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கல்விப் பொதுத் தராதரப் பத்திர (சாதாரண தர)ப் பரீட்சை, 2023(2024)
General Certificate of Education (Ord. Level) Examination, 2023(2024)

විද්‍යාව I
விஞ்ஞானம் I
Science I

පැය එකයි
ஒரு மணித்தியாலம்
One hour

Instructions :

- * Answer **all** questions.
- * In each of the questions 1 to 40, pick one of the alternatives (1), (2), (3), (4) which you consider is correct or most appropriate.
- * Mark a cross (X) on the number corresponding to your choice in the answer sheet provided.
- * Further instructions are given on the back of the answer sheet. Follow them carefully.

- Urea which is an excretory product is produced in
(1) kidneys. (2) liver. (3) urinary bladder. (4) nephrons.
- What is the unit of power?
(1) W s (2) W s⁻¹ (3) J s (4) J s⁻¹
- The formula of an isopropyl alcohol molecule is (CH₃)₂CHOH. What is the number of atoms in this molecule?
(1) 8 (2) 10 (3) 11 (4) 12
- What is the tissue that transports food produced in plant leaves throughout the plant body?
(1) xylem (2) phloem (3) cambium (4) sclerenchyma
- When two objects are rubbed together and one of them gets positively charged, transferred to the other are
(1) electrons. (2) protons. (3) neutrons. (4) electrons and protons.
- Which of the following includes an acidic oxide, an amphoteric oxide and a basic oxide in respective order?
(1) SO₃, Al₂O₃, SiO₂ (2) SO₃, Al₂O₃, MgO
(3) CO₂, SiO₂, MgO (4) SiO₂, CO₂, Al₂O₃
- In a plant cell can be called a non-living structure.
(1) cell wall (2) plasma membrane (3) ribosomes (4) Golgi body
- Another morphological feature of a plant bearing the leaves with the venation shown in the diagram is
(1) presence of a tap root system.
(2) having a branched stem.
(3) having one cotyledon in the seed.
(4) bearing tetramerous or pentamerous flowers.
- Which of the following statements on electromagnetic waves is false?
(1) They transmit energy.
(2) They travel with a speed of 3 × 10⁸ m s⁻¹ in vacuum.
(3) Frequency is less in a material medium than in vacuum.
(4) Speed is less in a material medium than in vacuum.
- Which of the following statements is true about ionic compounds?
(1) They conduct electricity in the solid state.
(2) All dissolve well in water.
(3) Boiling points and melting points take high values.
(4) They do not conduct electricity in the fused state.



[See page two]

11. Following symptoms are seen in a person suffering from a disease in the respiratory system.

- release of blood with cough
- loss in body weight
- high fatigue

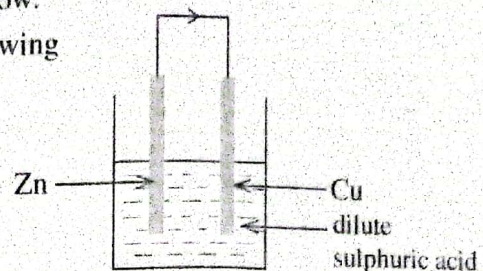
This person would have contracted

- (1) pneumonia. (2) bronchitis. (3) tuberculosis. (4) silicosis.

• Questions 12 and 13 are based on the figure given below.

12. In the direction shown by the arrow, which of the following flow(s) in the external circuit?

- (1) conventional current
(2) electrons
(3) Zn^{2+} ions
(4) Cu^{2+} ions



13. What is the cathodic reaction taking place in the above cell?

- (1) $\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Zn}(\text{s})$ (2) $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Cu}(\text{s})$
(3) $2\text{H}^+(\text{aq}) + 2\text{e}^- \longrightarrow \text{H}_2(\text{g})$ (4) $4\text{OH}^-(\text{aq}) + 4\text{e}^- \longrightarrow \text{O}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$

14. Consider the following statements regarding refraction of light.

A - Light refracts only when it travels from a rarer medium to a denser medium.

B - Reason for the refraction is the difference in the speed of light in the two media.

C - Frequency of light changes during refraction.

Of the above, true statement(s) is/are

- (1) only A. (2) only B. (3) only A and C. (4) only B and C.

15. The acceleration due to gravity on the Earth is 10 m s^{-2} . On the moon its value is $\frac{1}{6}$ th the value on the Earth. What is the weight of an object on the moon if it weighs 60 N on the Earth?

