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இலங்கைப் பரீட்சைத் திணைக்களம்  
Department of Examinations, Sri Lanka

34 E I

අධ්‍යයන පොදු සහතික පත්‍ර (සාමාන්‍ය පෙළ) විභාගය, 2021(2022)  
கல்விப் பொதுத் தராதரப் பத்திர (சாதாரண தர)ப் பரீட்சை, 2021(2022)  
General Certificate of Education (Ord. Level) Examination, 2021(2022)

විද්‍යාව I  
விஞ்ஞானம் I  
Science I

පැය එකයි  
ஒரு மணித்தியாலம்  
One hour

**Note :**

- \* 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.

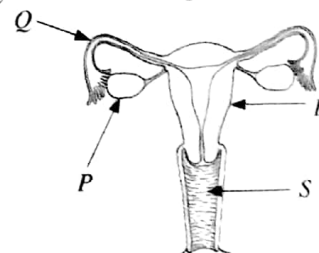
1. To which of the following organizational level does the human heart belong?  
(1) cell (2) tissue (3) organ (4) system
2. The hydrocarbons contained in LP gas as its major components are  
(1) methane and ethane. (2) propane and butane.  
(3) butane and pentane. (4) propane and pentane.
3. What is the unit of the amount of work?  
(1)  $\text{kg m s}^{-1}$  (2)  $\text{kg m s}^{-2}$  (3)  $\text{kg m}^{-1} \text{s}^{-1}$  (4)  $\text{kg m}^2 \text{s}^{-2}$
4. Which of the following is **not** a characteristic of the cardiac muscle tissue?  
(1) cells being mononuclear (2) occurrence of intercalated discs  
(3) cells being branched (4) acting voluntarily
5. A seed observed by a student during a field study is shown in the diagram.  
This seed is dispersed by  
(1) animals. (2) water.  
(3) wind. (4) explosion.
6. Which of the following quantity increases uniformly in an object moving with a constant acceleration?  
(1) distance (2) displacement (3) velocity (4) retardation
7. Which of the following is equal in  $^{40}_{19}\text{K}$  and  $^{40}_{20}\text{Ca}$  atoms?  
(1) number of electrons  
(2) number of neutrons  
(3) sum of the number of electrons and protons  
(4) sum of the number of protons and neutrons
8. Which property of water causes water to be used as a cooling agent to remove excessive heat generated in an automobile engine?  
(1) having a high specific heat capacity (2) having a high boiling point  
(3) being a colourless liquid (4) having a high density
9. In the process of digestion of food, bile necessary for the emulsification of lipids is produced in the  
(1) gall bladder. (2) liver. (3) duodenum. (4) pancreas.
10. What is the essential element for the production of thyroxine hormone in the thyroid gland?  
(1) sodium (2) phosphorus (3) calcium (4) iodine
11. How much is the mass of NaCl contained in  $100 \text{ cm}^3$  of a sodium chloride solution of concentration  $1.0 \text{ mol dm}^{-3}$ ? (Na = 23, Cl = 35.5)  
(1) 585 g (2) 58.5 g (3) 5.85 g (4) 0.585 g



- Questions 12 and 13 are based on the female reproductive system given in the diagram.

12. *R* and *S* respectively represent

- (1) uterus and vagina.
- (2) uterus and fallopian tube.
- (3) ovary and vagina.
- (4) ovary and fallopian tube.



13. An ovum fertilizes with a sperm in

- (1) *P*.
- (2) *Q*.
- (3) *R*.
- (4) *S*.

14. The image of a real object produced by a convex mirror is always

- (1) real and smaller than the object.
- (2) real and larger than the object.
- (3) virtual and smaller than the object.
- (4) virtual and larger than the object.

15. What is the increasing order of pH of four solutions of HCl, CH<sub>3</sub>COOH, NaOH and NH<sub>3</sub> of equal concentration?

