Hee Xin Wei
OVERMUGGED
O Level Mock Paper ANSWER

SCIENCE (CHEMISTRY, BIOLOGY)

5078/01

Paper 1 Multiple Choice

September 2021
1 hour

INSTRUCTIONS TO CANDIDATES

There are **20** questions in this paper. Answer **all** questions. For each question, there are 4 possible answers, **A, B, C and D**.

Choose the one you consider correct.

Each correct answer wills score one mark. A mark will not be deducted for a wrong answer.
The use of an approved scientific calculator is expected, where appropriate.

Questions in reference to Admiralty Secondary School, Xinmin Secondary School and CHIJ St Joseph. Credits to these school ☺

21.C
22.B
23.D
24.C
25.B
26.B
27.A
28.D
29.B
30.D
31.D
32.A
33.C
34.A
35.B
36.C
37.D
38.C
39.D
40.D

Hee Xin Wei
OVERMUGGED
O Level Mock Paper ANSWER

SCIENCE (CHEMISTRY, BIOLOGY) **5078/04**
Paper 4 Biology **September 2021**
1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write in dark blue or black pen.
You may use an HB pencil for diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer **any two** questions.
Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

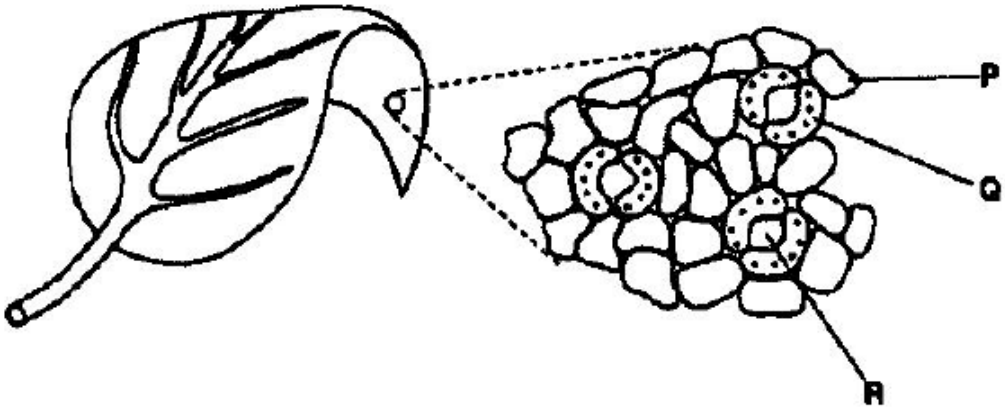
The number of mark is given in brackets [] at the end of each question or part question.

Section A

Answer **all** questions.

Write your answers in the spaces provided.

1. Figure 1.1 shows a leaf and a type of plant cells



(a) Label P, Q and R

P Epidermal cell

Q Guard cell

R Stoma (singular) [3]

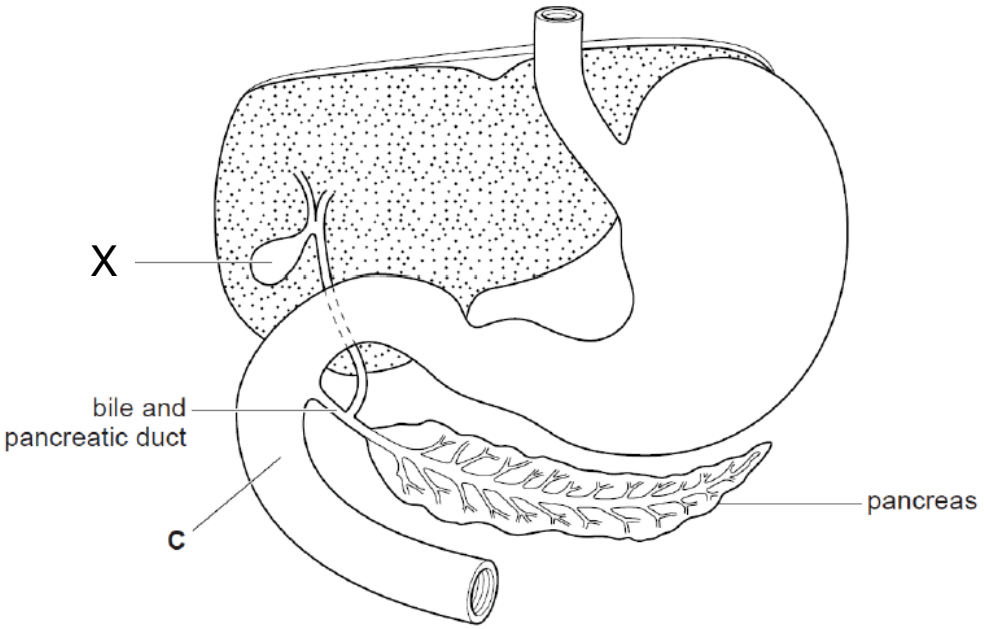
(b) Describe and explain how structure Q helps structure R to remain open and close.