- (1) 10 N (2) 60 N (3) 100 N (4) 360 N

16. Of the following characteristics, what are the characteristics common only to Aves and Mammalia belonging to the vertebrate animal group?

A - warm bloodedness

B - skin covered with hair

C - bony internal skeleton

D - four chambered heart

- (1) A and B (2) A and D (3) B and C (4) C and D

17. Which of the following is false about metals?

- (1) Majority of the elements are metals.
(2) All metals conduct electricity.
(3) Metal atoms lose electrons and form positive ions.
(4) All metals react with acids and liberate hydrogen.

18. When a few drops of methyl orange were added to a certain solution, it turned red. Which of the following is most likely to be the pH value of that solution?

- (1) 2 (2) 7 (3) 12 (4) 14

19. It takes four seconds for an ultrasonic wave sent by a ship to the bottom of the sea to be reflected and come back to the ship. If the depth to the bottom of the sea is 2880 m, what is the speed of the ultrasonic wave in sea water?

- (1) 720 m s^{-1} (2) 1440 m s^{-1} (3) 2880 m s^{-1} (4) 3700 m s^{-1}

20. Given below are some properties of a gas.

- can be burnt easily
- density is less than that of air
- slightly soluble in water

This gas is

- (1) hydrogen. (2) nitrogen. (3) oxygen. (4) carbon dioxide.

21. What is the part belonging to the central nervous system which controls the rate of heart beat?

- (1) cerebrum (2) cerebellum (3) spinal cord (4) medulla oblongata

22. Consider the following statements about the resistance of a conductor.

- A - depends on the potential difference between the two ends of the conductor
 B - directly proportional to the length of the conductor
 C - depends on the current flowing through the conductor

Of the above, the true statement(s) is/are,

- (1) only A. (2) only B. (3) only A and B. (4) only A and C.

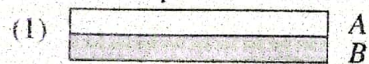
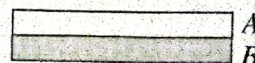
23. What is the amount of moles of calcium carbonate in 10 g of calcium carbonate? ($\text{CaCO}_3 = 100$)

- (1) 0.01 (2) 0.1 (3) 1 (4) 10

24. Select the correct statement about carbohydrates.

- (1) All carbohydrates are water-soluble.
 (2) All carbohydrates are crystalline.
 (3) In carbohydrates, ratio between C and H is 1:2.
 (4) Glucose is the structural unit of carbohydrates.

25. The figure on the right shows a bimetal strip made of two metals A and B. Of these, the metal expanding more is A while the metal expanding less is B. In which of the following ways does the shape of the bimetal strip change when its temperature is increased?



26. If an object made up of a solid substance is to float in a liquid,

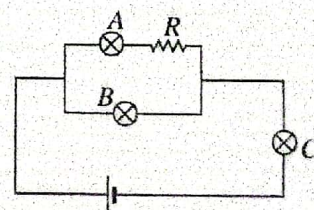
- (1) the density of the solid substance should be less than the density of the liquid.
 (2) the mass of the solid object should be equal to the mass of the liquid displaced.
 (3) weight of the solid object should be equal to the weight of the liquid volume displaced by it.
 (4) weight of the solid object should be less than the upthrust acting on it.

27. Of the offspring produced by the interbreeding of two organisms with the genotype Tt, the numbers of the genotypes and the phenotypes differing from one another respectively are

- (1) 2 and 1. (2) 3 and 2. (3) 4 and 2. (4) 4 and 3.

28. The figure indicates how three identical bulbs A, B and C and a resistor R are connected in a circuit. Which statement correctly indicates the relationship among the brightness of the bulbs A, B and C?

- (1) $A < B < C$ (2) $A = B = C$
 (3) $A = B < C$ (4) $A < C < B$



29. Indicated below is the reaction between haematite and carbon monoxide.



What is the mass of Fe that can be produced using one mole of Fe_2O_3 ? (Fe = 56)

- (1) 28 g (2) 56 g (3) 112 g (4) 168 g

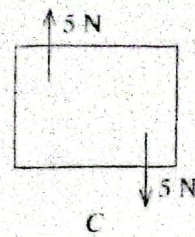
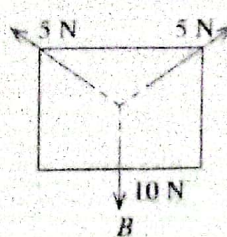
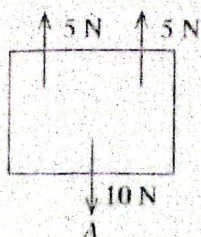
30. The amount of platelets in the blood of a person subjected to a viral infection has decreased below the normal value. As a result of it, in his body,

- (1) transport of oxygen becomes faster. (2) production of antibodies is suppressed.
 (3) clotting of blood does not occur properly. (4) transport of hormones becomes slower.

