. Between R and S the number of enzyme molecules is limiting the rate of reaction.
B. Between R and S the number of product molecules is limiting the rate of reaction.
C. Between S and T the number of enzyme molecules is limiting the rate of reaction.
D. Between S and T the number of substrate molecules is limiting the rate of reaction.

9. 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. The cell receives the signal to begin to divide.
4. Covalent bonds form between adjacent nucleotides on the same strand.
5. 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 → 5
C. 5 → 2 → 1 → 4
D. 5 → 2 → 3 → 1

10. Which statement explains how mass flow arises in sieve tube elements?

A. Sucrose actively loaded into sieve tube elements decreases the water potential causing the hydrostatic pressure to increase.

B. Sucrose actively loaded into sieve tube elements increases the water potential causing the hydrostatic pressure to decrease.

C. Sucrose diffused into sieve tube elements decreases the water potential causing the hydrostatic pressure to increase.

D. Sucrose diffused into sieve tube elements increases the water potential causing the hydrostatic pressure to decrease.

11. An increase in carbon dioxide in human blood shifts the oxyhaemoglobin dissociation curve to the right.

What is the explanation for this effect?

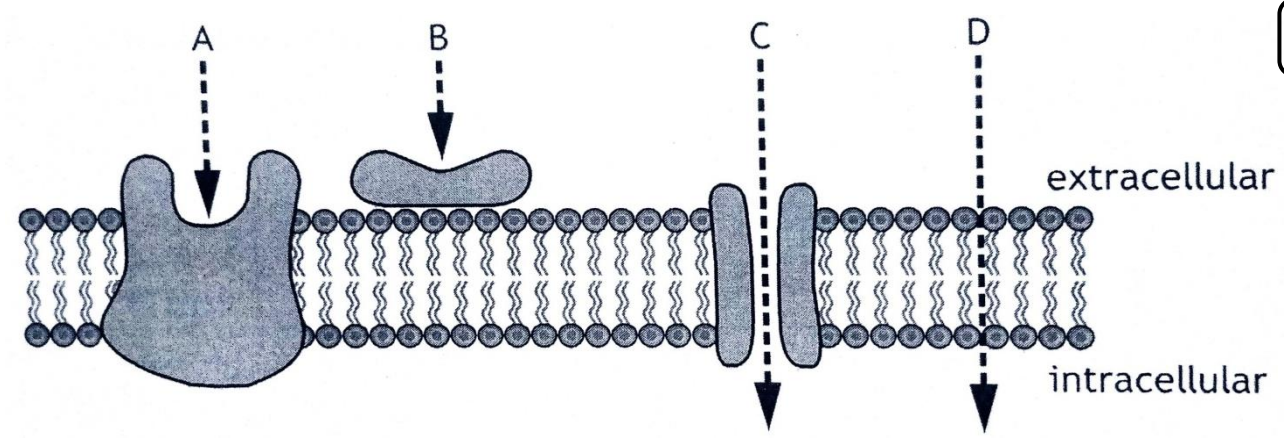
A. An increase in carbon dioxide concentration increases the ventilation rate.

B. Carbon dioxide is more soluble than oxygen and displaces it.

C. Diffusion of carbon dioxide between the alveoli and the blood is more rapid.

D. Increasing the H+ concentration decreases haemoglobin affinity for oxygen.

12. Which letter in the diagram represents the first stage in cell signaling for a peptide hormone molecule?



13. Stages of aerobic respiration are shown below.

1. Glycolysis
2. Citric acid cycle
3. Electron transfer chain

Which stage(s) involve(s) **both** phosphorylation of intermediates and generation of ATP?

A. 1 only

B. 3 only

C. 1 and 2 only

D 1 and 3 only

14. What is the role of cholesterol in the cell surface membrane?

A. to assist active transport

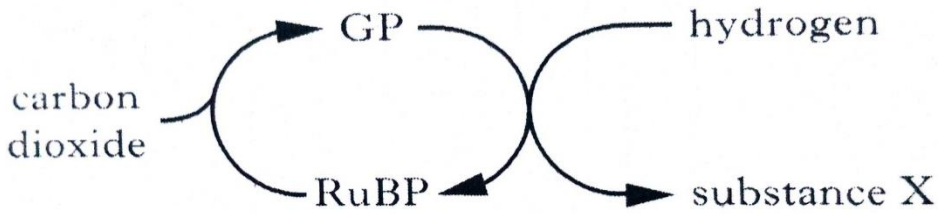
B. to provide hydrophilic channels

C. to assist facilitated diffusion

D. to regulate fluidity of the membrane

15. What is the role of decomposers in the nitrogen cycle?
A They convert proteins to ammonium compounds.
B They fix atmospheric nitrogen.
C They oxidise ammonium compounds to nitrites.
D They oxidise nitrites to nitrates.

