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## Theory 2

9 questions | 45 points  
90 minutes

(1) **Figure 1** shows forelimbs of three animals. These forelimbs are known as homologous structures.

- (i) **State** the process in nature, which gave rise to the homologous structures in **Figure 1**. [1 mark]
- (ii) **State** one difference in the structure of the forelimb of the whale and the crocodile and explain their function [2 marks]

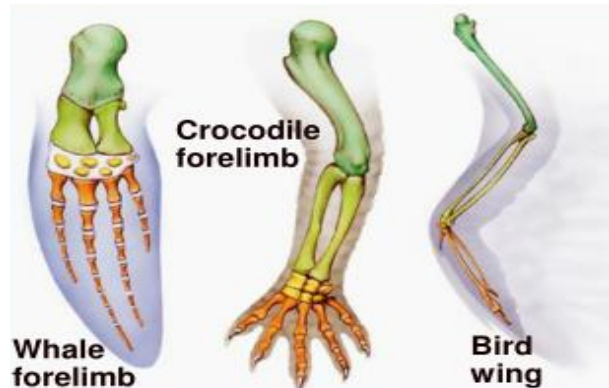


Figure 1

	Structure	Function
Whale		
Crocodile		

(2) **Figure 2** shows the transverse section of a leaf taken from plant A.

- (i) **Identify** the type of environment that plant A is adapted to live in. [1 mark]
- (ii) **Describe and explain** how ONE structural feature of plant A aids in photosynthesis and allows the plant to be adapted to live in the environment mentioned in part (i). [2 marks]

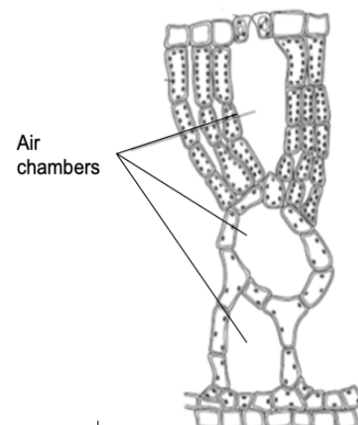


Figure 2

(3) **Figure 3** on the right shows a typical human digestive system.

- (i) **Explain** the role of parts 2 and 4 in a healthy digestive system? [2 marks]
- (ii) **Explain** how a blockage in the tube connecting structures 2 and D affect complete digestion of fats? [1 mark]
- (iii) Considering your answer in (i) and (ii), **construct** a bar graph to show the amount of undigested fats in the alimentary canal (structures A, B, C, D, and E). [4 marks]

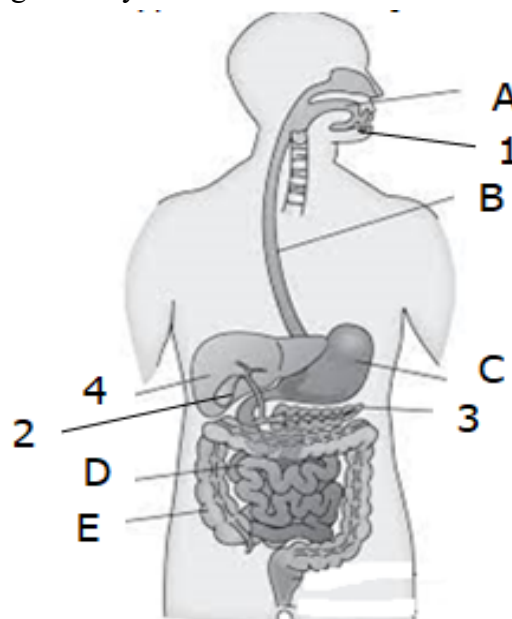
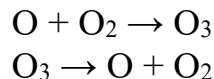
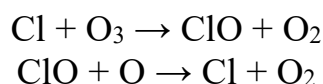


Figure 3

(4) In the mid-1980s, scientists discovered a hole in the ozone layer over the Antarctic region. This is largely caused by the release of chlorofluorocarbons (CFCs) in the stratosphere. Ozone ( $O_3$ ) is constantly produced and depleted in the stratosphere from molecular oxygen ( $O_2$ ) and atomic oxygen (O).



