NAMA: _____ **KELAS:** _____

SMJK SAM TET IPOH
PEPERIKSAAN PERCUBAAN
SEMESTER 1 STPM 2022

BIOLOGY (964/1)
PAPER 1

One and a half hours

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Instructions to candidates:

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE ALLOWED TO DO SO.

Answer **all** *questions in Section A.*

Answer **all** *questions in Section B.*

Answer **two** *questions only in Section C.*

All working should be shown. For numerical answers, units should be quoted whenever appropriate.

Answers may be written either in English or Malay.

Fill in your personal detail on page 1.

For examiner's use	
Section A	
1-15	
Section B	
16	
17	
Section C	
Total	

This question paper consists of 8 printed pages.

Section A [*15 marks*]

Instruction: There are 15 questions in this section. For each question, four suggested answers are given. Choose one correct answer and indicate it on the answer sheet provided. Answer all questions.

1

- Panting of a dog
- Cooling of transpiring hibiscus leaves

Which physiological role of water best describes the condition above?

A High adhesion and cohesion
B High specific heat capacity
C High latent heat of vaporisation
D High latent heat of fusion

2 Which is **not** true about cellulose?

I Alternate β-glucose residues in cellulose is rotated at 180°.
II Cellulose macrofibrils arranged to form microfibrils.
III It is tough polysaccharide in plant cell wall.
IV Linear cellulose chains are bound together with another cellulose chain by glycosidic bonds.

A I and II only
B I and III only
C II and IV only
D III and IV only

3 If a piece of double stranded DNA has guanine-cytosine pairing content of 70%, what proportion of uracil do you expect in the mRNA formed through transcription process?

A 15%
B 30%
C 35%
D 70%

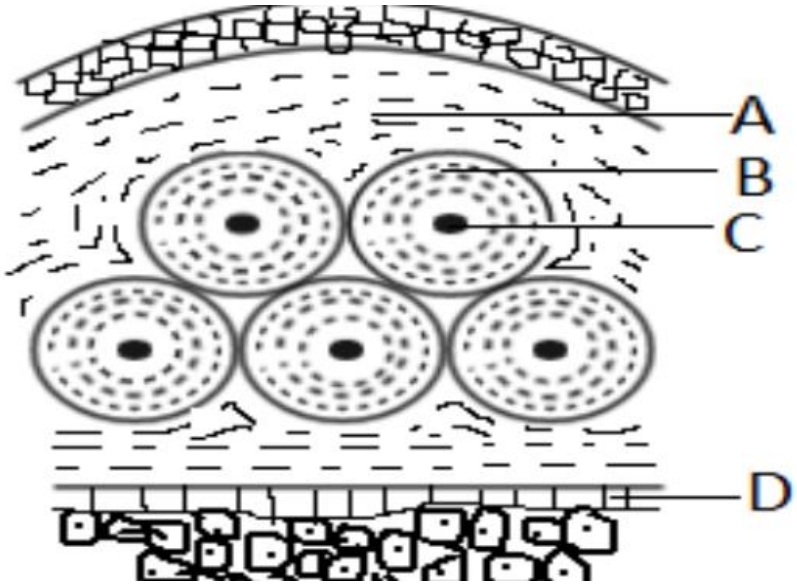
4 The table below shows three specialised plant cells and their functions.

Organelle		*Function*	
P	Parenchyma	a	Storage of food
Q	Collenchyma	b	Mechanical support
R	Sclerenchyma	c	Intercellular spaces for gaseous exchange
		d	Able to protect the seed in hard-skinned fruit
		e	Flexible and able to stretch together with other cells
		f	Provide grittiness

Which of the following are correct matches for the organelles and their functions ?

	P	**Q**	**R**
A	b, f	a, c	d, e
B	a, c	b, e	d, f
C	d, e	a, f	b, c
D	c, d	a, f	b, e

5 Which structure in the cross section of the bone consist of lymph vessel and nerve fibres?



6 Which statement explains the role of membrane protein as antigen?

A Able to recognise other cells
B For chemical-signaling
C Link to neighbouring cells
D Provide stronger framework for the cell

7 Which statements about cholesterol are true ?

I Without cholesterol, the membrane can break up.
II At warm temperature, the cholesterol molecules reduce fluidity of membrane.
III At low temperature, cholesterol slows down solidification.