- During the day, guard cells photosynthesise and energy is used to pump potassium ions into the guard cells from neighbouring epidermal cells.
- lowers the water potential of guard cells thus water moves in from neighbouring cells via osmosis
- Guard cells become turgid and lead to opening of stoma
- In the night, **Potassium ions move out** of the guard cells via **diffusion**
- **Water potential** is **increased** in guard cells thus water **moves out** of the guard cells to the neighbouring cells via osmosis
- Guard cells become **flaccid** and the **stoma closes**.

talk about 1 scenarios in full and another one briefly [4]

[Total:7]

2. Figure 2.1 shows a section of human alimentary canal and its accessory organs



(a) Label X and state its function

X - gall bladder [1]

Function - store bile that is produced by the liver [1]

(b) One effect of cystic fibrosis is that the bile and pancreatic duct becomes blocked with mucus.

Suggest why a person whose bile and pancreatic duct is blocked may find it difficult to gain weight despite eating a balanced diet.

- Bile is not able to enter small intestine and emulsify fats
- Smaller surface area to volume ratio for lipase to act on

Max 2:

- Pancreatic duct blocked, pancreatic lipase/trypsin/amylase cannot be secreted
- Reduced digestion of fats to glycerol and fatty acids/ protein to amino acid / maltose to glucose
- Reduced nutrients to be absorbed [3]

(c) Using your knowledge about the alimentary canal, why is medicine containing protein coated in lipid?

The stomach contains protease/pepsin that catalyses the digestion of protein into amino acids

Stomach doesn't secrete lipase that digests lipid / only small intestine secretes lipase

Medicine will not be digested before it reaches the small intestine and thus be absorb in whole to exert its effect

[3]

(d) State two functions of the liver.

Any 2

1. Regulate glucose concentration
2. Deamination of excess amino acid
3. Synthesis of essential protein eg fibrinogen, prothrombin, antibodies
4. Detoxification and breakdown of alcohol
5. Produces bile [2]

[Total:10]

3. Table 3.1 shows the pressure changes in the left side of the heart during one cardiac cycle.

time /s	blood pressure / kPA	
	left atrium	left ventricle
0.0	0.7	0.3
0.1	1.0	2.0
0.2	0.1	12.5
0.3	0.2	15.3
0.4	1.0	4.5
0.5	0.5	1.0
0.6	0.6	0.3
0.7	0.7	0.3

(a) With reference to the table, explain when is the valve between the atrium and the ventricle closed.

0.1 to 0.5s

Pressure in left ventricle is higher than that of right ventricle, atrioventrivular valve close to prevent backflow of blood from ventricle fo atrium [2]

(b) The pressure in the ventricle is much higher than that in atrium. Suggest why is it so.