16. The diagram below shows an outline of the carbon fixation stage of photosynthesis.



Substance **X** is
A. ATP
B. oxygen
C. glucose
D. water.

17. Human males affected by Klinefelter syndrome may have two X chromosomes and a Y chromosome (XXY). This condition arises as a result of
A. recombination
B. crossing-over
C. sex-linkage
D. non-disjunction.

18. Rifampicin is an antibiotic used to treat tuberculosis (TB).
It works by inhibiting RNA polymerase in bacteria. Which processes are directly inhibited by this antibiotic?
1. DNA replication
2. transcription
3. ATP synthesis
A. 1, 2 and 3 B. 1 and 2 only. C. 1 and 3 only D. 2 only

20. A light microscope is used to observe two structures that are 200nm apart. How far apart are the structures when the magnification is changed from ×40 to ×400?
A. 2 µm B. 20 µm C. 200nm D. 2000nm

21. During unexpected periods of drought the South American lungfish, *Lepidosiren paradoxa*, survives by burying into mud. This type of behaviour is known as
A. predictive dormancy
B. daily torpor
C. aestivation
D. hibernation.

22. An experiment was set up to investigate the effect of different respiratory substrates on the rate of respiration in yeast. Methylene blue can be used to measure the rate of respiration as it changes from dark blue to colourless when it accepts hydrogen ions. Four test tubes were set up, each containing yeast, methylene blue and one of the respiratory substrates. The table below shows the results of this investigation.

Test tube number	*Respiratory Substrate*	*Appearance of the methylene blue after 20minutes*
1	Starch	dark blue
2	Sucrose	light blue
3	Lactose	dark blue
4	Glucose	Colourless

Which of the following conclusions is correct?
The rate of respiration is
A. higher with starch than with glucose
B. lower with sucrose than with lactose
C. higher with glucose than with lactose
D. lower with glucose than with sucrose.

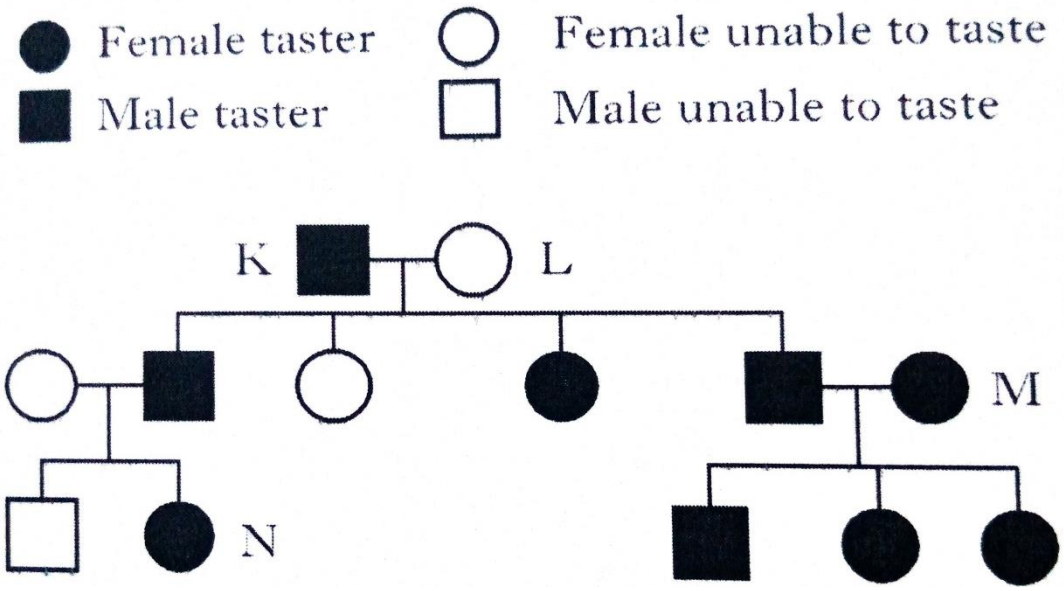
23. On returning to their roost after feeding, vampire bats may regurgitate blood to feed an unrelated individual in the same social group.
This is an example of
A. mutualism
B. social hierarchy
C. altruism
D. kin selection.