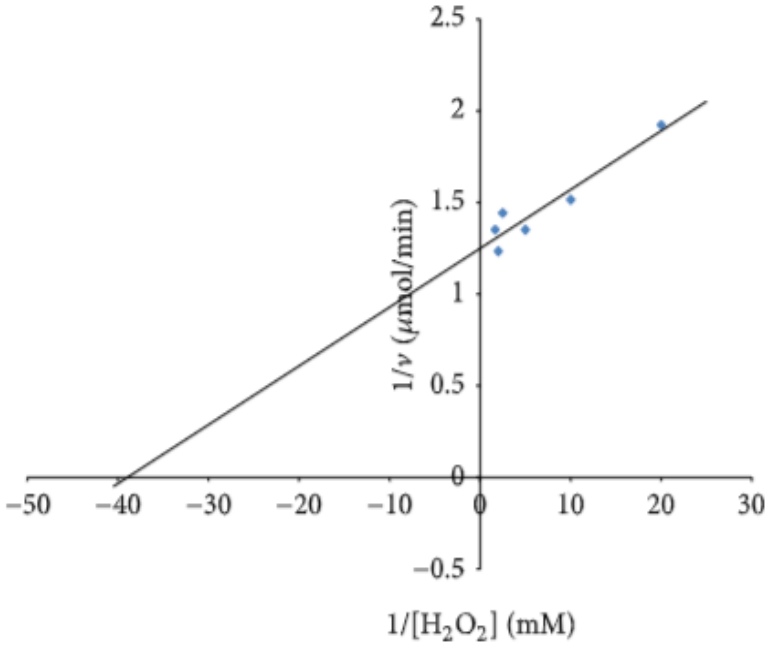
A I only
B I and II only
C II and III only
D I, II and III

8 The statements below shows the steps in sodium-potassium pump. Arrange accordingly.

I Carrier protein changes conformation to release sodium ion.
II Sodium ion binds to carrier protein.
III ATP is hydrolysed to ADP.
IV Dephosphorylation occurs.
V Potassium ion released.

A V, II, III, I, IV
B V, IV, III, II, I
C II, I, III, IV, V
D II, III, I, IV, V

9 The diagram below shows the Lineweaver-Burk plot of initial velocity data using different concentration of H_2O_2 as substrate.



Express the Michaelis-Menten constant from the data given above.

A - 0.025
B - 0.800
C 0.025
D 0.800

10 Which examples of enzyme reactions shown below classified as lyase?

A Phosphorylation of glucose in glyolysis.
B Decarboxylation in link reaction.
C Redox reaction in electron transport chain.
D Regeneration of RuBP in Calvin cycle.

11

The diagram shows a fatty acid known as Capric Acid. Calculate the number of ATP produced by the oxidation of fatty acid through beta-oxidation.

A 38
B 60
C 120
D 145

12 What is the name of the substrate that is involved in passing the electrons from complex I and II to complex III?

A Cytochrome
B Complex Q
C Flavoprotein
D Ubiquinone

13 Where does photorespiration occurs in C_4 plants?

A Thylakoid space
B Mesophyll cell
C Bundle sheath cell
D Both, mesophyll cell and bundle sheath cell

14 Which of the following statements best represents the Kranz anatomy?

A The inner mesophyll cells layer and the outer bundle sheath cells layer.
B The mesophyll cells have less starch grains.
C The bundle sheath cell contains small chloroplast with larger grana.
D The mesophyll cell contains large chloroplast with smaller grana.

15 How to prevent photorespiration and increase the photosynthetic output in C_3 plants?

A Use aeroponic method
B Use hydroponic method
C Grow the plant in a glass house
D Increase the exposure to sunlight

Instruction: Please shade your answers for Section A in the answer sheet given.

1	A	B	C	D	**6**	A	B	C	D	**11**	A	B	C	D
2	A	B	C	D	**7**	A	B	C	D	**12**	A	B	C	D
3	A	B	C	D	**8**	A	B	C	D	**13**	A	B	C	D
4	A	B	C	D	**9**	A	B	C	D	**14**	A	B	C	D
5	A	B	C	D	**10**	A	B	C	D	**15**	A	B	C	D

SECTION B [*15 marks***]**
Answer **all** questions in this section.

