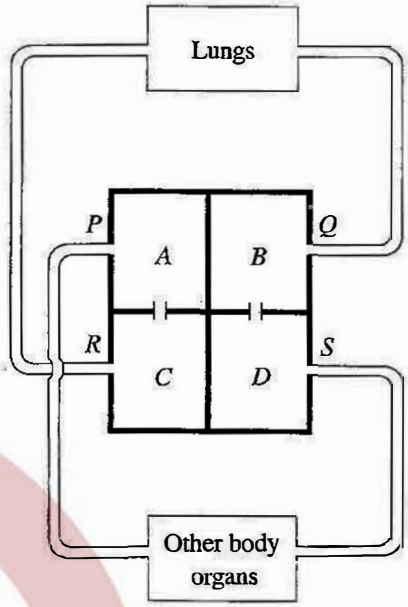
Part B

- Answer only **three** questions from the questions No. **5, 6, 7, 8** and **9**.

5. (*A*) Indicated below is a diagram drawn to depict double circulation of blood in humans. *A*, *B*, *C* and *D* indicate chambers of the heart while *P*, *Q*, *R* and *S* indicate the blood vessels connected to those chambers.



(i) Why is the human blood circulation known as double blood circulation?

(ii) *P* represents two vessels. Of them, name the vessel bringing blood from the inferior parts of the body.

(iii) Name the following blood vessels.
(a) blood vessel *R* starting from chamber *C*
(b) blood vessel *S* starting from chamber *D*

(iv) Indicate a difference in the composition of blood contained in vessels *R* and *S*.

(v) Name the valve located between the chambers *B* and *D*.

(vi) (a) By what name is the pressure exerted when *D* contracts and pushes blood into *S* known?
(b) What is the value of that pressure of a healthy adult?
(c) Even in a healthy adult, that value can change from time to time. State a factor affecting it.

(*B*) Muscle tissue can be identified as a main tissue type contributing to build up the human body. There are three main types of muscle tissues. One of them is the smooth muscle tissue.

(i) Name the other **two** main types of muscle tissues found in the human body.

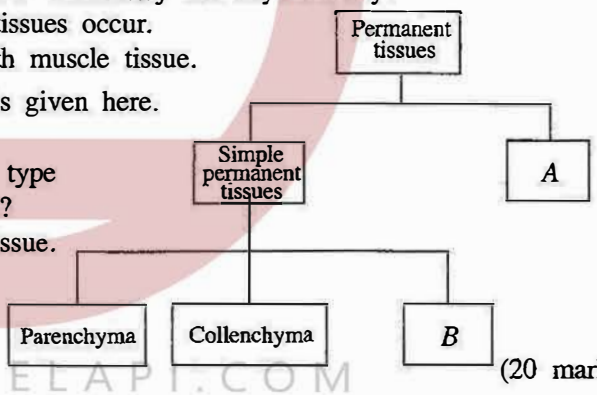
(ii) What is the muscle tissue type having multinucleate cells?

(iii) What is the muscle tissue type that acts voluntarily and rhythmically?

(iv) Name a place where smooth muscle tissues occur.

(v) Draw a sketch of a cell of the smooth muscle tissue.

(*C*) A figure on classification of plant tissues is given here.



(i) Name *A* and *B*.

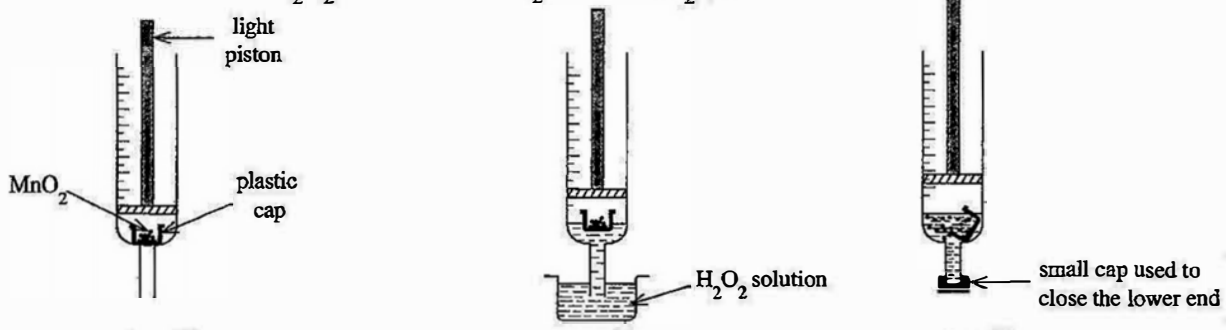
(ii) What is the simple permanent tissue type most abundantly seen in a plant body?