- (1) HCl < CH<sub>3</sub>COOH < NaOH < NH<sub>3</sub>
- (2) HCl < CH<sub>3</sub>COOH < NH<sub>3</sub> < NaOH
- (3) CH<sub>3</sub>COOH < HCl < NaOH < NH<sub>3</sub>
- (4) CH<sub>3</sub>COOH < HCl < NH<sub>3</sub> < NaOH

16. What is the number of CO<sub>2</sub> molecules in 22 g of carbon dioxide?

(C = 12, O = 16, Avagadro constant =  $6.022 \times 10^{23} \text{ mol}^{-1}$ )

- (1)  $\frac{22}{44} \times 6.022 \times 10^{23}$
- (2)  $\frac{44}{22} \times 6.022 \times 10^{23}$
- (3)  $\frac{6.022 \times 10^{23}}{44 \times 22}$
- (4)  $44 \times 22 \times 6.022 \times 10^{23}$

17. The chemical formula of the chemical fertilizer urea is CO(NH<sub>2</sub>)<sub>2</sub>. Select the correct statement about urea.

- (1) Urea possesses the properties of the constituent elements.
- (2) A molecule of urea has two carbon atoms.
- (3) A molecule of urea has four hydrogen atoms.
- (4) The total number of atoms in a urea molecule is seven.

18. Which option contains only the components that are found in the glomerular filtrate but not in urine of a healthy person?

- (1) glucose, amino acids
- (2) water, glucose
- (3) urea, amino acids
- (4) water, urea

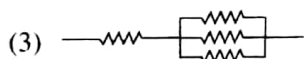
19. A jack fruit of mass 10 kg is falling freely from a height of 5 m of a jack tree. What is the velocity acquired by the fruit when it touches the ground? (Acceleration due to gravity is  $10 \text{ m s}^{-2}$ . Assume that the resistance of air is negligibly small.)

- (1)  $5 \text{ m s}^{-1}$
- (2)  $10 \text{ m s}^{-1}$
- (3)  $50 \text{ m s}^{-1}$
- (4)  $100 \text{ m s}^{-1}$

20. Select the correct statement regarding the circulation of blood in humans.

- (1) Always arteries contain oxygenated blood.
- (2) When circulated once through the body, blood goes twice through lungs.
- (3) Left ventricle acts as the pump of systemic blood circulation.
- (4) Always veins circulate blood away from the heart.

21. A few ways of connecting four resistors of equal magnitude are shown below. Of them, which one has the lowest equivalent resistance?



22. Consider the following organs.

A - skin      B - kidneys      C - pancreas

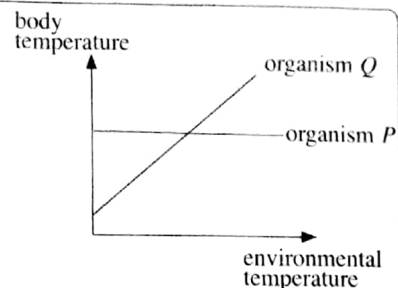
Of these, those that contribute to maintain homeostasis of the body is/are

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

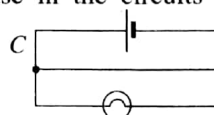
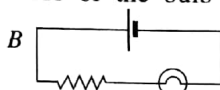
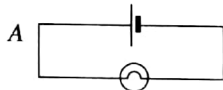
[See page three]

23. The graphs  $P$  and  $Q$  respectively indicate how the body temperature of the two organisms  $P$  and  $Q$  varies with the temperature of the environment. The organisms  $P$  and  $Q$  respectively can be

- (1) ox and bat.
- (2) fowl and tortoise.
- (3) elephant and duck.
- (4) frog and Thilapia.



24. In which order does the brightness of the bulb decrease in the circuits  $A$ ,  $B$  and  $C$ ?



- (1)  $A > B > C$
- (2)  $A > C > B$
- (3)  $B > C > A$
- (4)  $C > A > B$

25. Some information regarding an element are as follows.

- Has several allotropic forms.
- One allotropic form conducts electricity.

This element is

- (1) carbon.
- (2) oxygen.
- (3) sulphur.
- (4) iron.

26. Some functions of the human brain are given below.

$A$  - reception of senses

$B$  - maintaining the balance of the body

$C$  - controlling the rate of heart beat

Of the above, cerebellum controls

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

27. Consider the following statements.

$A$  - The rate of a reaction increases when the temperature increases.

$B$  - The kinetic energy of reactant particles increases when the temperature increases.

