



**Coimisiún na Scrúduithe Stáit**  
**State Examinations Commission**

**LEAVING CERTIFICATE EXAMINATION, 2003**

**PHYSICS AND CHEMISTRY - ORDINARY LEVEL**

MONDAY, 16 JUNE – MORNING 9.30 to 12.30

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**Six** questions to be answered.

Answer any **three** questions from **Section I** and any **three** from **Section II**.

All the questions carry equal marks.

However, in each Section, one additional mark will be given to each of the first two questions for which the highest marks are obtained.

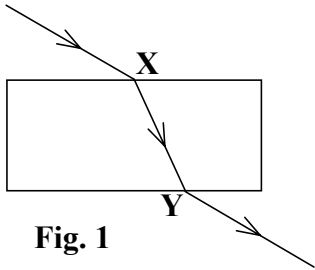
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**SECTION I – PHYSICS (200 marks)**

1. Answer *eleven* of the following items, (a), (b), (c), etc. All the items carry equal marks. *Keep your answers short.*

- (a) What is meant by *kinetic energy*?
- (b) A mass of 40 kg is at a height of 20 metres above the ground. Calculate its potential energy. (Take acceleration due to gravity,  $g = 10 \text{ m s}^{-2}$ .)
- (c) A car has a mass of 1000 kg. What force is needed to give it an acceleration of  $5 \text{ m s}^{-2}$ ?

(d) **Fig. 1** shows a ray of light passing through a glass block. What name is given to the phenomenon that occurs at **X** and at **Y**?

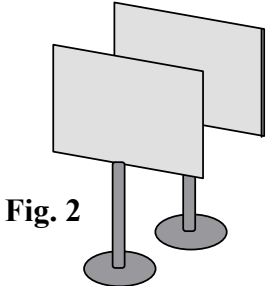


**Fig. 1**

(e) Copy and complete the statement: ‘Infrared radiation can be detected by its . . . . . effect and it has a . . . . . wavelength than ultraviolet radiation.’

- (f) State *Boyle’s law*.
- (g) What is meant by an *ideal gas*?

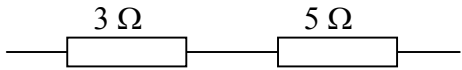
(h) **Fig. 2** shows a simple parallel plate capacitor. Give one factor on which the capacitance of the capacitor depends.



**Fig. 2**

- (i) What is the advantage of transmitting electricity at high voltages?
- (j) Calculate the current flowing in a 60 watt electric bulb connected to a 240 V power supply.

(k) **Fig. 3** shows two resistors connected in series with each other. Calculate the effective resistance of the two resistors.



**Fig. 3**

- (l) Name one device that is based on the principle that a current-carrying conductor in a magnetic field experiences a force.
- (m) Copy and complete the statement: ‘In the photoelectric effect . . . . . are emitted from the surface of a metal when . . . . . falls on it.’
- (n) From the following list:  $\alpha$ -particles;  $\beta$ -particles;  $\gamma$ -rays; choose (i) the most ionising, (ii) the most penetrating, radiation.
- (o) What is meant by *nuclear fission*?

(11 × 6)

2. (a) Define (i) *velocity*, (ii) *acceleration*. (12)

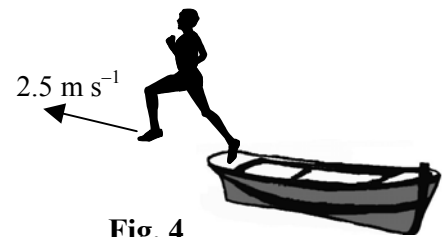
A cyclist starts from rest and moves with a uniform acceleration of  $1.5 \text{ m s}^{-2}$  in a straight line.