16 The diagram shows paper chromatography technique.

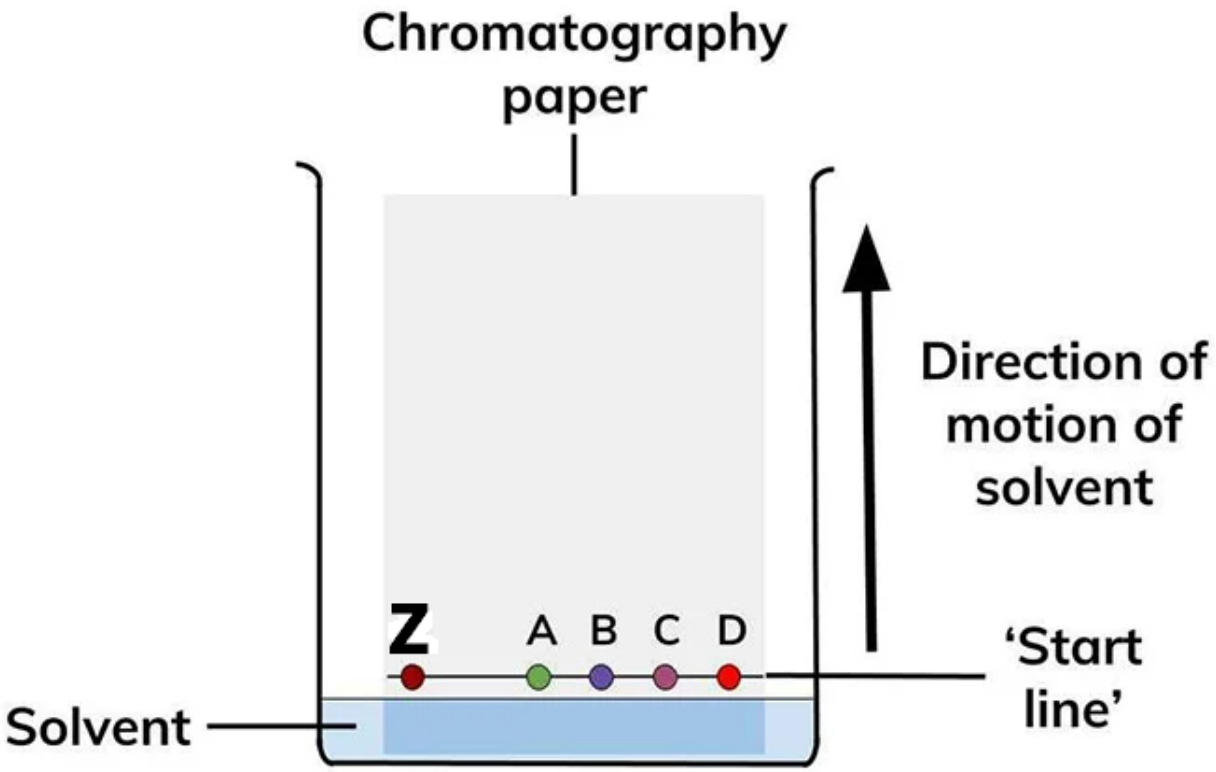


Diagram 16

(a) Explain the function of the technique above. [1 *mark*]

……..

……..

(b) Describe TWO basic principles of paper chromatography. [2 *mark*]

(i) ……

……

(ii) ……

……

(c) The technique works by the fact that the solvent moves up the paper chromatography. State the name of the upward motion that allow this to happen. [1 *mark*]

……

(d) Kiki collected the results of R_f values for components A, B, C and D.