24. Parthenogenesis is most likely to be common in environments with a
A. warm climate and low parasite density
B. warm climate and high parasite density
C. cool climate and low parasite density
D. cool climate and high parasite density.

25. Which of the following groups of plants has a dependent sporophyte?
A. Filicinophytes
B. Coniferophytes
C. Bryophytes
D. Angiospermophytes

26. If the frequency of the recessive allele in a certain population is 0·7, what is the proportion of individuals that would be heterozygous?
A. 0·09
B. 0·42
C. 0·21
D. 0·49

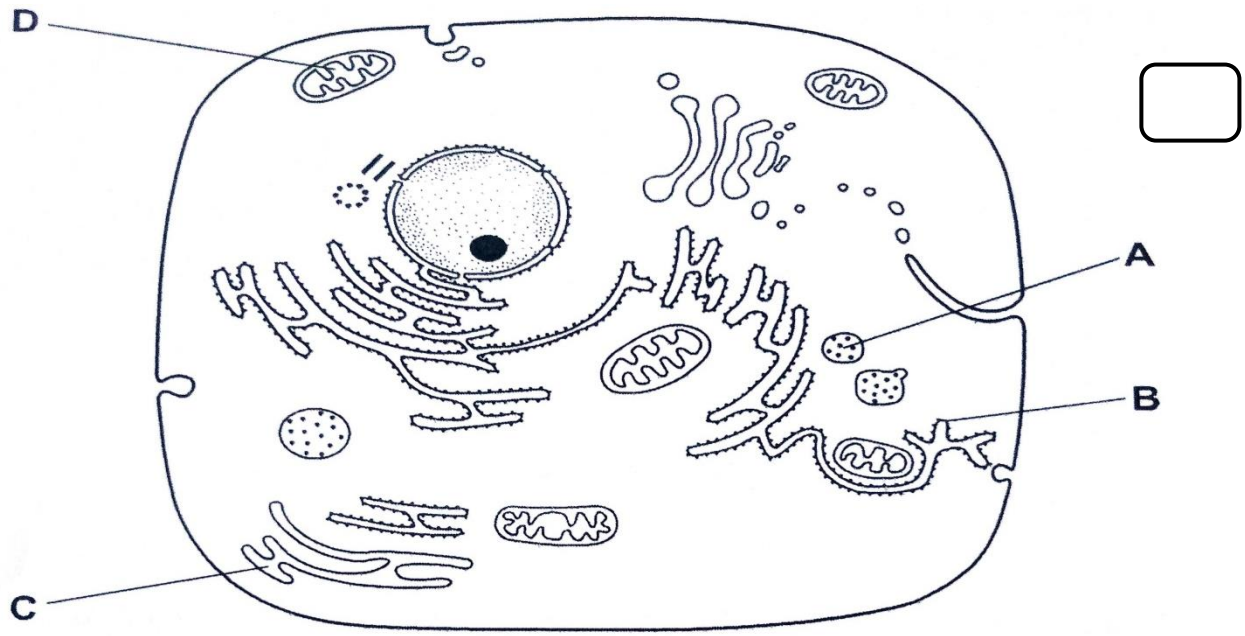
27. In humans, the ability to taste a certain chemical is controlled by one pair of alleles. The allele which gives the ability to taste the chemical is dominant.



Which of the following conclusions about the individuals indicated in the above family tree may be **incorrect**?

A. K is heterozygous for this characteristic.
B. L is homozygous for this characteristic.
C. M is homozygous for this characteristic.
D. N is heterozygous for this characteristic.