31. Figures A, B and C show how coplanar forces are applied on three rectangular sheets.

Of the above, the sheet(s) in equilibrium is/are

- (1) only A.
 (2) only B.
 (3) only A and C.
 (4) all A, B and C.



32.

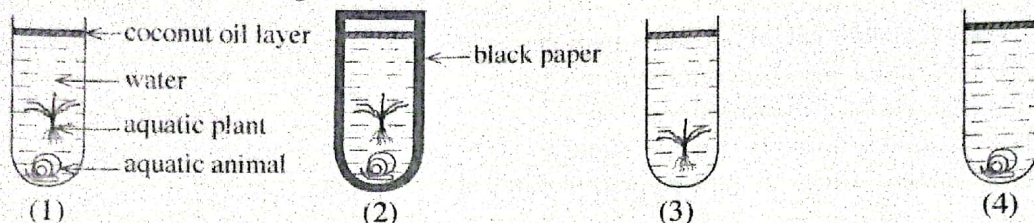
A - Catalysts increase the rate of a chemical reaction.

B - At the end of the reaction, the chemical composition of the catalyst changes.

Of the above,

- (1) both the statements A and B are true. (2) statement A is true while statement B is false.
 (3) both the statements A and B are false. (4) statement A is false while statement B is true.

33. The set ups (1), (2), (3) and (4) shown in the figures were prepared by adding equal volumes of water with equal concentration of carbon dioxide to four identical test tubes. In which set up will there be the **lowest** carbon dioxide concentration after exposing these four set ups for three hours to identical conditions of light?



34. Consider the following statements on polymers.

A - have a very high relative molecular mass

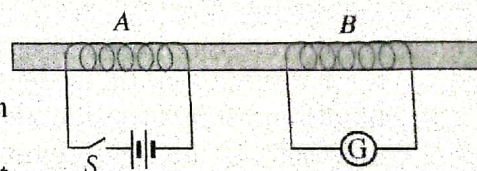
B - small molecules contributing to make them are known as repeating units

C - can be classified as artificial and natural based on origin

Of these, the true statement(s) is/are,

- (1) only A. (2) only B. (3) only A and C. (4) only B and C.

35. The figure illustrates how two insulated copper coils A and B are wound around a soft iron core. Which of the following statement is true about this arrangement?



- (1) The moment the switch S is closed, a current flows in A while no current flows in B.
 (2) When the switch S is kept continuously closed, a current flows in A and a current flows in B too.
 (3) Only the moment the switch S is closed, a current flows in B.
 (4) Only the moment the switch S is opened and is closed, a current flows in B.

36. Of the following statements on the velocity-time graphs, which one is **false**?

- (1) The area covered by the graph gives the displacement of the object.
 (2) The graph starts from the origin for the objects starting their motion from the state of rest.
 (3) The gradient of the graph is zero in a motion where the velocity varies with time.
 (4) The gradient of the graph gives the acceleration / deceleration.

37. What is the pollutant that contributes to the abnormal growth of algae population in oceanic ecosystems?

- (1) heavy metals (2) sulphate (3) nuclear waste (4) phosphate

38. During the discussions held with a few adults living in coastal areas, they stated that at present, they witness an increase in the number of outbreaks of storms occurring per year and their severity while coastal erosion occurs largely. Which of the following environmental phenomenon contributes most to this condition?

- (1) global warming (2) greenhouse effect
 (3) ozone layer depletion (4) eutrophication

39. The environmental pyramids always indicated in an upright way are,

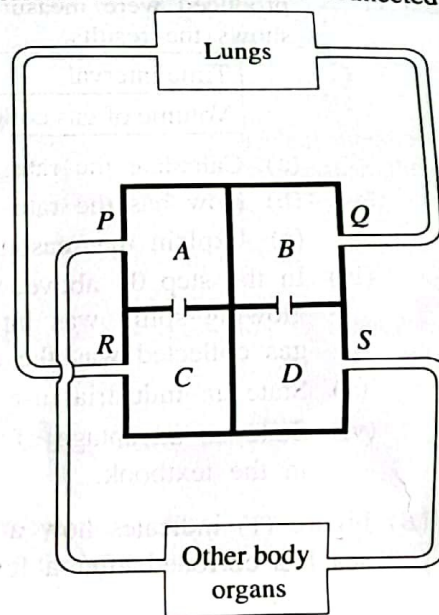
- (1) biomass pyramids. (2) number pyramids.
 (3) energy pyramids. (4) energy pyramids and biomass pyramids.