Component	R_f value
A	0.87
B	0.77
C	0.57
D	0.37

Predict the results of the components A, B, C and D and label "X" for each of the predicted components on the paper chromatography in *Diagram 16*. [1 *mark*]

(e) Define R_f value. [1 *mark*]

……

……

(f) After 15 minutes, Kiki found that components A, B, C and D could be spotted moving on the paper chromatography except component Z. What should Kiki do to allow component Z to start moving upwards? [1 *mark*]

……

17 The diagram below shows the stages in glycolysis in fungi.

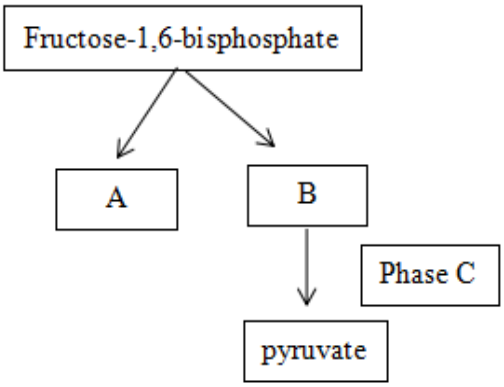


Diagram 17

(a) Define glycolysis. [1 *mark*]

……

(b) Name the substances A, B and Phase C. [2 *marks*]

A - ……

B - ……

C - ……

(c) Substance A and substance B are interconvertible. Identify the process. [1 *mark*]

……

(d) Phase C is named such, for a reason. Explain. [2 *marks*]

……

……

……

(e) What happens to pyruvate in the absence of oxygen? [2 *marks*]

……

……

……

Section C [30 *marks***]**
Answer **any two** questions in this section.

18 (a) Differentiate the basic principles of light microscope and electron microscope. [5 *marks*]

(b) Describe the functions of Golgi body. [5 *marks*]

(c) Describe the functions of vacuole. [5 *marks*]

19 (a) Explain the mode of action of enzymes. [5 *marks*]

(b) Illustrate lock and key hypothesis. [5 *marks*]

(c) Explain the significance of K_m and V_{max}. [5 *marks*]

20 (a) Explain the absorption and action spectrums of photosynthetic pigments. [5 *marks*]

(b) Explain photoactivation of chlorophyll *a* resulting in photolysis of water. [10 *marks*]

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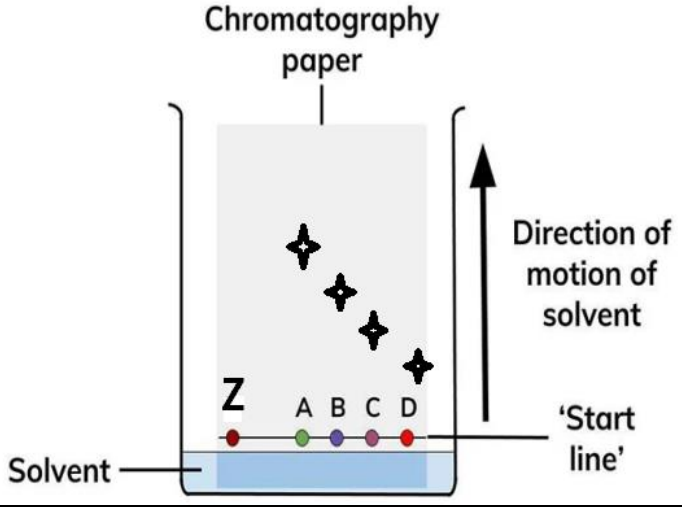
Marking scheme

1	C	6	A	11	B
2	C	7	D	12	D
3	A	8	D	13	C
4	B	9	C	14	B
5	C	10	B	15	C

Q		Suggestion Answer	Marks
16	The diagram shows paper chromatography technique.		
	(a)	Explain the function of the technique above.	[1 m]
		Separating mixtures into its components which can be isolated, identified and used for further investigation	1
	(b)	Describe TWO basic principles of paper chromatography.	[2 m]
		Components with higher affinity towards the solvent will move further up the paper	1
		The higher solubility of the components, the faster the components will up the paper	1
		Lighter molecular weight of components / adhesion of macromolecules to the paper, the faster the components will move up **(Any of the two points can be accepted)**	1
	(c)	The technique works by the fact that the solvent moves up the paper chromatography. State the name of the upward motion that allow this to happen.	[1 m]
		Capillary action	1
	(d)	Predict the results of the components A, B, C and D and label "X" for each of the predicted components on the paper chromatography in *Diagram 16*.	[1 m]
			1