28. The diagram shows the ultrastructure of a typical animal cell. Which structure synthesizes and transports lipids?



29. The hormone thyroxine is

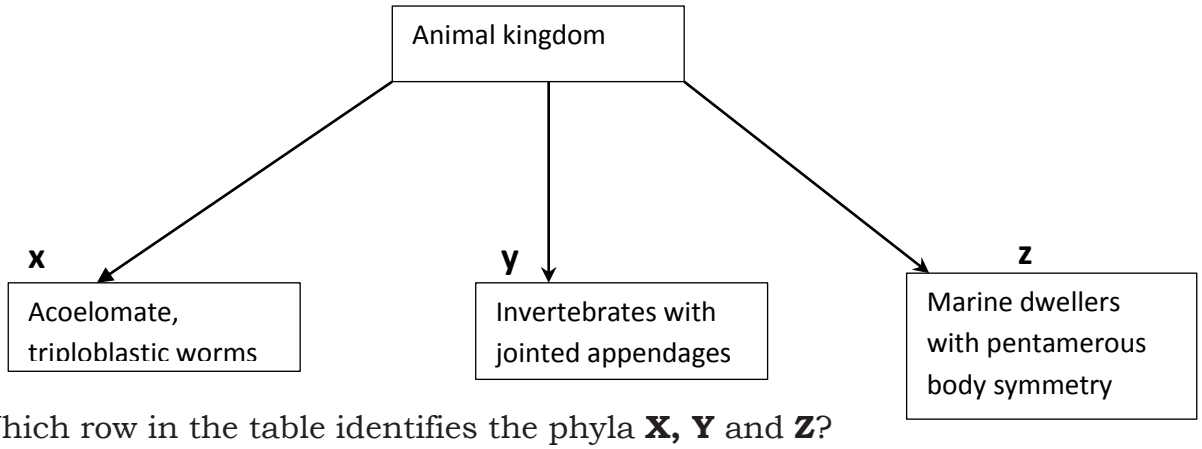
A hydrophobic and unable to pass through the cell membrane

B hydrophilic and unable to pass through the cell membrane

C hydrophobic and able to pass through the cell membrane

D hydrophilic and able to pass through the cell membrane.

30. The diagram below shows features of some phyla in the animal kingdom.



Which row in the table identifies the phyla **X, Y** and **Z**?

	Phylum		
	X	**Y**	**Z**
A	Nematoda	Mollusca	Chordata
B	Annelida	Arthropoda	Cnidaria
C	Platyhelminthes	Arthropoda	Echinodermata
D	Arthropoda	Annelida	Mollusca

31. In tomato plants, the genes for stem colour and presence of epidermal hairs are found on different chromosomes. The allele for purple stem **P** is dominant to the allele for green stem **p** and the allele for hairy stem **H** is dominant to the allele for smooth stem **h**. The following cross was carried out.

PpHh × pphh;

32 offspring were produced from this cross. How many of these offspring would be expected to have purple, smooth stems?

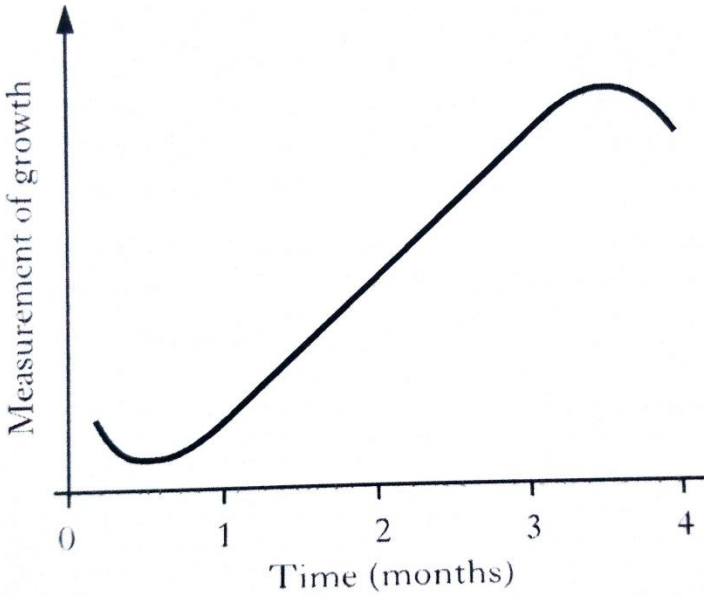
A. 24

B. 16

C. 8

D. 4

32. The graph below shows the pattern of growth of an organism over a period of 4 months.



The graph shows changes in the

A. mass of an insect
B. length of an insect
C. dry mass of an annual plant
D. length of an annual plant.

33. Shags and cormorants both belong to the genus *Phalacrocorax,* but different species. They look very similar and nest near each other on the same cliffs. The table below shows the main components of each bird's diet.