However, chlorine atom (Cl) from CFCs reacts with the ozone in the following equation:



- (i) **Explain** the importance of ozone layer to humans. [1 mark]
- (ii) CFCs are harmful because they introduce chlorine atoms that reacts with ozone. Even though ozone is constantly produced and depleted, **Describe** and **explain** how a single chlorine atom can accelerate the depletion of the ozone layer? [2 marks]
- (iii) **Suggest** two ways to prevent the further depletion of the ozone layer. [2 marks]



- (5) Carbon dioxide concentration is now at 400 ppm, a dangerous level for our planet. One possible solution to this problem is transforming carbon dioxide back to fuel (e.g. methane, ethane) using electricity by a process known as electrocatalytic carbon dioxide reduction as shown in the diagram (Figure 4).

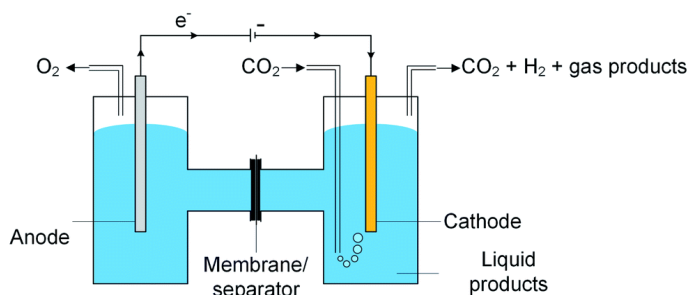
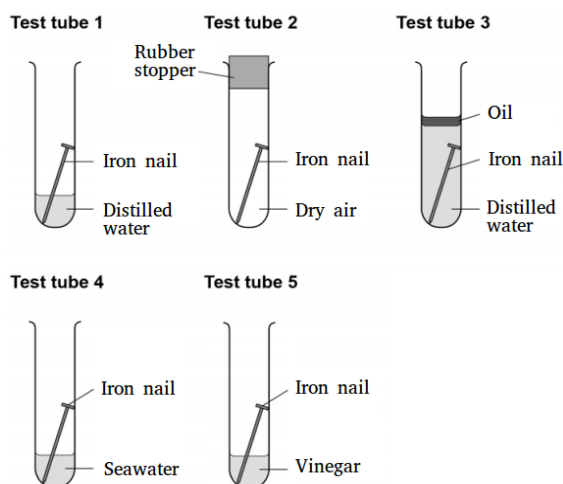


Figure 4

The process makes use of a copper catalyst as the cathode. Carbon dioxide is dissolved in water. As carbon dioxide attaches to the surface of the cathode, it uses electricity to transform it into the desired gas products. Excess CO<sub>2</sub> and hydrogen by-product are also collected.

- (i) Fossil fuels are burnt to produce energy. **Explain** how can the electrocatalytic reduction of carbon dioxide possibly address this problem? [2 marks]
  - (ii) Electricity is needed to successfully convert carbon dioxide to fuel. **Describe** three energy sources where we can get the electricity needed in order to make this technology sustainable? [3 marks]
- (6) Nathan was investigating the rusting of iron. He set up five test tubes as shown below, and left them for three days.



Test tube	Observation after three days
1	Nail slightly rusty
2	Nail still shiny
3	Nail still shiny
4	Nail very rusty
5	Nail slightly rusty, bubbles of gas seen

- (i) **Explain** why the nails had not rusted in Test tubes 2 and 3. [1 mark]
- (ii) **List** down the required conditions for rusting to occur. [1 mark]
- (iii) **Explain** how salt affects the rate of rusting. [1.5 marks]
- (iv) **Name** the gas formed in Test tube 5? [1 mark]
- (v) **Suggest** three ways to decrease the nail's rate of rusting. [1.5 marks]



- (7) The diagram (Figure 5) shows an object OO' placed in front of a converging lens. The image is formed on the line XY.