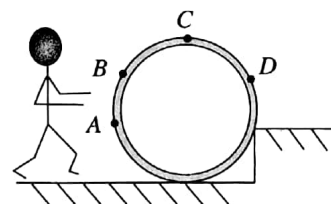
Of these

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

28. Which of the following phenomena **cannot be** explained by the Archimedes principle?

- (1) a ship cruising in the sea sinking more when entering a river
- (2) a balloon filled with helium gas moving upwards through air
- (3) floating of sunk orange seeds in a glass of orange juice when dissolving sugar
- (4) lifting a large mass by a hydraulic jack by applying a small force

29. The diagram shows a cross section of a cylindrical concrete ring kept on a flight of steps. Indicated as  $A$ ,  $B$ ,  $C$  and  $D$  are four points at which force can be applied by a man to roll it to the upper level. What is the point at which force can be applied on the cylinder in a suitable direction to roll it up with a lowest force?



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

30. When thin iron wool is heated, it instantly burns. But though an iron nail is heated till red hot, it does not undergo a considerable change. What conclusion can be drawn from these observations?

- (1) Iron wool acts as a catalyst.
- (2) Iron wool and iron nail undergo reactions different from each other.
- (3) The composition of iron wool and iron nail is different from each other.
- (4) The rate of a reaction depends on the physical nature of the reactants.

31. In 2011, the number of elephants in Sri Lanka was 5879. What is the most suitable biospherical organizational level to denominate that number of elephants?

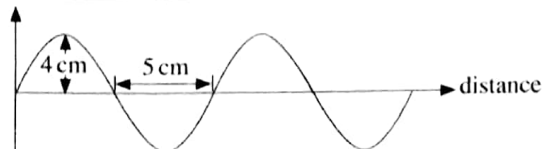
- (1) species
- (2) population
- (3) community
- (4) eco-system

[See page four]

32. Select the correct option with regard to an *npn* transistor.

|     | Base | Emitter | Collector |
|-----|------|---------|-----------|
| (1) | p    | n       | n         |
| (2) | n    | p       | n         |
| (3) | p    | n       | p         |
| (4) | n    | n       | p         |

33. The situation of transverse wave travelling on the surface of water at a certain moment is shown in the figure. The amplitude and the wave length of this wave respectively are

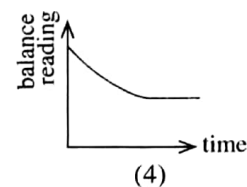
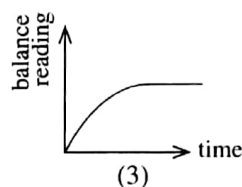
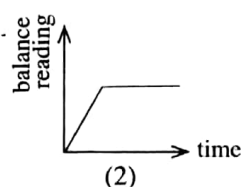
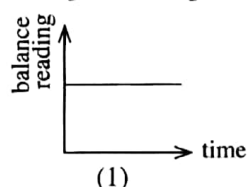


- (1) 4 cm and 5 cm. (2) 4 cm and 10 cm.  
(3) 5 cm and 4 cm. (4) 8 cm and 10 cm.

34. Which of the following statements is **false** about electroplating of iron?

- (1) An aqueous solution of a compound of the metal that is electroplated should be the electrolyte.  
(2) The electrolyte should be in high concentration for quality electroplating.  
(3) Iron should be made the cathode of the electrolytic cell.  
(4) The current used should be a direct current.

35. A conical flask containing aqueous hydrochloric acid is kept on a sensitive balance. Pieces of limestone were added to it in excess. Which of the following graphs indicates how the balance reading varies against time after the addition of limestone?



36. The number of turns in the primary coil and the secondary coil of a transformer are  $N_p$  and  $N_s$  respectively. The voltage difference of the primary coil is  $V_p$  and the voltage difference of the secondary coil is  $V_s$ . What is the correct relationship between the numbers of turns and the voltage differences?

- (1)  $\frac{V_p}{V_s} = \frac{N_p}{N_s}$  (2)  $\frac{V_s}{V_p} = \frac{N_p}{N_s}$  (3)  $V_s V_p = N_s N_p$  (4)  $V_s N_s = \frac{1}{V_p N_p}$

• Questions 37 to 40 are based on the information given in the following table.

Information relating to the method of obtaining energy, lighting devices and cooking equipment used in four houses A, B, C and D are given below.

| House | Method of obtaining energy | Lighting device   | Cooking equipment      |
|-------|----------------------------|-------------------|------------------------|
| A     | solar cells                | CFL bulbs         | LP gas cooker          |
| B     | national electric grid     | filament bulbs    | electric heater/cooker |
| C     | electricity generator      | fluorescent lamps | kerosene stove         |
| D     | biogas unit                | biogas lamps      | firewood hearth        |

37. For the energy obtaining method of which house is only a **non-renewable** energy source used?

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

38. Which houses use the lighting devices that largely contribute to pollute soil and water when improperly disposed to the environment?