	(e)	Define R_f value.	[1 m]
		The ratio of the distance travelled by the compound to the distance travelled by the solvent front	1
	(f)	After 15 minutes, Kiki found that components A, B, C and D could be spotted moving on the paper chromatography except component Z. What should Kiki do to allow component Z to start moving upwards?	[1 m]
		Increase the polarity of the solvent	1
17	The diagram below shows the biochemical pathway that occurs in the matrix of the mitochondrion.		
	(a)	Define glycolysis.	[1 *m*]
		Splitting of sugar	1
	(b)	Name the substances A, B and Phase C.	[2 *m*]
	A	**Dihydroxyacetone phosphate**	0/1
	B	**Glyceraldehyde-3-phosphate**	0/1
	C	**Energy-payoff phase**	0/1
		Any two correct, 1 mark **All three correct, 2 marks**	
	(c)	Substance A and substance B are interconvertible. Identify the process.	[1 *m*]
		Isomerisation	1
	(d)	Phase C is named such, for a reason. Explain.	[2 *m*]
		ATP is produced through substrate-level phosphorylation	1
		NADH is produced through the oxidation of substrate/ during dehydrogenation	1
	(e)	What happens to pyruvate in the absence of oxygen?	[2 *m*]
		Alcoholic fermentation	1
		Ethanol and two ATP is produced	1

18	**(a)**	**Differentiate the basic principles of light microscope and electron microscope.**	**5 m**
	P1	Source of radiation of light microscope is light while electron microscope is electrons	1
	P2	Magnification for light microscope is 1500x while electron microscope is 250000-500000x	1
	P3	Condenser lenses for light microscope is glass while lenses for electron microscope is electromagnets	1
	P4	Resolution limit for light microscope is 200nm while electron microscope is 0.2 nm	1
	P5	Biological specimen for light microscope is living or dead while for electron microscope is dead	1
	P6	Common stains used for specimen under light microscope is colored dyes such as methylene blue while electron microscope, sections are treated with solution of heavy metals to reflect electrons	1
	P7	Depth of field for light microscope is restricted while for electron microscope is a greater depth of field can be investigated	1
	P8	The specimen for light microscope is usually supported on a glass slide while specimen for electron microscope is supported on a small copper grid in a vacuum	1
		Any 5 points	**5m**

	(b)	**Describe the functions of Golgi body.**	**5m**
	P1	Receives, stores, transports and modifies the product of ER	1
	P2	Manufacture lysosomes	1
	P3	Glycoproteins are modified and carbohydrate components become markers that route the proteins to specific organelles	1
	P4	In plant cells, Golgi body secretes polysaccharides for formation of cell wall	1
	P5	May release slime, wax, gum and mucilage secretion	1
	P6	Golgi body in goblet cells release mucin which forms mucus	1
	P7	Golgi body in plant leaf of insectivorous plants secrete a slime to trap insects	1
	P8	Secretory vesicles produced by Golgi body releases its content by exocytosis	1
	P9	Fusion of Golgi vesicle with plasma membrane maintains the membrane	1
		Any 5 points	**5**
	(c)	**Describe the functions of vacuole.**	**5m**
	P1	Role in water balance of the cell	1
	P2	Storage compartment for inorganic compounds	1
	P3	Role in plant growth as water enters the concentrated sap cell by osmosis and lead to build-up of pressure within the cell	1
	P4	In plants, the waste can be recycled in vacuole or accumulated to form small crystals	1
	P5	Vacuole of some plant cells contains coloured pigments such as anthocyanin to attratct insects for pollination	1
	P6	Contractile vacuole in *Amoeba sp*. regulate water content in the cell	1
	P7	Tannins which are poisonous are stored in vacuoles to protect the plants from herbivores	1
		Any 5 points	**5**