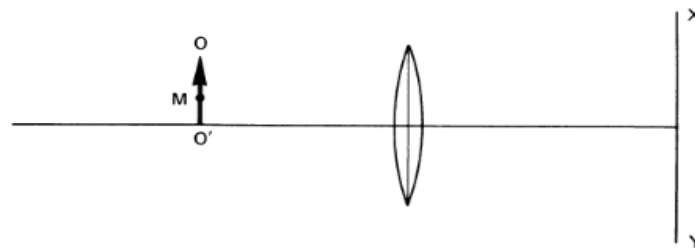


Figure 5

- Draw** three rays leaving O (the arrow head at the top of the object) and passing through the lens. Show clearly the position of the image. [1 mark]
  - Draw** the image formed by the lens and give two characteristics of the image. [1.5 marks]
  - The object is now moved closer to the lens so that it is less than a distance of one focal length from lens. **Describe** the image [1.5 marks]
  - Name** one optical device that uses this concept. [1 mark]
- (8) A. Three identical light bulbs, **A**, **B**, **C** and **D** are connected as shown on Figure 6 on the right.

- A switch **S** is placed along the circuit such that when **S** is closed, all the bulbs will light up but when **S** is opened, only bulbs **A** and **D** will light up. On the circuit, **locate** the possible location of **S** by placing a slash (/) on it. [1 mark]
- When switch **S** is closed, **identify** which light bulb/bulbs will be the [2 marks]
  - brightest
  - least bright

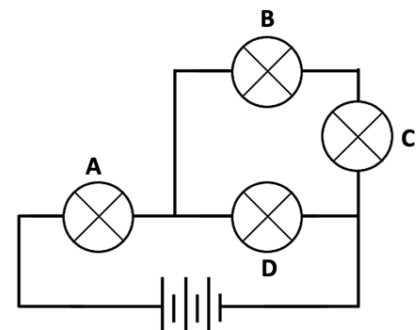


Figure 6

- B. Study the circuit diagram (Figure 7) on the right carefully. All bulbs are identical.

- When switches **S1** and **S2** are closed, **identify** which of the bulbs will be brightest? [1 mark]
- In the diagram, when both switches **S1** and **S3** are closed and **S2** remain open, **identify** which of the bulb(s) will **NOT** light up? [1.5 marks]

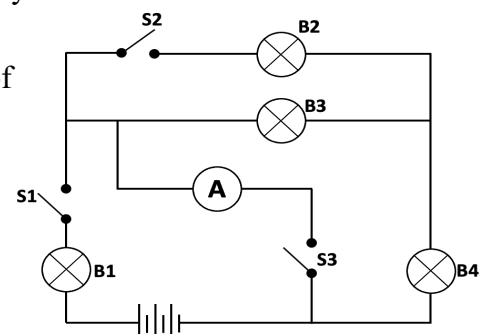


Figure 7



(9) Sedimentary rocks are a combination of many things – small fragments of rocks, minerals, and soil even remnants of living organisms like bones, shells, and plant matters that dissolves in water. These particles accumulate and are deposited until such time it is turned into rocks through a process called lithification.

Since particles that accumulate varies in type, shape, and sizes, sedimentary rocks are often diverse in appearance and characteristics. That is why geologists often devise and use an identification flowchart (Figure 8) to ease the process of identifying sedimentary rocks.