Prey	***Percentage composition of diet***	
	Shag	***Cormorant***
sand eels	33	0
Sprats	49	1
Flatfish	1	26
Shrimps	2	33
Gobies	4	17
other fish	4	18

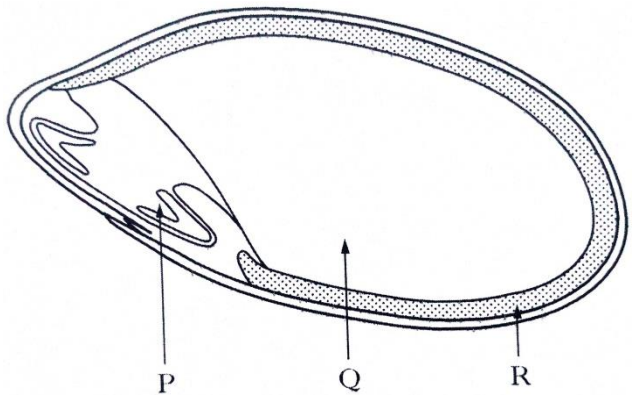
The data in the table show

A. competitive exclusion
B. resource partitioning
C. competition within each species
D. the fundamental niche of each species.

34. If ten percent of the bases in a molecule of DNA are adenine, what is the ratio of adenine to guanine in the same molecule?

A 1:1
B 1:2
C 1:3
D 1:4

35. The diagram below shows some structures within a barley grain.



Which row in the table below identifies correctly the site of synthesis and the site of action of the hormone gibberellic acid (GA)?

	Site of synthesis of gibberellic acid (GA)	*Site of action of gibberellic acid* (GA)
A	P	Q
B	P	R
C	R	Q
D	R	P

36. Mating frequency was observed in sheep exposed to different periods of light and darkness. The results are shown in the table below.

Light period (hours)	*Dark period* (hours)	*Mating frequency* (0 = no mating) + = occasional ++ = frequent)
6	18	++
8	16	++
10	14	++
12	12	+
13	11	0

From information in the table, what is the critical factor required for mating to take place?

A. A minimum light period of 6 hours.
B. A maximum light period of 10 hours.
C. A minimum dark period of 12 hours.
D. A maximum dark period of 12 hours.

37. The list below shows processes which affect plants.

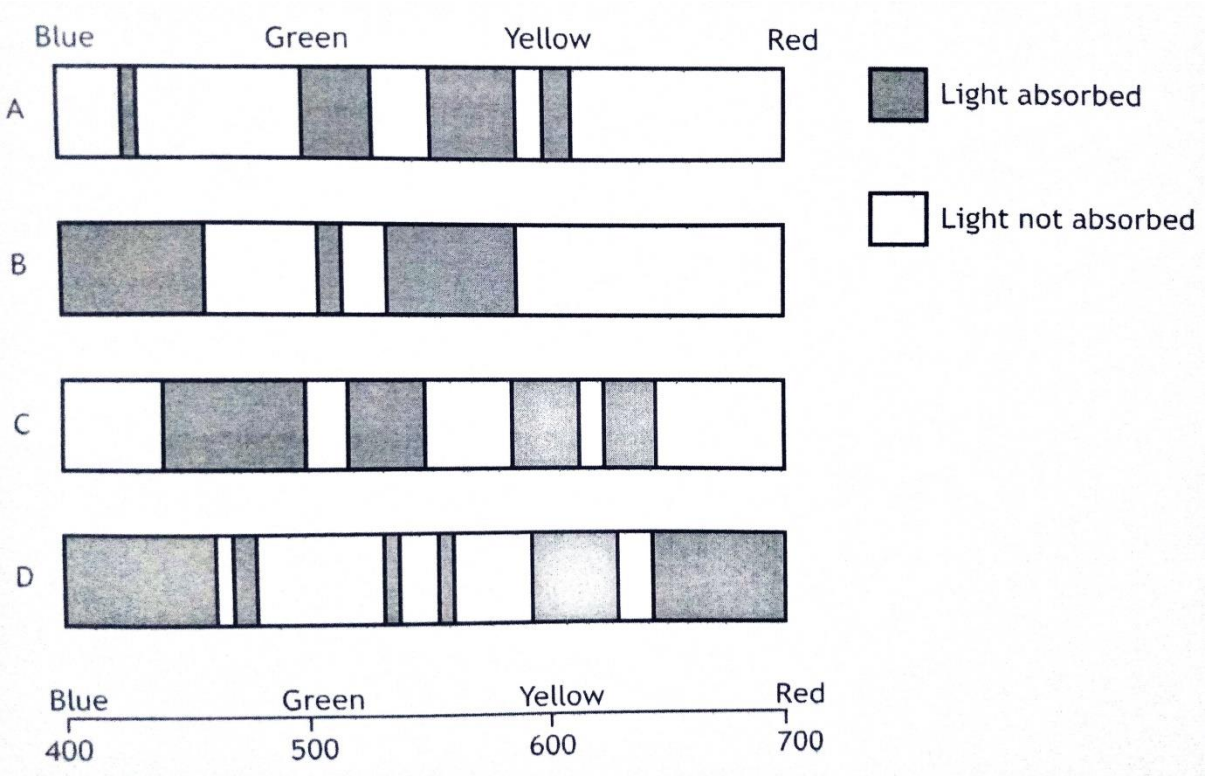
1. Leaf abscission inhibition
2. Fruit formation
3. Photoperiodism
4. Apical dominance