Ventricular wall is thicker than that of atrium

When the heart contracts, more pressure is exerted to the ventricles / generates more force [2]

(don't recommend to talk about how ventricle is transporting blood to the aorta and thus the rest of body thus require a higher pressure. It is a consequence instead of a cause)

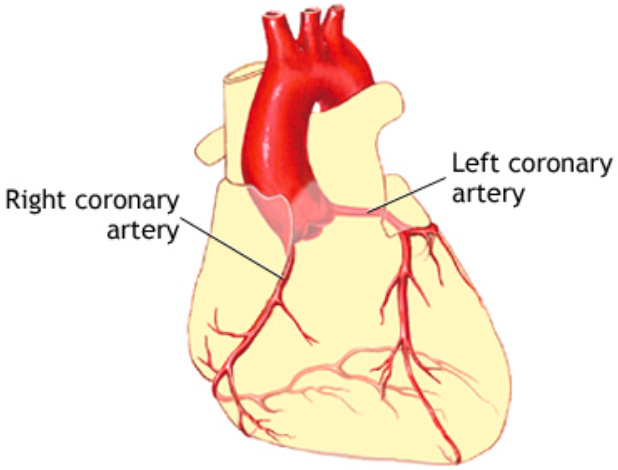
(c) How do blood vessels ensure that blood is moved only in one direction?

Presence of valves in veins

Muscle contracting to push blood forward

Arteries are elastic thus stretch and recoil [2]

(d) Figure 3.2 shows a human heart



(i) Describe the route of oxygen from the alveoli being transported to the coronary artery.

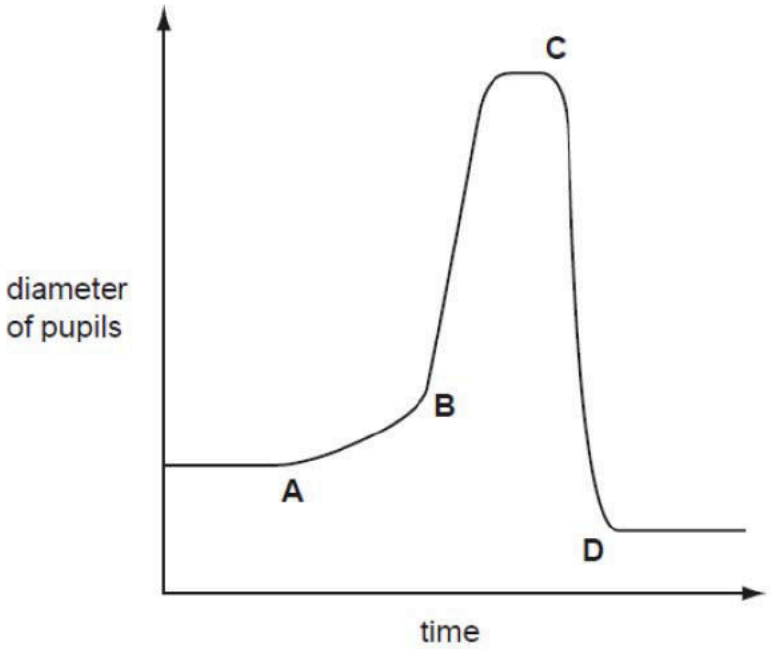
Alveoli > blood capillaries in lung > pulmonary vein >
left atrium > left ventricle (heart) > aorta > coronary artery [2]

(ii) Explain why it is advised that patients with coronary heart disease to not smoke.

Nicotine increases heart beat and blood pressure
Increase risk of blood clot thus heart attack
Carbon monoxide increases the risk of fatty deposits in inner arterial wall / atherosclerosis [2]

[Total:10]

4. Figure 4.1 shows the changes in the diameter of Norman's pupils



(a) (i) At which point did Norman walk from his outdoor garden to a storeroom that is not lit

Point B [1]

(ii) With your understanding of a reflex action, explain the events that have happened in Norman's eyes when he walked from his outdoor garden to at the storeroom

Receptors/photoreceptors in the eyes detect the decrease in light intensity

Nerve impulses are produced which are transmitted by the **sensory neurone** to the spinal cord.