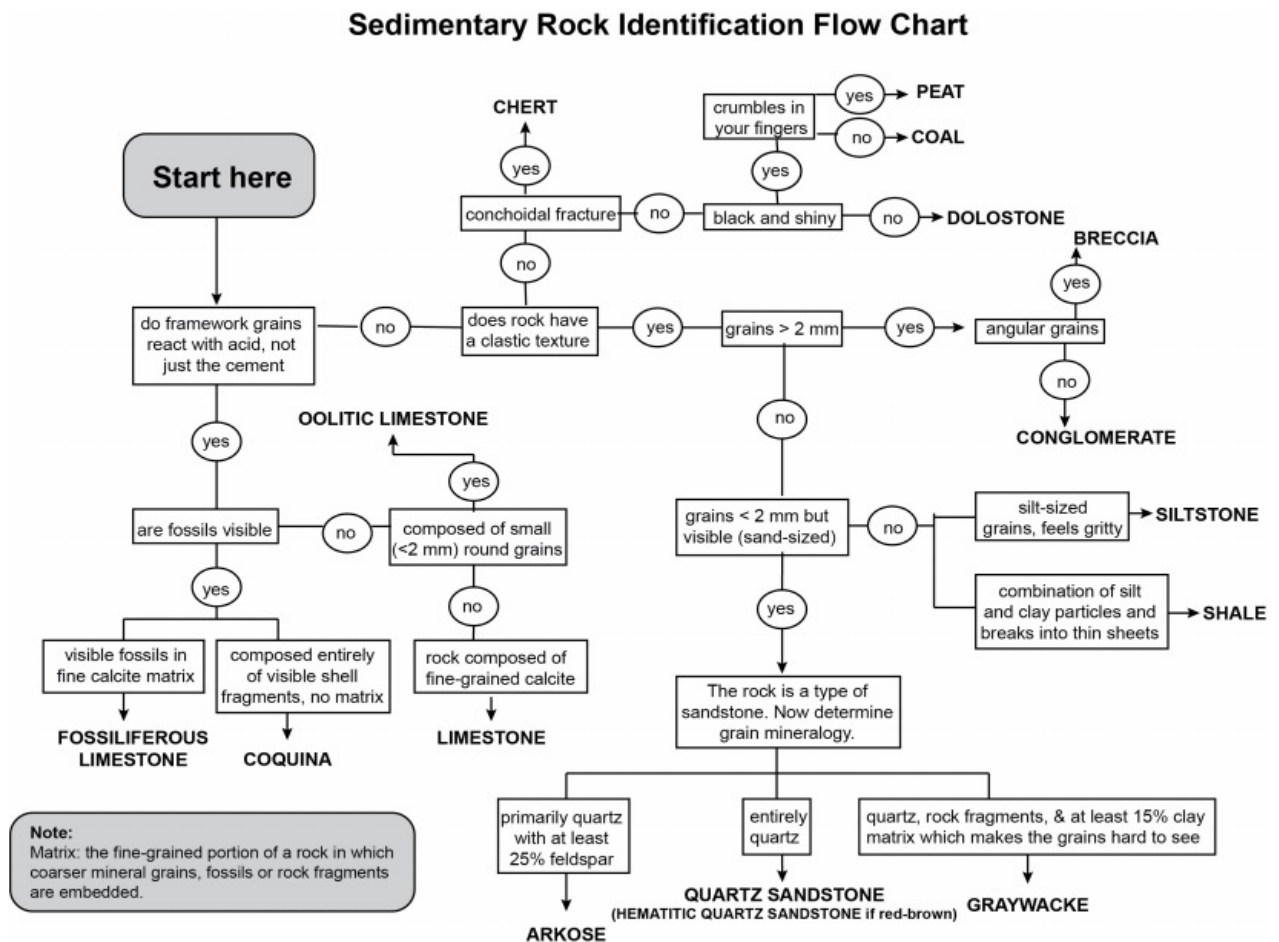


Figure 8

- (i) A geologist wants to identify a white rock he found in a river. He added a few drops of hydrochloric acid on it and observed that bubbles formed. There were no traces of fossils and the grains are not visible with the naked eye. Using a microscope, he determined that the grains are 1 mm in diameter on average. Using Figure 8, **identify** the rock. [2 marks]
- (ii) A small fragment of sedimentary rock consisting of siltstone, limestone and breccia. **Devise** a three-step plan to separate these rocks. [3 marks]