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

39. Which house uses the cooking equipment that minimally contributes to pollute air inside the house?

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

40. What is the house that has taken most practical solutions to the electricity and fuel crisis?

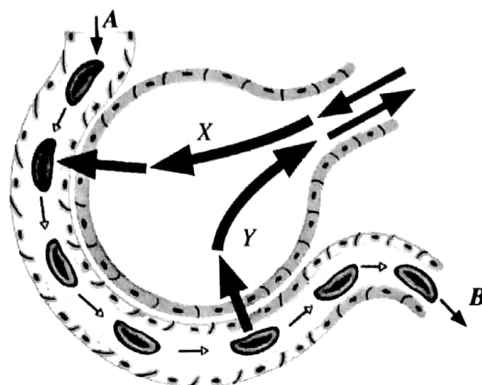
- (1) A (2) B (3) C (4) D

## Part B

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

5. (A) Respiration is a biological process. The system organized for it is called the respiratory system.

- Write **two** changes occurring in inhaled air when it passes through the nasal cavity of man.
- Name the **two** structures which contain muscles contributing to increase the volume of the thoracic cavity during inspiration.
- A sketch of an alveolus in which gas exchange takes place in the respiration of man is given below. Indicated as X and Y in the figure are two types of gases that exchange in the alveolus.



- Name gas X and gas Y in respective order.
  - By what process does gas exchange occur between alveoli and blood capillaries?
  - What is the main difference between the blood that enters the capillary at A and the blood that leaves the capillary at B?
  - State an adaptation of alveoli to make the gas exchange efficient.
  - By what name is the ailing condition of gradual destruction of alveoli due to accumulation of compounds based on silica in alveoli known?
- (B) The process of producing food in green plants is called photosynthesis.
- Write the energy transformation occurring in the process of photosynthesis.
  - State how atmospheric carbon dioxide necessary for photosynthesis enters plant leaves.
  - "It is not possible to show water is an essential factor for photosynthesis by a simple laboratory experiment." Do you agree with this statement? Give a reason to validate your answer.
  - The water essential for photosynthesis is absorbed by roots and transported to plant leaves through the xylem tissue.
    - Of the cells that form the xylem tissue, what are the types of cells that contribute to transport water?
    - In addition to water, name another substance that is transported through the xylem tissue.
    - In addition to transport function, state the other function carried out by the xylem tissue.
    - Describe briefly how the cells in the xylem tissue are adapted to fulfil the function you stated in (c) above.

(20 marks)

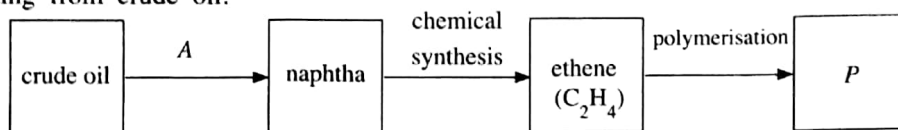
6. (A) Sodium hydroxide (NaOH) is a basic chemical compound. It acts as a strong base in an aqueous solution.

- Explain what is a base according to the way it behaves in an aqueous solution.
- Why is sodium hydroxide called a strong base?
- Name an industrial use of sodium hydroxide.
- For a laboratory experiment, a student prepared  $500 \text{ cm}^3$  of a sodium hydroxide solution with concentration of  $1.00 \text{ mol dm}^{-3}$ .
  - Name **two** laboratory glassware required to prepare the above solution.
  - How much is the mass of sodium hydroxide required to prepare the above solution? (H = 1, O = 16, Na = 23)

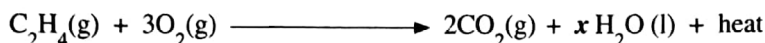
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- (c) It was experimentally found that the concentration of the solution prepared by the student was a little less than  $1.00 \text{ mol dm}^{-3}$ . State **two** errors that would have happened in the preparation of the solution causing that defect.

(B) The following flow chart indicates the manufacturing process of a commonly used polymer *P* starting from crude oil.