Nerve impulses are transmitted across a synapse to a **relay neurone** and then across another synapse to the **motor neurone**.

Which then transmits nerve impulses to the **effector** which is iris

Radial muscles contract, circular muscle relax, pupil dilates (compulsory 1 mark)

[4]

(iii) Why is it important for the event from (ii) to happen?

- Help the body to adjust rapidly to changes in the environment / help eyes adjust to changes in light intensity
- Increase amount of light entering Norman's eyes so he can see clearly in a dark environment [2]

(b) It is recommended that students should not read too close to books or look too close to screens for a long period of time. Suggest why is that so.

To focus on an object that is close, ciliary body contract, suspensory ligament relax

Suspensory ligament slacken, relaxing its pull on the lens

Lens are thick and less convex

This will strain the ciliary body as it remains contracted for a long time [3]

(c) Describe the differences between a reflex action and a voluntary action
Any 2

Not consciously controlled vs consciously controlled

Immediate vs immediate / delayed

Require a stimulus vs happen with or without a stimulus [2]

[Total:10]

5. (a) Briefly describe the cause of each of the following:

(i) Down's Syndrome

Down syndrome is caused by a chromosome mutation during gamete production at meiosis, resulting in three copies of chromosomes 21 [1]

(ii) Sickle cell anaemia

Sickle-cell anaemia is caused by a change in the sequence of nucleotides in the DNA coding for haemoglobin, resulting in haemoglobin S (HbS) / sickle shaped red blood cells [1]

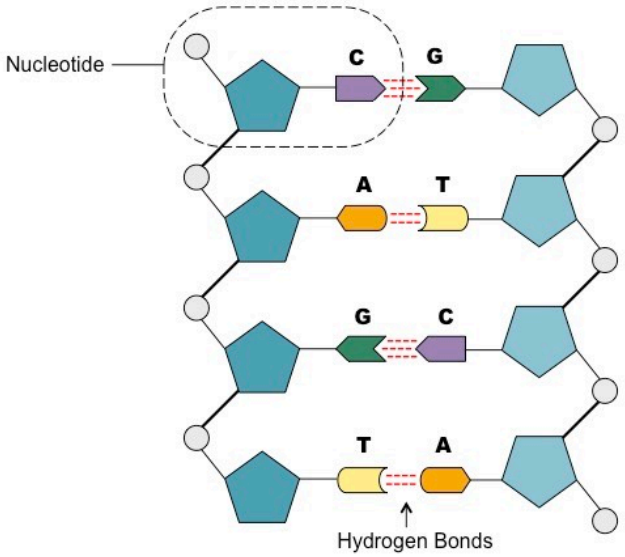
(b) Name one factor that may increase the rate of Down's Syndrome or sickle cell anaemia

Ultraviolet radiation, x rays, gamma rays

Chemicals such as benzene, ethidium bromide

Tar in cigarette [1]

(c) Figure 5.1 shows a DNA molecule



(i) Describe two ways how a DNA molecule is different from a polypeptide

Basic unit: Nucleotides vs amino acid

Number of strand: Single stranded vs double stranded

Shape: double helix vs specific 3D conformation

Hydrogen bonding between complementary base pairing vs absence of that / peptide bond in protein

[2]

(ii) outline the relationship between genes, chromosomes, and DNA

DNA molecule is made up of two polynucleotidestrands twisted together to form a double helix structure.

A gene is a sequence of DNA nucleotides that controls the production of polypeptide.