**- END OF THEORY 2 -**





**IMSO SCIENCE TEST THEORY 2**  
**ANSWER SHEET**

Page	Score	
<b>1</b>		
<b>2</b>		
<b>3</b>		
<b>4</b>		
<b>Total</b>		

**Printed name:** ..... **ID:** .....

**Instructions:**

1. Do NOT start answering this paper until you are told to do so.
2. Be sure that your name and ID are written on spaces provided.
3. Follow all the instructions carefully.
4. Write only your answers in this ANSWER SHEET.
5. Answer all the questions in English.
6. Use BLACK ink to write on the Answer Sheet.
7. Diagrams are not drawn to scale.
8. There are 9 questions printed on a total of 5 pages.
9. You have 90 minutes to complete this test.
10. Submit a clear scanned copy of this paper to your team leader within 15 minutes after the end of the session.

(1) (i) ..... [\_\_/1]

(ii) ..... [\_\_/2]

	<b>Structure</b>	<b>Function</b>
Whale		
Crocodile		

(2) (i) ..... [\_\_/2]

(ii) ..... [\_\_/2]

.....



**Printed name:** ..... **ID:** .....

(3) (i) Part 2: ..... [ \_\_\_/2]

Part 4: .....

(ii) ..... [ \_\_\_/1]

(iii) ..... [ \_\_\_/4]

(4) (i) ..... [ \_\_\_/1]

(ii) ..... [ \_\_\_/2]

(iii) ..... [ \_\_\_/2]





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(5) (i) ..... [ \_\_\_/2]  
.....

(ii) *Source 1:* ..... [ \_\_\_/3]  
*Source 2:* .....  
*Source 3:* .....

(6) (i) ..... [ \_\_\_/1]  
.....

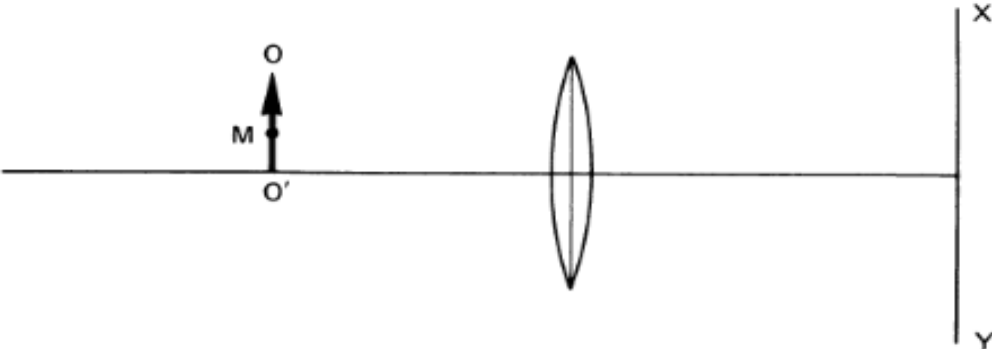
(ii) ..... [ \_\_\_/1]  
.....

(iii) ..... [ \_\_\_/1.5]  
.....

(iv) ..... [ \_\_\_/1]

(v) ..... [ \_\_\_/1.5]  
.....

(7) (i)- [ \_\_\_/1]  
(ii) [ \_\_\_/1.5]



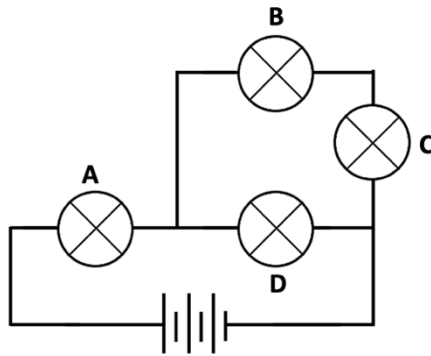
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(iii) ..... [\_\_/1.5]

.....

(iv) ..... [\_\_/1]

(8) A (i) ..... [\_\_/1]



(ii) a. .... [\_\_/2]

b. ....

B (i) ..... [\_\_/1]

(ii) ..... [\_\_/1.5]

(9) (i) ..... [\_\_/2]

(ii) *Step 1:* ..... [\_\_/3]

*Step 2:* .....

*Step 3:* .....