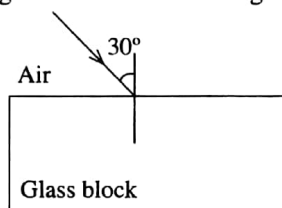
- (i) (a) The letter A indicates a separating technique. Name that technique.
- (b) State a solid component that can be separated from crude oil using the technique you mentioned in (a) above.
- (ii) Draw the structural formula of the ethene molecule.
- (iii) Name the polymer indicated by the letter *P*.
- (iv) Ethene can be polymerised. But, ethane cannot be polymerised. What is the reason for this?
- (v) The equation relevant to the complete combustion of ethene is given below.



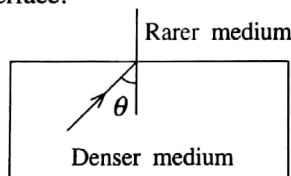
- (a) What is the value relevant to *x* in the above equation?
- (b) Sketch the energy level diagram relevant to the complete combustion of ethene indicating the levels where reactants and products exist.

(20 marks)

- ✓ (A) The diagram shows how a ray of light coming through air falls on a block of glass. That ray of light travels through the glass block and emerges into the air again.



- (i) Draw the rough sketch of the complete path of the light ray on your answer script.
- (ii) In the sketch, mark the angle of refraction '*r*' relevant to the first refraction of the ray.
- (iii) Write the equation which shows the relationship between the angle of incidence and angle of refraction. (Consider that the refractive index of glass with respect to air is *n*.)
- (iv) What is the value of the angle of emergence of the light ray?
- (v) The following diagram indicates how a light ray travelling from a denser medium to a rarer medium falls on the interface.



- (a) What is the path of the refracted ray when the angle of incidence  $\theta$  in the denser medium is equal to the critical angle?
- (b) By what name is the phenomenon happening known when the angle of incidence  $\theta$  in the denser medium is greater than the critical angle?
- (c) Write **two** examples for instances where the phenomenon in (b) above is made use of.

(B) Water of mass 1 kg is contained in an electric kettle used in a house.

- What is the amount of heat required to raise the temperature of 1 kg of water from 20 °C to 100 °C? (**Specific heat capacity** of water is  $4200 \text{ J kg}^{-1} \text{ }^{\circ}\text{C}^{-1}$ .)
- Find the amount of heat absorbed by the kettle when the temperature of the water in the kettle was increased from 20 °C to 100 °C. (**Heat capacity** of the kettle is  $160 \text{ J }^{\circ}\text{C}^{-1}$ .)
- The power of the heating coil used to heat the kettle is 1000 W. What is the time taken to heat the water in the kettle from 20 °C to 100 °C?
- The following measures have been taken to prevent the loss of heat from the kettle to the outer environment.
  - closing the kettle with a lid
  - polishing the outer surface of the kettle well

State the method of heat transfer controlled by each of the above measures.

(20 marks)

8. (A) Some phenomena faced and identified by a farmer maintaining a mixed crop cultivation are given below. Answer the questions asked on them.

- The passion fruit cultivation produces flowers but does not set fruits. Therefore the flowers need to be artificially pollinated. How are the passion fruit flowers artificially pollinated?
- Cocoyam (gahala/shembu) plants grow again after a certain period of time following the death of their aerial parts. What is the term used to describe this process by which the Cocoyam plants ensure their survival?
- In the farmland, one bush of banana trees gives a greater yield. The plants in that bush are highly resistant to diseases. Name an artificial vegetative propagation method suitable to obtain a large number of banana plants with those traits at once.
- The farmer intends to use a woodapple plant growing in the farmland as the stock and graft an orange twig to it. State **two** characteristics of the woodapple plant which would have caused its selection as the stock.
- The farmer cultivated in the farmland a garden pea plant which was rare in the area where his farmland is situated. That garden pea plant bears round seeds. A majority of the new pea plants grown from that garden pea plant bears round seeds. But the rest bears wrinkled seeds. Based on your knowledge in genetics explain this phenomenon using the Punnett square.

(B) In Figure 1, **AB** and **CD** indicate two metal rails. **PQ** is a conductor rod which can be slid on the two rails. The resistance of the rails and the rod are negligibly small. A uniform magnetic field is applied into the plane perpendicular to it on which the metal rails are placed. When the rod **PQ** is moved to right, an electric current is induced in it.