(iii) State a function of the collenchyma tissue.

(20 marks)

6. (*A*) The figures illustrate the steps of an experiment conducted by a group of students who studied the following reaction of hydrogen peroxide (H_2O_2).

Reaction : $2H_2O_2(aq) \longrightarrow 2H_2O(l) + O_2(g)$



step 01
placing the plastic cap with some MnO_2 inside the syringe

step 02
sucking in about 5 ml of H_2O_2 solution into the syringe

step 03
mixing H_2O_2 and MnO_2 and allowing the gas liberated to collect inside the syringe

[*See page six*

(i) According to the classification of reactions you learned, what type of a reaction is the above reaction?

(ii) What is the function of manganese dioxide (MnO_2) in the above reaction?

(iii) From the moment the gas started collecting inside the syringe, the volumes of the gas produced were measured in six successive 10 second time intervals. The following table shows the results.

Time interval	1	2	3	4	5	6
Volume of gas collected /ml	14	9	5	3	1	0

(a) Calculate the rate of production of gas during the first time interval.

(b) How has the rate of production of the gas changed with passage of time?

(c) Explain the reason for the variation you stated in (b) above.

(iv) In the step 03 above, when the piston was removed after the collection of the gas and a glowing splint was introduced into the syringe, it lighted brightly. What property of the gas collected was the reason for this observation?

(v) State an industrial use of the gas collected in the syringe.

(vi) State an advantage of adopting the above method instead of preparing gases as indicated in the textbook.

(*B*) Figure (1) indicates how a straight cylindrical iron pillar planted on the bottom of a shallow sea has corroded after a few years.

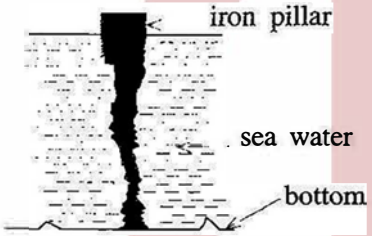


Figure (1)

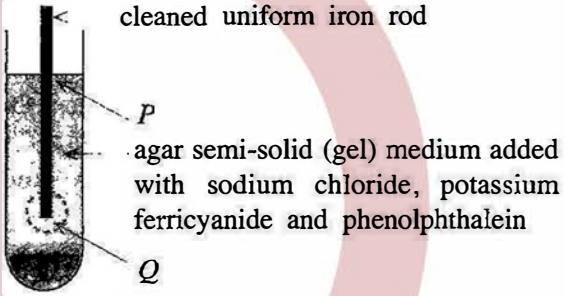


Figure (2)

The following hypothesis was proposed by a student who observed the iron pillar. 'In places where the contact between iron and oxygen is less, the rate of corrosion of iron is high.'

To test this hypothesis, the student assembled the set up shown in figure (2) and observed after a few hours. He could see that the area labelled *Q* has become blue in colour.

(i) What are the factors necessary for corrosion of iron?

(ii) What species produced by the iron rod caused the blue colour in area *Q*?

(iii) (a) What colour could be observed in area *P* in this experiment?

(b) Write the ion-electron half reaction causing the colour you stated above.

(iv) What is the use of adding sodium chloride to the jelly medium?

(v) Does the result of the experiment validate student's hypothesis?

(vi) (a) State a method used to protect from corrosion, the iron hulls of ships which frequently come in contact with sea water.

(b) Explain briefly, how the method you stated above contributes to reduce corrosion of iron.