19	**(a)**	**Explain the mode of action of enzymes.**	**5 m**
	P1	Each enzyme is specific and have a unique 3D structure called active site	1
	P2	The active site is the portion of ezyme that interacts with the substrate to form enzyme-substrate complex	1
	P3	Any substance that block or changes the active site affects the enzyme activity	1
	P4	When substrate molecules collides into an enzyme, it fits into the active site of an enzyme to form product, which explains enzyme specificity	1
	P5	A substrate has a surface region that is complementary in size, shape, solubility and charge to the active site	1
	P6	The minimum energy requirement for substance to react is called activation energy (E_a) or free energy of activation	1
	P7	Enzyme speeds up the reaction rate by lowering the activation energy and this makes the reaction to take place easily	1
	P8	When an enzyme is destroyed by heat or change in pH, the shape of the active site is changed and the substrate no longer fits into the active site	1
		Any 5 points (must include activation energy, specificity & ES complex in order to get max marks)	**5**
	(b)	**Illustrate lock and key hypothesis.**	**5 m**
	P1	The substrate binds to the active site to form an E-S complex.	1
	P2	The enzyme does not form any chemical bonds with the substrate	1
	P3	The E-S complex holds the substrate in a suitable position and lowers the activation energy	1

	P4	Products are formed and not complementary to the active site	1
	P5	The products leave the enzyme and enzyme can be reused.	1
		5 points	**5**
	(c)	**Explain the significance of K_m and V_{max}.**	**5 m**
	P1	Different enzymes have different K_m values	1
	P2	Most enzymes have Km values between 10^{-1} and 10^{-7} M	1
	P3	The K_m value of an enzyme depends on the substrate and environment conditions like pH and temperature	1
	P4	A high K_m indicates a weak ES binding/lower affinity between substrate and enzyme	1
	P5	A weak K_m indicates a strong ES binding/ higher affinity between substrate and enzyme	1
	P6	V_{max} shows the turnover number of an enzyme/number of substrates converted to product	1
	P7	V_{max} is the maximum velocity, is the velocity of enzyme-catalysed reaction when there is saturating level of substrate	1
	P8	K_m shows how tight the binding of substrate is to the enzyme	1
		Any 5 points	**5**
20	**(a)**	**Explain the absorption and action spectrums of photosynthetic pigments**	**5 m**
	P1	An absorption spectrum is a graph which shows the relative absorption rate of different wavelength of lights by photosynthetic pigment	1
	P2	Two peaks of absorption spectrum for chlorophyll *a* and *b* but only one peak for carotenoids	1
	P3	Absortion spectrum for chlorophyll *a* is broader , peaks at 450 nm and 680 nm whereas chlorophyll *b* is narrower , peaks at 490 nm and 650 nm	1
	P4	Wavelength of light between 400 - 500 nm is around blue region while wavelength of light between 650 -700 nm is around red region, most absorbed by plants for photosynthesis	1
	P5	Action spectrum is a graph that shows effectiveness of different wavelength of lights involved in photosynthesis	1
	P6	Chlorophyll *a* and *b* and caretenoids are pigments responsible for absorbing light used in photosynthesis	1
		Any 5 points (in order to get max marks, must include absorption & action spectrum)	**5**
	(b)	**Explain photoactivation of chlorophyll *a* resulting in photolysis of water**	**10 m**
	P1	There are 2 types of photosystem, namely photosystem I and photosystem II located in the thylakoid membrane	1
	P2	When a photon of light energy strikes a pigment molecule, the energy is passed from one pigment molecule to another molecule	1
	P3	Until it reaches the chlorophyll *a* molecule at reaction centre, that is P_{680} at photosystem II and P_{700} at photosystem I	1
	P4	At reaction centre, P_{700} absorbs light best wavelength of 700 nm while P_{680} absorbs light best wavelength of 680 nm	1
	P5	Energy received by P_{700} and P_{680} causes the electron to be raised to a higher level, the chlorophyll *a* pigment is said to be photoactivated	1
	P6	Each electron that flows out of the photosynthetic pigment is accepted by a electron acceptor	1
	P7	The primary electron acceptor that accepts the excited electron in PSI is FeS while in PSII is substance Q	1

	P8	After releasing the excited electrons, the photoactivated chlorophyll molecules of PSII become positively charged	1
	P9	The water molecules in the thylakoid space activated by light energy and dissociate to produce free hydroxyl radicals (OH^-) hydrogen ions (H^+) and activated electrons	1
	P10	The activated electrons released are accepted by the positively charged chlorophyll molecule, $PSII^+$ to form back the neutral PSII	1
	P11	The free hydroxyl radicals combine to form oxygen gas	1
		Any 10 points **(in order to get max marks, must include bothe points from photoactivation and photolysis of water)**	10