Which processes involve indole acetic acid (IAA)?

A. 1 and 3 only
B. 2 and 3 only
C. 1, 2 and 4 only
D. 3 and 4 only

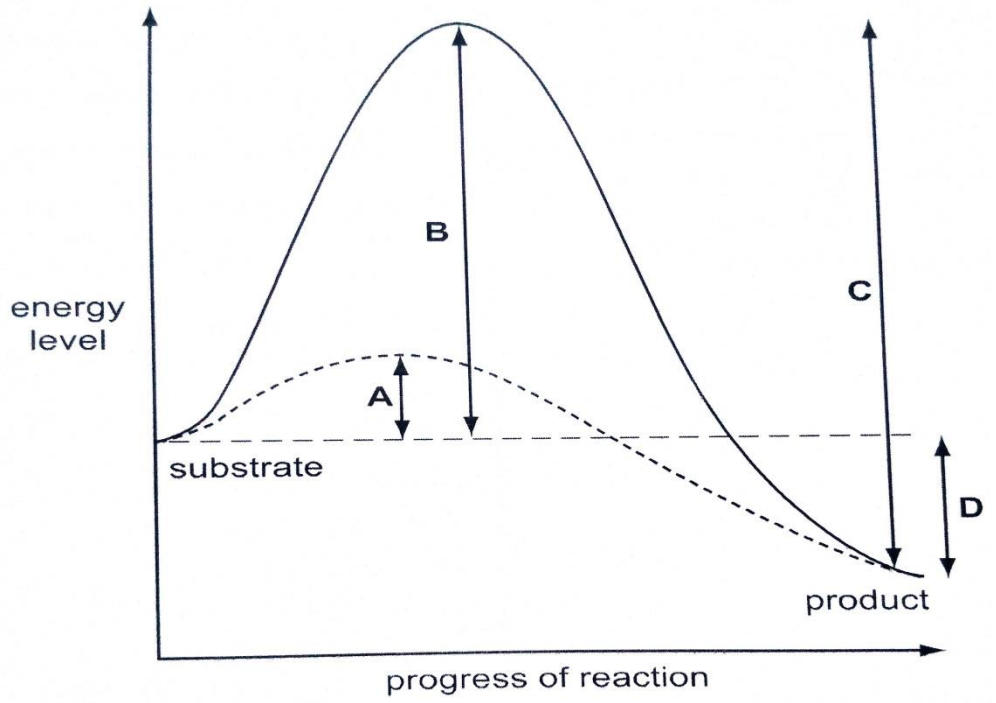
38. The following absorption spectra were obtained by testing four different plant extracts.

Which extract contains chlorophyll?