(20 marks)

7. (*A*) (i) When a coin placed on the bottom of a vessel containing water is viewed from top, the coin appears as if it is raised above the bottom. Copy figure (1) in your answer script and draw the ray diagram which shows how the coin appears raised like that.

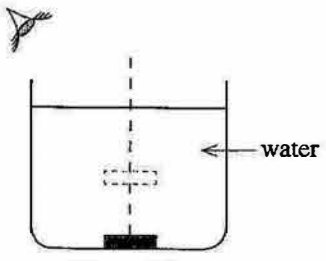
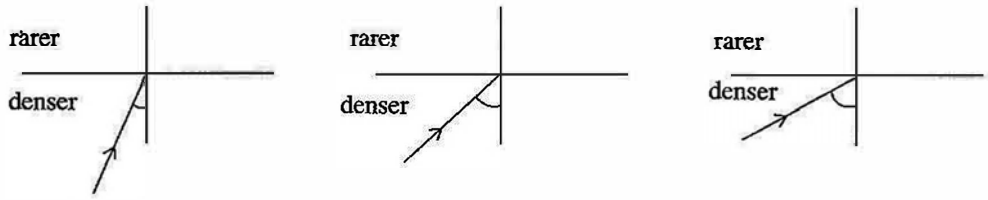


Figure (1)

[*See page seven*

(ii) Figure (2) below illustrates three instances of the incident angle in the denser medium of a light ray travelling from a denser medium to a rarer medium.



(*X*) incident angle is smaller than the critical angle

(*Y*) incident angle is equal to the critical angle

(*Z*) incident angle is greater than the critical angle

Figure (2)

(a) What is meant by the critical angle?

(b) Copy figure (2) in your answer script and complete the ray diagrams in instances (*X*), (*Y*) and (*Z*) indicating the continued path of the ray.

(c) Name the phenomenon occurring in the instance (*Z*) in figure (2).

(d) Give examples for **two** occasions in which the phenomenon stated in (c) above is made use of.

(*B*) The time spent for boiling a quantity of water required to prepare four cups of tea using an electric kettle which indicates that its power is 1000 W is three minutes.

(i) Calculate the amount of electric energy spent here.

(ii) How much is that amount of electrical energy in kWh? ($1\,kWh = 3.6 \times 10^6\,J$)

(iii) How much is the amount of electrical energy wasted in kWh, if an amount of water required to prepare eight cups of tea was boiled to prepare four cups of tea?

(*C*) When a motor car runs with a uniform speed of $10\,m\,s^{-1}$ ($36\,km\,h^{-1}$) on a rectilinear road, the driver of the car sees a barrier placed at a distance of 4 m. In this instance, he applies brakes to avoid an accident. The time that elapses from the moment of deciding that brakes be applied to putting the application of brakes into effect, that is his reaction time is 0.2 s.

(i) Find the distance travelled by the car during the time of 0.2 s.

(ii) The retardation applied by the brakes was $40\,m\,s^{-2}$ and the distance travelled under that retardation till the car stopped was 1.25 m.

(a) Could the driver avoid the accident?

(b) If the mass of the car was 1000 kg, what was the force applied by the brakes?

(c) Explain by a calculation, whether the accident could have been avoided by applying the above force in an instance where the reaction time was 0.3 s of a driver who was sleepy or under the influence of liquor.

(20 marks)

8. (*A*) Proteins, lipids and nucleic acids are three basic types of organic compounds contained in living matter.

(i) Why are proteins, lipids and nucleic acids called organic compounds?

(ii) State **two** elements that may be contained in proteins but **not** contained in lipids.

(iii) Name the structural unit of proteins.

(iv) State a common function of the compounds proteins and lipids.

(v) There are two major types of nucleic acids. One of them is called DNA. What is the other type?

(vi) In a living cell, name the organelle that contains DNA.

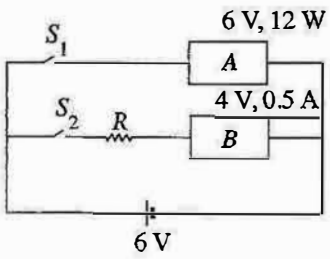
(vii) Explain how the genotype of an organism is changed in gene technology.

