Scheme for Trial STPM Biology Term 1 2022 Set 2

Section A

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

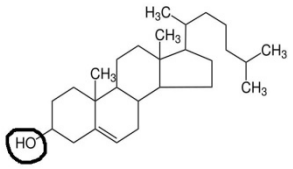
Section B

16. (a) Steroids **[1 mark]**

(b) ***X***: Cholesterol

Y: Oestrogen **[2 marks]**

(c)



X

[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. **Any 3 [3 marks]**

(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. - The greater the surface area, the higher the rate of diffusion. - The diffusion distance. - The shorter the diffusion distance, the greater the rate of diffusion or the thicker the membrane, the greater the diffusion distance and the lower the rate of diffusion. - The concentration gradient. - The greater the difference in concentration between two places the faster the rate of diffusion between them or the steeper the gradient , thehigherthe rate of diffusion. - The size and type of molecules. - Small and non-polar molecules e.g oxygen, carbon dioxide and lipid 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 proteins. - Molecules that are soluble in lipids can cross the membrane faster than water soluble ones. - Temperature - At higher temperatures, molecules have more kinetic energy and so diffuse more quickly.	1M 1M 1M 1M 1M 1M 1M 1M 1M 1M Total=12M **Max =10M**
(b)	- Water potential is a measure of the potential energy in water that 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 contain any amount of solute. - The more the amount of solute is,the lower is the water potential and the solute potential is negative.	1M 1M 1M

	- Water potential is affected by the pressure potential (ψ_p) of the cell wall against the cellular components. - Pressure potential always has a positive value. - Pressure potential is a zero when the cell is flaccid.	1M 1M 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) oxidoreductase

(ii) transferase

(iii) hydrolase

(iv) lyase

(v) isomerase

(vi) ligase/synthetase **[Max 6 marks]**

(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_2CR_1 HCOOH + R_2 COCOOH -----› R_1COCOOH + NH_2CR_2HCOOH

Phosphorylase

Glycogen + phosphate ------› glucose phosphate

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

Example:

- Maltase

Maltose + H_2O------› 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 CO_2)

Pyruvate + coenzyme A + NAD + Acetylcoenzyme A + NADH + H^+ + CO_2

- Carboxylase (fixation of CO_2)

Ribulose biphosphate (RuBP) + H_2O+CO_2 + 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

- Glucose-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

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

[Max 9 marks]

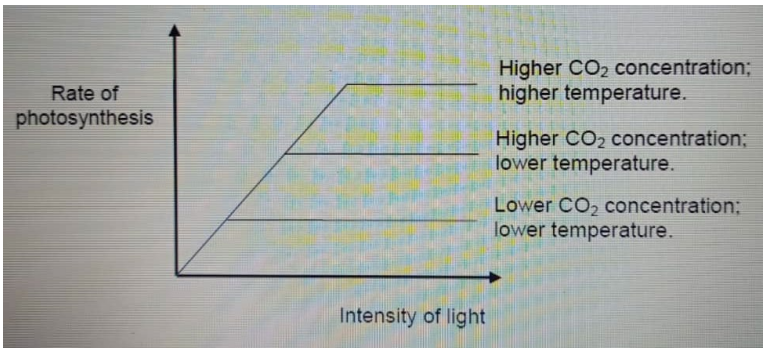
20.(a) - Light energy (photon) is used in the light phase of photosynthesis.

- 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 light intensity 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/ photosynthetic pigment become saturated with light.
- Beyond the saturation point, further increase in light intensity have no effect/ rate of photosynthesis reached a plateau.
- 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 inten
- |}sity 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]