40. Which of the following practices is an example for the principle of recycling?

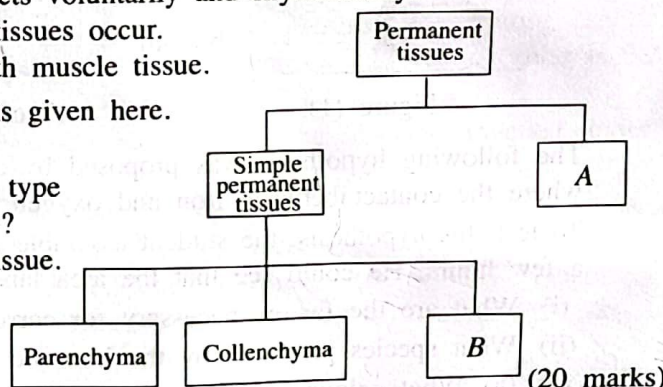
- (1) making door mats from the Denim trousers no more in use
 (2) younger brother wearing the clothes used by his elder brother
 (3) using the same cloth bag to carry foodstuffs bought day-to-day
 (4) restitching and wearing a clothe whose stitches have gone undone

Part B

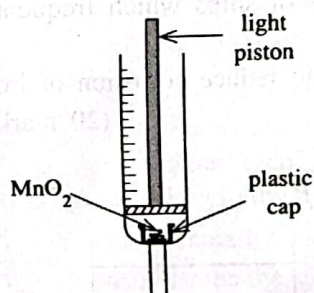
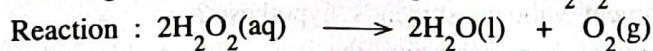
- Answer only **three** questions from the questions No. 5, 6, 7, 8 and 9.
5. (A) Indicated below is a diagram drawn to depict double circulation of blood in humans. A, B, C and D indicate chambers of the heart while P, Q, R and S indicate the blood vessels connected to those chambers.



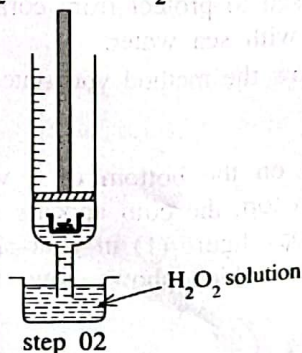
- Why is the human blood circulation known as double blood circulation?
 - P represents two vessels. Of them, name the vessel bringing blood from the inferior parts of the body.
 - Name the following blood vessels.
 - blood vessel R starting from chamber C
 - blood vessel S starting from chamber D
 - Indicate a difference in the composition of blood contained in vessels R and S.
 - Name the valve located between the chambers B and D.
 - By what name is the pressure exerted when D contracts and pushes blood into S known?
 - What is the value of that pressure of a healthy adult?
 - 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.
- Name the other **two** main types of muscle tissues found in the human body.
 - What is the muscle tissue type having multinucleate cells?
 - What is the muscle tissue type that acts voluntarily and rhythmically?
 - Name a place where smooth muscle tissues occur.
 - Draw a sketch of a cell of the smooth muscle tissue.
- (C) A figure on classification of plant tissues is given here.
- Name A and B.
 - What is the simple permanent tissue type most abundantly seen in a plant body?
 - State a function of the collenchyma tissue.



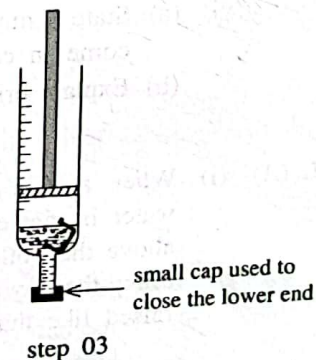
6. (A) The figures illustrate the steps of an experiment conducted by a group of students who studied the following reaction of hydrogen peroxide (H_2O_2).



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.