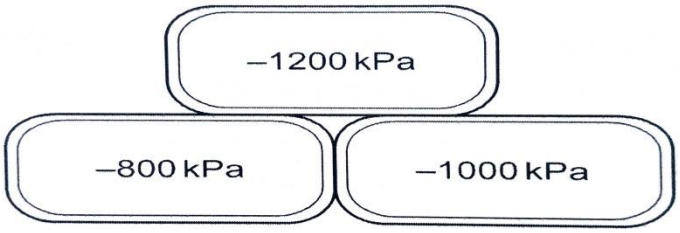


39. The graph shows the progress of a reaction in the presence and absence of an enzyme.

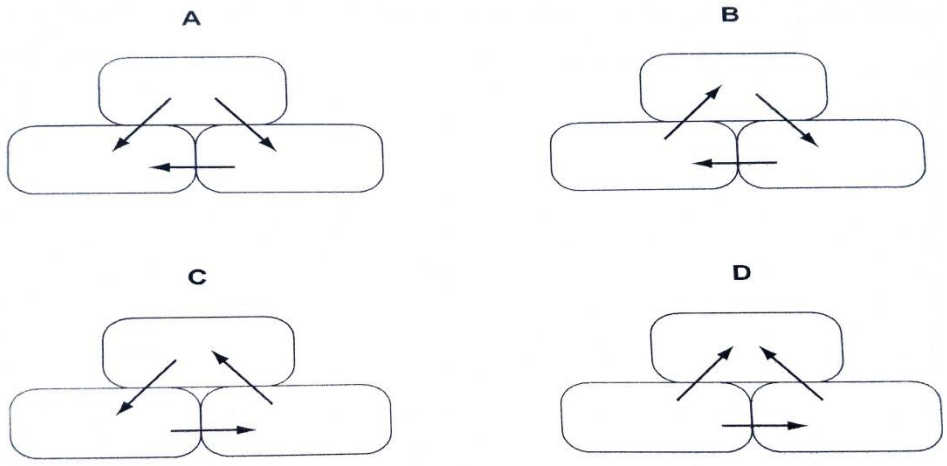
What is the activation energy of the reaction in the presence of the enzyme?



40. The diagram shows the water potential of three adjacent plant cells.



In which directions will there be net movement of water by osmosis?



SECTION B (60 MARKS)

Write answers in the spaces provided.

41. (a) Distinguish between **stroke volume** and **cardiac output**. *(02 marks)*

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(b) The table below shows times taken in the various stages of a complete cardiac cycle.

Stage of cardiac cycle	**Time taken / s**
Contraction of the atria	0.1
Contraction of the ventricles	0.3
Relaxation of both atria and ventricles	0.4

(i) Use the information in the table to calculate the heart rate in beats per minute. *(01 mark)*

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(ii) If the same rate of heartbeat were maintained throughout a 12-hour period, for how many hours would the ventricular muscle be contracting? *(02 marks)*

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(c) Describe how regular contraction of the atria and ventricles is initiated and coordinated by the heart itself. *(05 marks)*

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42. (a) (i) What is an **antigen**? *(02 marks)*

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(ii) Describe how B cells respond when stimulated in the presence of antigens. *(05 marks)*

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(b) Giving an example in each case, distinguish between **natural passive** and **natural active immunity**. *(03 marks)*

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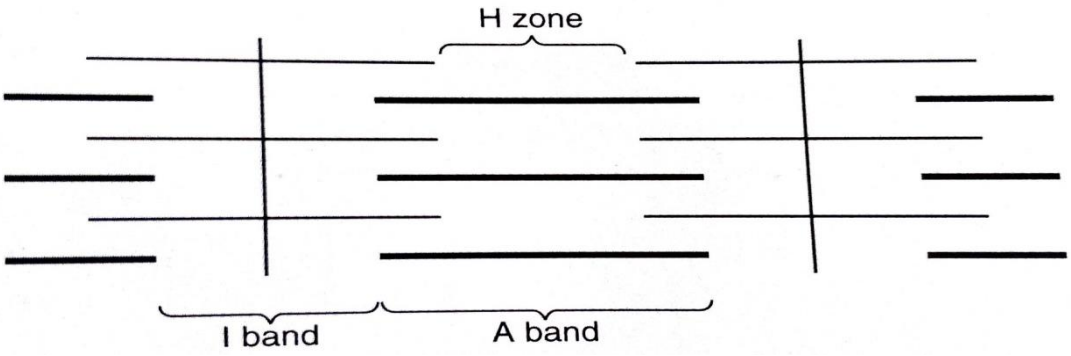
43. The figure below represents a longitudinal section through part of a striated muscle.



The diagram shows the **A** band, the **I** band and the **H** zone. Which one or more of these:

(i) contains actin but not myosin; *(01 mark)*

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(ii) shortens when the muscle contracts? *(01 mark)*

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(b) Describe the role played by each of the following in muscle contraction.

(i) ATP; *(03 marks)*

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(ii) calcium ions *(02 marks)*

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(iii) action potential (03 marks)

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44. (a) Progressive selection occurs in a certain population of rabbits such that large females only mate with equal sized males.

(i) Sketch graph(s) to show the frequency distribution of the rabbits as a result of the above selection. *(03 marks)*

(ii) Suggest one possible cause of the above form of selection.