(viii) Name the species of micro-organisms used to produce insulin by means of gene technology.

(ix) It is required to verify that a crime was committed by the suspect of that crime using a sample of hair collected from the site of that crime. State how gene technology is used for it.

[*See page eight*

(*B*) The figure shows how two electrical appliances *A* and *B* are connected to a 6 V battery. It is indicated that the specifications of *A* are 6 V, 12 W and the specifications of *B* are 4 V, 0.5 A. S_1 and S_2 are two switches.



(i) Name the way *A* and *B* are connected to the circuit.

(ii) What is the current flowing through *A* when switch S_1 is closed?

(iii) What is meant by stating the specifications of *B* as 4 V, 0.5 A?

(iv) When switch S_2 is closed, appliance *B* should operate according to specifications.

(a) For this, what should be the potential difference across *R*?

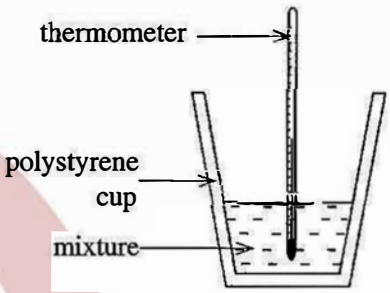
(b) What is the current flowing through *R* in this instance?

(c) Calculate the due value for *R*.

(v) How much is the current drawn from the battery when both the appliances operate?

(20 marks)

9. (*A*) A student added 50 cm^3 of hydrochloric acid (HCl) solution, concentration 0.1 mol dm^{-3} at 30 °C to a polystyrene cup and introduced a thermometer into it. Afterwards, 50 cm^3 of sodium hydroxide (NaOH) solution, concentration 0.1 mol dm^{-3} at 30 °C were added to the same cup.



(i) The maximum temperature, the mixture reached after mixing the two solutions was 38 °C. Explain the reason for the rise in temperature of the mixture.

(ii) State,

(a) a change in the above set up

(b) a change in the concentration of reactants

that should have been done to bring the maximum temperature reached by the mixture to a value above 38 °C.

(iii) It is expected to repeat the experiment using an amount of solid NaOH which contains the same amount of moles of NaOH that was present in the volume of NaOH solution used in the above experiment. A student states that the maximum temperature the mixture reaches will be 38 °C in this case also.

(a) Do you agree with this statement?

(b) Explain the reasons for your answer.

(iv) (a) Write the balanced chemical equation for the reaction taking place in this experiment.

(b) Explain the reason why this reaction is called a neutralization reaction.

(v) Why hydrochloric acid is considered a strong acid?

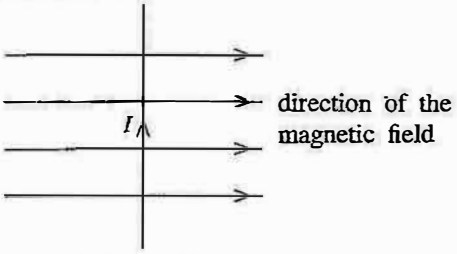
(vi) State an industrial use of sodium hydroxide.

(*B*) (i) A magnetic field is created around a straight conductor carrying an electric current.

(a) Using a diagram, illustrate the direction of the current flowing through such a conductor and also the shape and direction of the magnetic lines of force created by it.

(b) Present examples for **two** instances where electromagnets are made by modifying the conductor as a coil and sending a current.

(ii) When a conductor carrying a current is placed perpendicular to a magnetic field as shown in the figure, a force acts on it.



(a) State **two** factors affecting the magnitude of the force acting on the above conductor.

(b) Name the rule used to find the direction of the force acting on the conductor.

(c) Present examples for **two** instances in which the force generated as above is made use of.

(*C*) The production of electricity in a hydroelectricity power plant is based on the principle of electromagnetic induction.

(i) Explain briefly what is electromagnetic induction.

(ii) Illustrate separately and graphically, how the electric current produced by a hydroelectricity power plant and the electric current produced by a solar panel varies against time.

(20 marks)

* * *