The DNA molecule wraps around proteins and form chromosomes

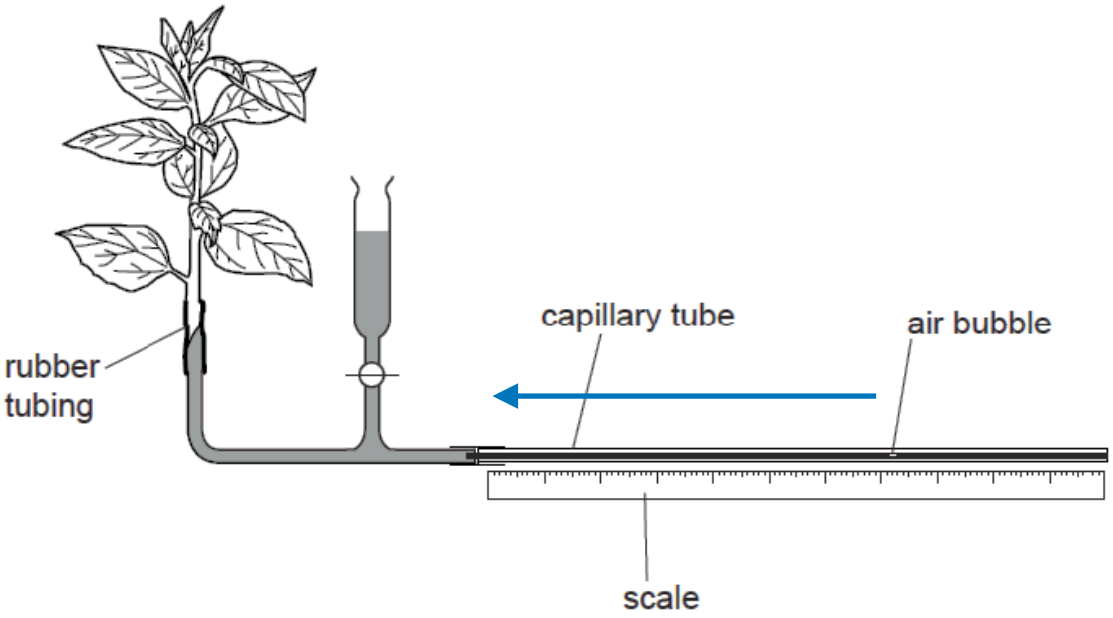
[Total:8]

Section B

Answer **any two** questions.

Write your answers in the spaces provided.

6. Figure 6.1 shows an apparatus used to investigate the uptake of water by a cut stem of a fresh green plant.



(a) Draw an arrow on Fig. 8.1 to show the direction in which the air bubble moves when the plant takes up water. [1]

(b) The water enters the cut stem of the plant.

Describe the detailed process where the water enters the cut stem and leaves to the atmosphere, and the importance of this process.

Transpiration process [max 5]

Water enters the cut stem through xylem

Water moves out of the mesophyll cells to form a thin film of moisture.

Water evaporates and moves into the intercellular air spaces.

Stomata are open, concentration of water vapour is higher in the intracellular air space than atmosphere

Thus water vapour diffuses through stomata to the atmosphere

Water potential in mesophyll cells decreases, thus absorb water from xylem via osmosis

Importance [max 2]

Main mechanism to draw water and mineral salts from the roots to the stems and leaves, which is needed for photosynthesis and to keep plants turgid.

Cooling of the plants as evaporation of water from the cells in the leaves removes latent heat of vaporisation.

(c) When this cut stem is placed in the soil, it started developing roots. Suggest how this plant reproduces and two advantages of this method.

Asexual reproduction

Advantages:

Only **one parent required** as fusion of gametes is not required.

All beneficial qualities are passed onto the offspring.

Faster method of producing offspring as compared with sexual reproduction.

7. (a) Describe the levels of hormone oestrogen and progesterone and its effect in the menstrual cycle.

- During menstruation which is day 1 to day 5, the levels of oestrogen and progesterone are very low.
- Uterine lining breaks down and flow out of the body through vagina
- During day 6 to day 13, level of oestrogen increases which causes the repair and growth of the uterine lining.
- After ovulation, progesterone level increases, which maintains and further thickens the uterine lining,
- If no fertilisation occurs, the levels of oestrogen and progesterone decline sharply at day 28, menstrual cycle repeats/menstruation occurs
- If fertilisation occurs, progesterone continues being secreted/level remains high
- Keep uterine lining thick to prepare for implantation

[5]

(b) Describe the importance of hormone to human, with named examples.