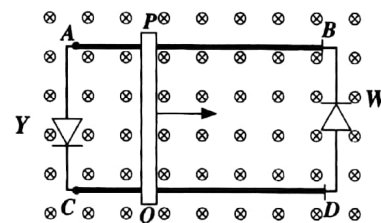


Figure 1

- Name the rule which can be used to decide the direction of the induced current in **PQ**.
- According to the rule stated in (i) above, does the current flow from **P** to **Q** or from **Q** to **P**?
- Due to the induced current in **PQ**, only one of the LEDs labelled **Y** and **W** lights.
  - What is the LED that lights?
  - State the reason why the other LED does not light.

(iv) Figure 2 shows how a battery and a switch are connected between **A** and **C** after removing the two LEDs in Figure 1.

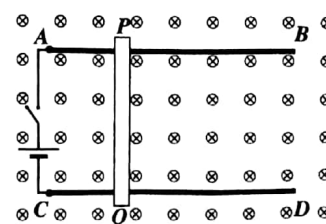


Figure 2

- State an observation made when the switch in the circuit is closed (put on).
- Name a device made by using the phenomenon associated with the observation mentioned in (iv) (a) above.

(20 marks)

[See page eight]

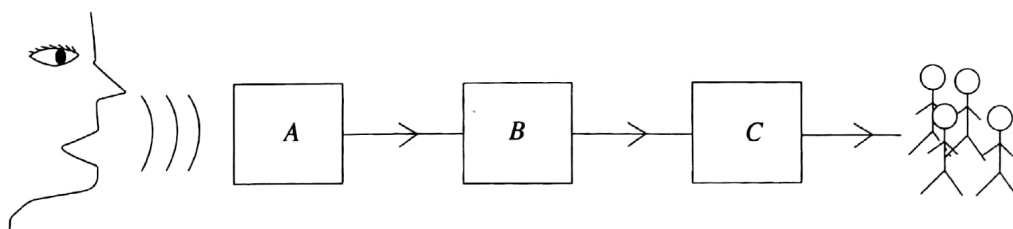


9. (A) The following table gives some chemical properties of the metal copper (Cu) and two other metals X and Y. (X and Y are not their standard symbols.)

| Metal | Reaction with water                                   | Reaction with dilute hydrochloric acid |
|-------|-------------------------------------------------------|----------------------------------------|
| Cu    | No reaction                                           | No reaction                            |
| X     | Reacts fast with cold water                           | Reacts violently                       |
| Y     | No reaction with cold water but reacts with hot water | Reacts very fast                       |

Answer the following questions using the above symbols where necessary.

- Write the above three metals in the decreasing order of their reactivity.
  - It is required to include hydrogen also in the series you made in (i) above according to its reactivity. Here, the place between which two metals does hydrogen occupy?
  - Of the metals given in the table, state the metal relevant to each of the following statements.
    - Stored in paraffin oil or kerosene without bringing into contact with air.
    - Extracted by reducing the metal oxide.
  - Y is a bivalent metal. Y reacts with dilute hydrochloric acid giving the metal chloride and a certain gas as products. Write the balanced chemical equation for this reaction.
  - A blue coloured aqueous solution of the sulphate of the metal copper was electrolysed using carbon electrodes.
    - Write the half reaction taking place on the cathode during electrolysis.
    - What kind of a colour change occurs in the electrolytic solution during the above electrolysis?
  - A simple cell is made using a copper metal plate and a zinc metal plate as electrodes and a dilute sulphuric acid solution as the electrolyte.
    - Which metal acts as the anode of the simple cell?
    - In which type of ion does the concentration remain constant in the solution of the electrolyte when the simple cell operates?
- (B) Equipment A converts the sound waves sent out by a speaker addressing a public meeting to an electrical signal of low amplitude. Equipment B converts the electrical signal of low amplitude to an electrical signal of high amplitude. Equipment C converts the electrical signal of high amplitude to sound waves again.



- Name the equipments A, B and C.
- Explain briefly the process taking place in equipment A.
- Draw the structure and the circuit symbol of the transistor, the main electronic device in equipment B and name its terminals.
- Name **two** main parts in the equipment C.
- In which characteristic of sound do the sound waves sent out by the speaker's mouth and the sound waves emitted by the equipment C differ from each other?
- When another speaker addresses the meeting in place of the first speaker, what characteristic of sound is different in the sound sent out by him?

(20 marks)

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