(01 mark)

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(iii) Explain how the above form of selection may bring about evolutionary change. *(01 mark)*

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(iv) State **two** other examples of such form of selection in nature. *(02 marks)*

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(b) (i) What is **polymorphism**? *(01 mark)*

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(ii) State two examples of stable polymorphism in nature. *(02 marks)*

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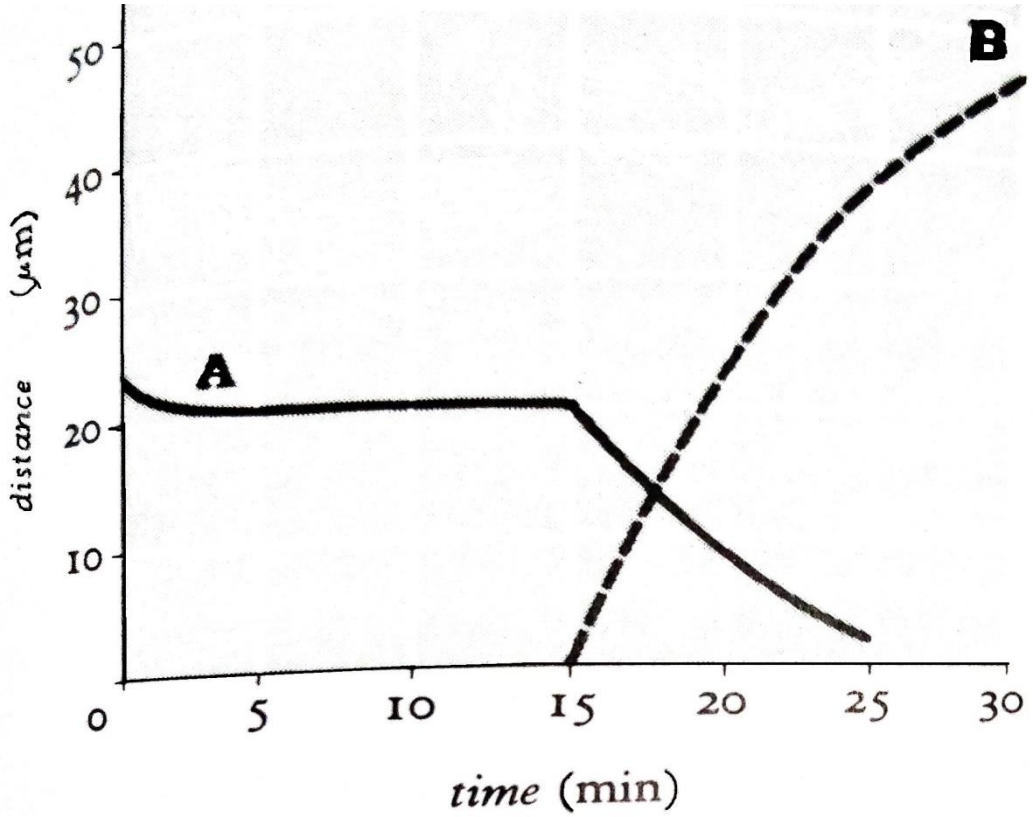
45. **(a)** The graph in the figure below *(on next page)* illustrates the movement of chromosomes within a cell during mitosis. Curve **A** shows the changes in the distance between the centromeres of the chromosomes and the poles of the spindle. Curve **B** shows changes in the distance between the centromeres of sister chromatids. One the time scale, zero (0) marks the beginning of the time when chromosomes line up on the equator.



(i) Explain the shapes of the curves 15 to 25 minutes after time 0.

(04 marks)

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(ii) Explain the shapes of curve **A** during the first five minutes.

(02 marks)

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(b) How does the process of meiosis cause genetic variation?

(04 marks)

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46. (a) The table below shows the thickness of the medulla in relation to the rest of the kidney in a number of selected mammals, and the maximum urine concentration produced in each case.

Mammal	**Relative medulla thickness (arbitrary units)**	**Maximum urine concentration (arbitrary units)**
Bear	1.0	52
Pig	1.3	110
Human	2.6	140
Common rat	5.2	300
Kangaroo rat	7.8	550
Animal X	9.8	940

(i) Explain the relationship between urine concentration and the relative thickness of the medulla. *(03 marks)*

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(ii) Suggest the natural habitat of: *(02 marks)*

The bear……

Animal **X**……

(b) State **three** physiological adaptations of the kangaroo rat to its environment. *(03 marks)*

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(c) With a reason, suggest a trend that would be expected in the amount of urine excreted by a herbivorous bird and a carnivorous one. *(02 marks)*

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END