Calculate:

- (i) the velocity of the cyclist after 4 seconds;  
 (ii) the distance she has travelled in the 4 seconds;  
 (iii) the time it takes her to travel a distance of 30 metres. (24)

- (b) State *the principle of conservation of momentum*. (12)

**Fig. 4** shows a man stepping out of a small boat onto a bank. Before he stepped out, the boat was at rest. The mass of the man is 80 kg and the mass of the boat is 160 kg. If the initial velocity of the man as he steps towards the bank is  $2.5 \text{ m s}^{-1}$ , calculate the initial velocity of the boat. (18)



**Fig. 4**

3. State *the laws of reflection of light*. (12)

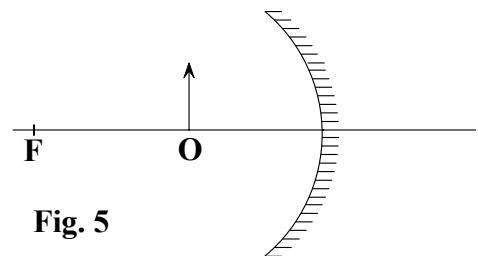
Describe a laboratory experiment to measure the focal length of a concave mirror.

Give one precaution you would take to ensure a more accurate result. (21)

**Fig. 5** shows an object, **O**, in front of a concave mirror.

Copy and complete the diagram to show the formation of a magnified image.

Give one use for a concave mirror used as shown in **Fig. 5**. (15)



**Fig. 5**

A converging (convex) lens may also be used to produce a magnified image.

Draw a ray diagram to show the formation of a magnified image in a converging lens.

Give one use of converging lenses. (18)

4. (a) What is meant by the *temperature* of a body? (6)

Name two units that are used to measure temperature. (6)

Describe an experiment to calibrate a mercury thermometer in the laboratory. (18)

(b) Explain the term *thermometric property*. (9)

Resistance is an example of a thermometric property. Give two other examples of thermometric properties. (6)

When using a resistance thermometer, temperature on the Celsius scale may be calculated from the equation

$$\frac{t}{100} = \frac{R_t - R_0}{R_{100} - R_0}$$

What does (i) the symbol  $R_0$ , (ii) the symbol  $R_{100}$ , stand for? (12)

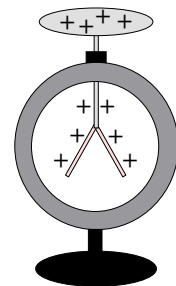
The value of  $R_0$  for a certain resistance thermometer is 60 ohms and the value of  $R_{100}$  is 68 ohms. When the thermometer is used to measure the temperature of water in a beaker its resistance is 66 ohms. Calculate the temperature of the water in the beaker. (9)

5. State *Coulomb's law of force*. (9)

**Fig. 6** shows a positively charged gold leaf electroscope.

What happens when the cap of the electroscope is touched with a metal rod?

Explain why this happens. (12)



**Fig. 6**

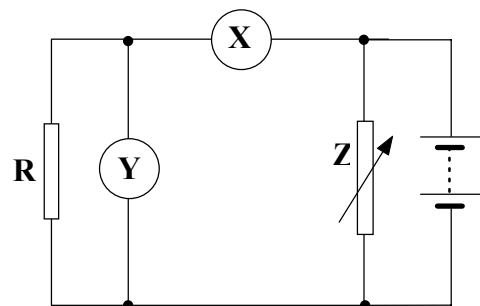
An electric current is a flow of charge. Name the unit used to measure electric current. (6)

**Fig. 7** shows a circuit used to investigate the relationship between the current flowing through a resistor,  $R$ , and the voltage across it.

Copy and complete the following statement.

'In the circuit, **X** is an ..... and it is used to measure the .....; **Y** is a ..... and it is used to measure the .....'

Name the part labelled **Z**. What is it used for? (21)



**Fig. 7**

Sketch the graph you would expect to get if you carried out this experiment. (9)

A current flowing in a resistor has a heating effect.

Name two domestic appliances that use the heating effect of an electric current.

Give one other effect of an electric current. (9)

6. Answer any **two** of the following parts, (a), (b), (c) and (d). Each part carries 33 marks.

(a) The acceleration due to gravity,  $g$ , on the surface of the earth is given by

$$g = \frac{GM}{r^2}$$

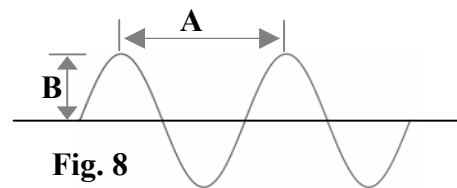
What do the symbols  $G$ ,  $M$  and  $r$  stand for? (12)

Describe an experiment to measure the acceleration due to gravity,  $g$ . (21)

(b) **Fig. 8** shows a waveform.

