Scheme for Trial STPM Biology Term 1 2022 Set 1

Section A

Nu.	Answer
1	В
2	С
3	С
4	В
5	D
6	D
7	В
8	D
9	А
10	D
11	В
12	А
13	С
14	В
15	С

Section B

16. (a) Steroids

- (b) X: Cholesterol
 - Y: Oestrogen

[1 mark]

[2 marks]



[1 mark]

- (d) Amphipathic molecules because polar hydrophilic phospholipid heads attracted to water and form hydrogen bonds with the molecules and nonpolar hydrocarbon fatty acid tails form hydrophobic interactions with one another. [2 marks]
- (e) Gives membranes fluidity and allow lipid soluble substances and small nonpolar substances to pass through. [1 mark]
- 17. (a) Enzymes immobilization is a process where an enzyme is attached to an inert and insoluble material to increase enzyme efficiency. [1 mark]
 - This process ensures that there is an increased enzyme availability for the substrate and a greater turnover of products. [1 mark]
 - (b) Entrapment in a gel enzymes are physically trapped in a gel for example silica or alginate.
 Entrapment in microcapsule Enzyme is trapped in a permeable microcapsule.
 Cross-linking Enzymes form cross links with other molecules.
 Covalent bonding Enzyme is bound covalently to a matrix of cellulose or collagen.
 Adsorption on to an insoluble matrix for example resin.
 - (c) The enzymes can be reused.
 - The products are not contaminated by the enzyme.

- The enzymes are more thermostable or resistant to changes in temperature or the

enzymes can be used over a wider range of temperature.

- It is more economical/ High turnover rate of products.
- The enzymes can be used continuously. Any 3 [3 marks]

Section C

18.(a)	- The surface area of membrane.	1M
	- The greater the surface area, the higher the rate of diffusion.	1 M
	- The diffusion distance.	1M
	- The shorter the diffusion distance, the greater the rate of diffusion or	1M
	the thicker the membrane, the greater the diffusion distance and the	
	lower the rate of diffusion.	
	- The concentration gradient.	1M
	- The greater the difference in concentration between two places the	1M
	faster the rate of diffusion between them or the steeper the gradient	
	, the higher the rate of diffusion.	
	- The size and type of molecules.	1M
	- Small and non-polar molecules e.g oxygen, carbon dioxide and lipid	1M
	soluble substances e.g alcohol, vit.A, D, E and K can diffuse	
	through the lipid bilayer of the membrane.	
	- Polar and charged particles pass through pores in the channel	1M
	proteins.	
	- Molecules that are soluble in lipids can cross the membrane faster	1M
	than water soluble ones.	
	- Temperature	1M
	- At higher temperatures, molecules have more kinetic energy and so	1M
	diffuse more quickly.	
		Total=12M
		Max =10M
(b)	- Water potential is a measure of the potential energy in water that	1M
	drives the movement of water through plants and is represented by	
	the equation $\psi = \psi_s + \psi_p$	
	- The solute potential (ψ_s) of pure water is zero since it does not	1M
	contain any amount of solute.	
	- The more the amount of solute is, the lower is the water potential	1M
	and the solute potential is negative.	

- Water por	tential is affected by the pressure potential (ψ_p) of the cell	1M
wall agai	nst the cellular components.	
- Pressure	potential always has a positive value.	1M
- Pressure	potential is a zero when the cell is flaccid.	1M
		Total=6M
		Max=5M

19.(a) Enzymes are globular protein catalysts that increase the rate of specific chemical reactions

There are six types of enzymes:

- (i) oxido-reductase
- (ii) transferase
- (iii) hydrolase
- (iv) lyase
- (v) isomerase
- (vi) ligase/synthetase

(b)

(i) Oxidoreductase enzymes transfer oxygen, electron or hydrogen ion from one

molecule (the oxidant) to another (the reductant).

Examples:

• Peroxidase

 $ROOR' + electron donor (2 e-) + 2H^+ --- ROH + R'OH$

• Oxidase

Cytochrome a $(Cu^+) + 2H^+ + 1/2 O_2$ Cytochrome a $(Cu^2) + H_2O$

(ii) **Transferase enzyme** transfer a functional group (e.g. a methyl or phosphate group) from one molecule to another.

Examples:

• Transaminase

 $NH_{2}CR_{1} HCOOH + R_{2} COCOOH \dashrightarrow R_{1}COCOOH + NH_{2}CR_{2}HCOOH$

[Max 6 marks]

Phosphorylase

Glycogen + phosphate -----> glucose phosphate

(iii) **Hydrolase enzyme** catalyse hydrolysis or breaking up of a complex chemical with water

Example:

• Maltase

Maltose + H₂O-----> 2 glucose

(iv) Lyase enzymes catalyse non-hydrolytic reactions in which groups are either removed or added to a substrate, thereby creating or eliminating a double bond, especially between carbon atoms or between carbon and oxygen.

Examples:

- Decarboxylase (removal of CO₂)
 Pyruvate + coenzyme A + NAD + Acetylcoenzyme A + NADH + H⁺ + CO₂
- Carboxylase (fixation of CO₂)
 Ribulose biphosphate (RuBP) + H₂O+CO₂ + 2 phosphoglyceric acid (PGA)
 - (v) **Isomerase enzymes** catalyse changes within one molecule, often by rearranging the functional groups and converting the molecule into one of its isomeric forms.

Examples:

- Phosphoglucomutase
 Glucose-1-phosphate-----Acetyl coenzyme A+NADH+H++CO2
 Phosphohexosiomerase
- Glicose-6-phosphate----- Fructose -6 phosphate

(vi) **Ligase/Synthetase** enzymes catalyse a reaction that joins 2 substrates using energy derived from simultaneous hydrolysis of a nucleotide triphosphate

examples :

Aminoacyl tRNA synthetase

Glysin + tRNA + ATP ------ Glysin-tRNA + AMP + pyrophosphate(PPi)

[Max 9 marks]

- 20.(a) Light energy (photon) is used in the light phase of photosynthesis.
 - The photons are absorbed by the primary pigments of photosynthesis for photoactivation process.
 - When light intensity is very low, photosynthesis rate is low because photoactivation of photosystem on the thylakoid membrane cannot occur.
 - When light intensity is increased, the rate of photosynthesis increases proportionally to lightintensity as more NADPH and ATP are produced in the light dependent phase of photosynthesis.
 - At higher light intensity, the rate photosynthesis reaches a maximum level called the saturation point.
 - The rate of photosynthesis is limited by other limiting factors such as carbon dioxide concentration and temperature.

[Max 5 marks]

- (b) The main factors affecting rate of photosynthesis are light intensity, carbon dioxide concentration and temperature.
 - The rate of a photosynthesis process will be limited by the factor which is in shortest supply.
 - Any change in the level of a limiting factor will affect the rate of reaction.
 - For example, the amount of light will affect the rate of photosynthesis.
 - If there is no light, there will be no photosynthesis.
 - As light intensity increases, the rate of photosynthesis will increase as long as other factors are in adequate supply.
 - As the rate increases, eventually another factor will come into short supply.
 - The graph below shows the effect of low carbon dioxide concentration.



- It will eventually be insufficient to support a higher rate of photosynthesis, and increasing light intensity will have no effect, so the rate plateaus.
- If a higher concentration of carbon dioxide is supplied, light is again a limiting factor and a higher rate can be reached before the rate again plateaus.
- If carbon dioxide and light levels are high, but temperature is low, increasing temperature will have the greatest effect on reaching a higher rate of photosynthesis.

[Max 10 marks]