Named examples [1] + its functions [3] + its importance [1]

1. Glucagon & insulin - regulate blood glucose concentration
2. Adrenaline - respond to dangers / stress
3. Antidiuretic hormone - regulate water potential in blood

An example:

- Glucagon and insulin regulate blood glucose concentration.
- When blood glucose level increases beyond normal, islet of langerhans secrete insulin directly into bloodstream, which is transported to muscle and liver cells
- Stimulates body cells to increase glucose uptake by increasing permeability of plasma membranes to glucose
- Stimulates the liver and muscle cells to convert excess glucose in the form of glycogen
- This ensures blood glucose level is constant and do not affect the water potential of blood OR When changes to internal body environment is detected, hormone serves as a message to effector organ to respond to stimulus

Please do not answer about progesterone/oestrogen anymore because you already talked about it in (a)!

8. Resistance to the widely used poison warfarin is now extremely common in rats. Warfarin interacts with vitamin K to prevent its normal functions in the blood clotting mechanism. Warfarin resistance in rats is determined by a single dominant allele.

(a) Explain the blood clotting process

Where there is an injury, **platelets are activated**, releasing **thrombokinase**.

Thrombokinase converts plasma protein, **prothrombin**, into **thrombin**

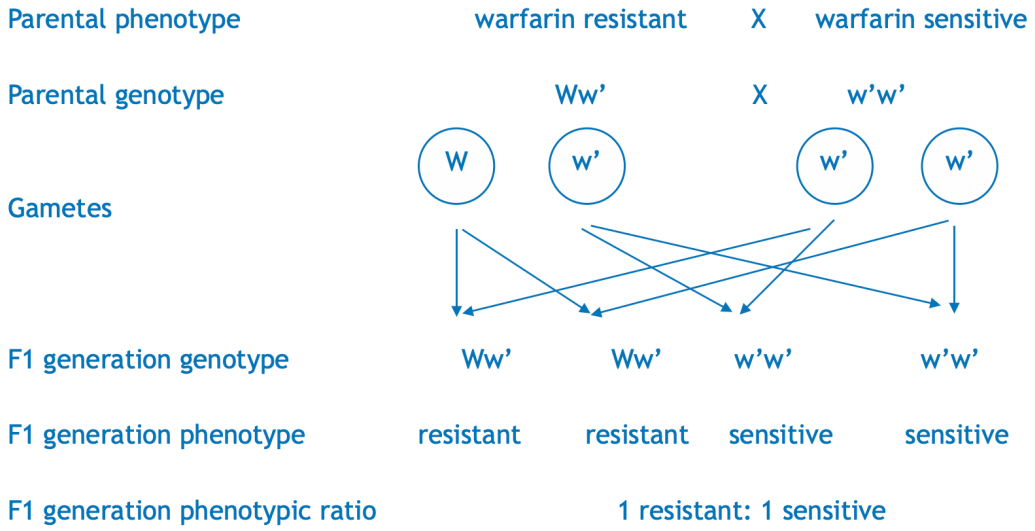
Thrombin converts soluble **fibrinogen** to **insoluble fibrin**

Fibrin forms a **mesh** across the damaged surface and traps red blood cells, forming a **clot**.

[3]

(b) With the aid of a genetic diagram, explain how can the genotype of a warfarin resistance rat be determined

Let W be warfarin resistant gene
Let w' be warfarin sensitive gene



Warfarin resistance rat could be either homozygous dominant or heterozygous [1]

When crossed with a warfarin sensitive rat, if the genotype is homozygous dominant, all offspring would be resistant. If heterozygous, the offspring ratio would be 1:1 [1]

You can also draw the WW x ww, but either way, you need to derive ratios in both scenario

[5]

(c) If there are only 6 offspring, explain the challenge of using this method to determine the genotype

actual observed ratio can be different from expected ratio when there is a small numbers of off spring because

Fertilisation of the ova and sperms is a random and chance event

[2]