What is (i) **A**, (ii) **B**, called? (6)

What is meant by the frequency of a wave? (6)



**Fig. 8**

Describe, with the aid of a diagram, what happens when a wave passes through a narrow slit.

What name is given to this phenomenon?

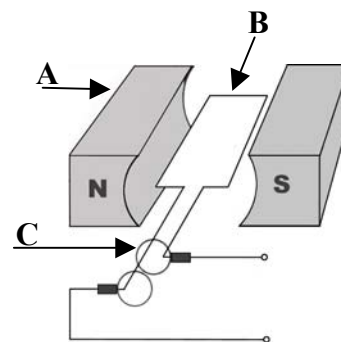
Describe briefly how you would demonstrate interference of waves in the laboratory. (21)

(c) State one law of electromagnetic induction. (9)

**Fig. 9** shows a simple a.c. generator. Name the parts labelled **A**, **B** and **C**.

What is the function of the part labelled **C**? (18)

Name one other device that is based on electromagnetic induction. (6)



**Fig. 9**

(d) What is meant by the terms (i) radioactivity, (ii) half-life? (18)

A radioactive substance has a half-life of 6 days.

How much of a given sample of the substance is left after 18 days? (9)

Give one precaution that should be taken when handling radioactive materials. (6)

**SECTION II - CHEMISTRY (200 marks)**

7. Answer *eleven* of the following items, (a), (b), (c), etc. All the items carry equal marks. *Keep your answers short.*

(a) What is meant by *ionisation energy*?

(b) What type of orbital is shown in **Fig. 10**?

(c) What is an *exothermic* reaction?

(d) What is meant by a *polar* bond?

(e) State *Hess's law*.

(f) Copy, complete and balance the equation:  $\text{Zn} + \text{HCl} \rightarrow$

(g) Calculate the percentage of carbon by mass in ethane ( $\text{C}_2\text{H}_6$ ).  
[C = 12, H = 1]

(h) What is the function of a catalyst in a chemical reaction?

(i) Calculate the **pH** of a **0.02 M** solution of hydrochloric acid.

(j) Give one everyday use for ethanoic (acetic) acid.

(k) Give one characteristic property of *transition elements*.

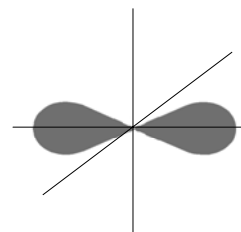
(l) The relative molecular mass of oxygen ( $\text{O}_2$ ) is 32. Calculate the number of molecules in 0.4 g of oxygen.

[Avogadro constant =  $6.0 \times 10^{23} \text{ mol}^{-1}$ ]

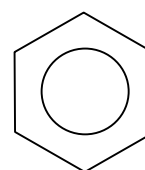
(m) Write down the chemical formula for hydrogen peroxide.

(n) Name a *ketone*.

(o) Name the compound shown in **Fig. 11**.



**Fig. 10**



**Fig. 11**

(11 × 6)

8. Explain the terms (i) *relative atomic mass*, (ii) *valency*. (12)

Copy the following table into your answerbook and complete it by filling in the missing numbers. (Refer to Mathematics Tables, p. 44.)

	Atomic number	Number of neutrons	Mass number
Chlorine	17	20	
Potassium			39
${}^1_6\text{C}$	6		
${}^{14}_6\text{C}$			

(24)

What name is given to a pair of atoms like  ${}^{12}_6\text{C}$  and  ${}^{14}_6\text{C}$ ?

(6)

Give the electronic (s, p) configuration of (i) chlorine, (ii) potassium.

(12)

State the type of bond formed when an atom of chlorine combines with an atom of potassium. Use a diagram to show how the bond is formed.