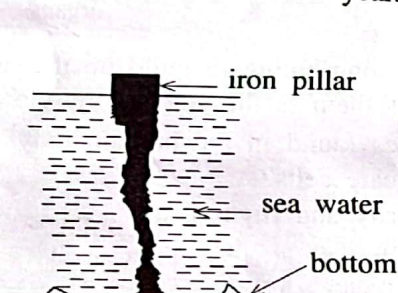


Figure (1)

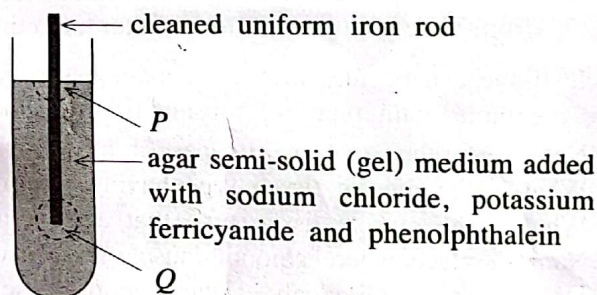


Figure (2)

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.

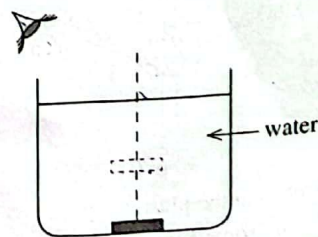


Figure (1)

[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.

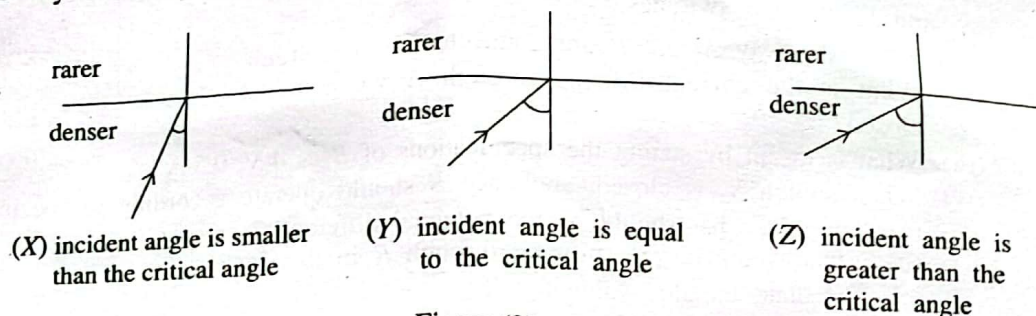


Figure (2)

- What is meant by the critical angle?
- 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.
- Name the phenomenon occurring in the instance (Z) in figure (2).
- 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.

- Calculate the amount of electric energy spent here.
- How much is that amount of electrical energy in kWh? ($1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$)
- 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.

- Find the distance travelled by the car during the time of 0.2 s.
- 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.
- Could the driver avoid the accident?
- If the mass of the car was 1000 kg, what was the force applied by the brakes?
- 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.

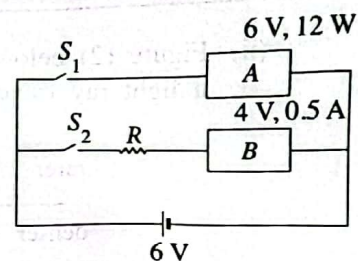
(20 marks)

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

- Why are proteins, lipids and nucleic acids called organic compounds?
- State two elements that may be contained in proteins but not contained in lipids.
- Name the structural unit of proteins.
- State a common function of the compounds proteins and lipids.
- There are two major types of nucleic acids. One of them is called DNA. What is the other type?
- In a living cell, name the organelle that contains DNA.
- Explain how the genotype of an organism is changed in gene technology.
- Name the species of micro-organisms used to produce insulin by means of gene technology.
- 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]

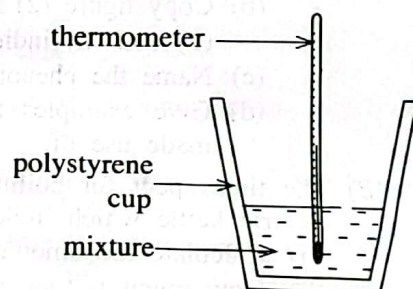
- (B) The figure shows how two electrical appliances A and B are connected to a 6 V battery. It is indicated that the specifications of A are 6 V, 12 W and the specifications of B are 4 V, 0.5 A. S_1 and S_2 are two switches.



- (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?

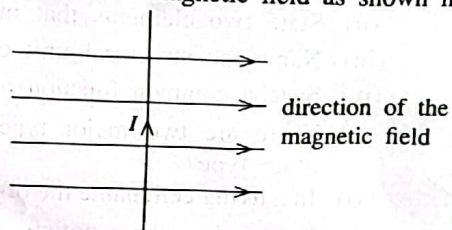
(20 marks)

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)