(12)

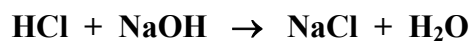
9. Define (i) *an acid*, (ii) *a base*, in terms of the Bronsted-Lowry theory. (12)

**Fig. 12** shows one piece of apparatus used in the titration of a sodium hydroxide solution with a standard **0.1 M** hydrochloric acid solution. Give the name of this piece of apparatus and explain how you would wash and fill it before starting the titration. (18)

Name two other pieces of apparatus you would use in this titration. (12)

Give two precautions you would take when carrying out this titration to ensure an accurate end-point. (12)

In this titration  $25.0\text{ cm}^3$  of the sodium hydroxide (**NaOH**) solution were neutralised by  $28.5\text{ cm}^3$  of the **0.1 M** hydrochloric acid (**HCl**) solution. The equation for this reaction is



Calculate the molarity of the sodium hydroxide solution. (12)



**Fig. 12**

10. (a) Define (i) oxidation, (ii) reduction, in terms of electron transfer. (12)

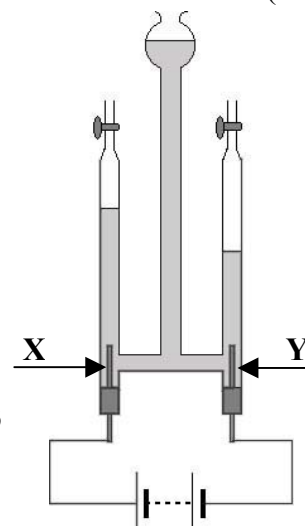
**Fig. 13** shows an apparatus which may be used in the electrolysis of acidified water.

Name the electrodes **X** and **Y**.

State at which electrode (i) oxidation, and (ii) reduction, occurs.

Name the gases liberated at **X** and at **Y**. (18)

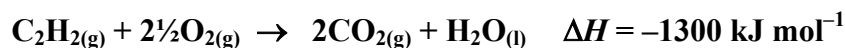
Give one everyday application of electrolysis. (6)



**Fig. 13**

- (b) Define *heat of combustion*. (6)

Ethyne ( $C_2H_2$ ) burns in air producing carbon dioxide and water. The equation for this reaction is



Calculate:

- the quantity of heat released in the combustion of two moles of ethyne;
  - the number of moles of  $CO_2$  released in the combustion of two moles of ethyne;
  - the quantity of heat released in the combustion of 6.5 g of ethyne.
- [C = 12; H = 1] (24)

11. What are *hydrocarbons*?

Explain the terms (i) homologous series, (ii) functional group. (21)

Ethane ( $C_2H_6$ )	Ethene ( $C_2H_4$ )
Ethanol ( $C_2H_5OH$ )	Ethanal ( $CH_3CHO$ )

Name the homologous series to which (i) ethane, (ii) ethene, belongs. (12)

What is the functional group in (i) ethanol, (ii) ethanal? (12)

Ethene is an unsaturated hydrocarbon. Explain the underlined term and describe a chemical test to show that ethene is unsaturated. (15)

Draw the structure of the ethanal molecule. (6)



12. Answer any **two** of the following parts (a), (b) and (c). Each part carries 33 marks.

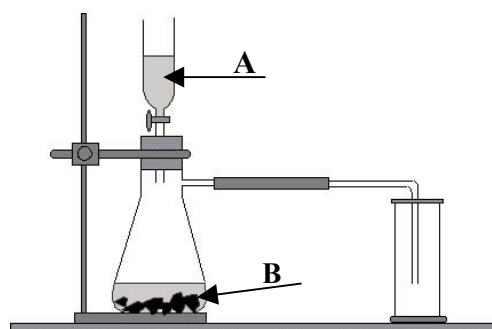
(a) The apparatus shown in **Fig. 14** is used to prepare a sample of carbon dioxide.

Name the liquid **A** and the solid **B**. (12)

The carbon dioxide is collected by upward displacement of air. What does this tell us about the nature of the gas? (6)

Describe a test for this gas. (9)

Give one chemical property and one use of carbon dioxide. (6)



**Fig. 14**

(b) Outline *the electron pair repulsion theory*. (12)

Sketch the shapes of any two of the following molecules, showing the positions of the atoms in each case.

**CH<sub>4</sub>      H<sub>2</sub>S      H<sub>2</sub>O** (12)

Use the electron pair repulsion theory to explain why one of the molecules has the shape you have drawn. (9)

(c) All of the following elements combine with oxygen to form oxides:

**carbon (C)    sodium (Na)    aluminium (Al)    sulphur (S)**

From the oxides formed by these elements, give the name and formula of (i) a neutral oxide, (ii) a basic oxide, (iii) an acidic oxide. (27)

What is meant by an *amphoteric* oxide? (6)

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