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LEAVING CERTIFICATE EXAMINATION, 1999

PHYSICS AND CHEMISTRY — ORDINARY LEVEL

MONDAY, 21 JUNE — MORNING, 9.30 to 12.30

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.

SECTION I – PHYSICS (200 marks)

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

- (a) Give an example of *conservation of energy*.
 (b) State *Coulomb's law*.
 (c) Copy and complete the following statement:

"The force of attraction between the Sun and a planet is proportional to the _____
 of their masses and inversely proportional to the _____."

- (d) What is meant by an *ideal gas*?
 (e) What reading on the absolute scale of temperature is equivalent to 77°C ?
 (f) State the relationship between volume and temperature for a fixed mass of gas at constant pressure.
 (g) Fig. 1 shows the object O and the image I formed by a concave mirror. What do F and C represent?

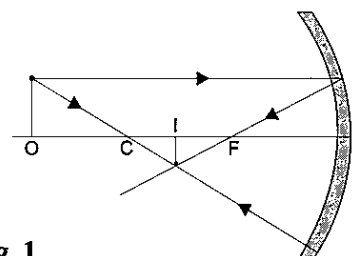


Fig. 1

- (h) What is meant by the *interference of light waves*?
 (i) What is the *photoelectric effect*?
 (j) Calculate the effective resistance of the arrangement of resistors shown in Fig. 2.

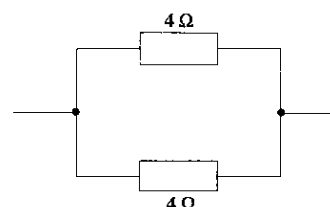


Fig. 2

- (k) Give one example of a *transverse wave*.
 (l) How would you show the magnetic effect of an electric current?
 (m) In the equation $E = mc^2$ what does c represent?
 (n) How may the voltage of mains a.c. be reduced?

(11 x 6)

2. (a) Define *potential energy*. (6)

A ball of mass 0.5 kg is allowed to fall from the top of a tower 30 m high. Calculate

- (i) the potential energy at the beginning. (6)

- (ii) the length of time it takes the ball to reach the ground. (12)

- (iii) the velocity of the ball just before it hits the ground (12)
[$g = 9.81 \text{ m s}^{-2}$].

- (b) State Newton's third law of motion. (12)

A gun, initially at rest, has a mass of 5 kg. It fires a bullet, of mass 0.01 kg, with a velocity of 250 m s^{-1} .

Calculate the recoil velocity of the gun. (18)

3. (a) What is meant by *Brownian motion*? (12)

Outline a laboratory experiment to illustrate Brownian motion. (18)

- (b) State *Boyle's law*. (12)

Describe a laboratory experiment to verify Boyle's law. Draw a labelled diagram of the apparatus used. Give three assumptions of the *kinetic theory of gases*. (24)

4. (a) What is meant by the *refraction of light*? (12)

Describe, with the aid of a clearly labelled diagram, how you would measure the refractive index of glass. (24)

- (b) Define (i) wavelength (ii) frequency, and state the units of each. (12)

Describe an experiment to measure the wavelength of light. (18)

5. What is the basic principle on which the moving-coil galvanometer depends? (12)

Fig. 3 Shows a moving-coil galvanometer. Answer the following questions.

- (i) Name the parts of the galvanometer labelled A, B, C, D in Fig. 3. (24)
- (ii) State the function of each part. (24)
How would you convert the galvanometer into a voltmeter? (6)

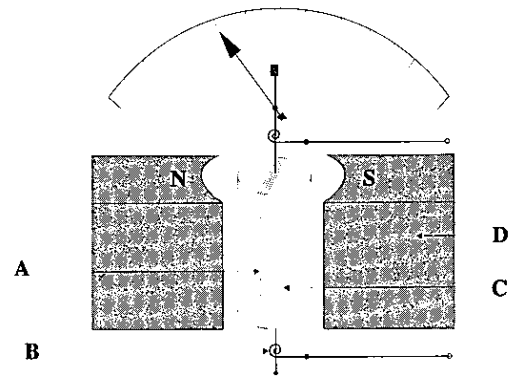


Fig. 3

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

- (a) Describe a laboratory experiment to measure g , the acceleration due to gravity. (21)

State two precautions that you would take. (12)

- (b) Describe a laboratory experiment to measure the focal length of a convex (converging) lens. (24)

Copy and complete Fig. 4 to show how a convex (converging) lens magnifies an object. (9)

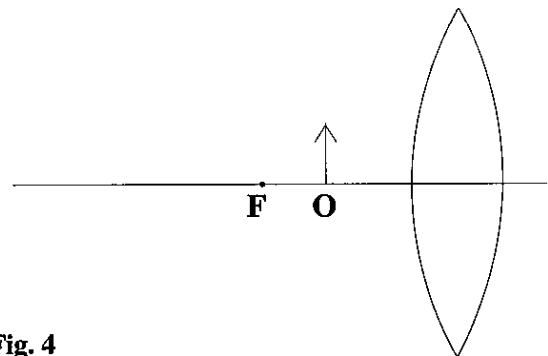


Fig. 4

- (c) State Ohm's law. (6)

Describe, with the aid of a clearly labelled diagram, a laboratory experiment to verify Ohm's law. State clearly what is measured. (21)

State one precaution you would take. (6)

- (d) What is meant by (i) nuclear fission, (ii) nuclear fusion? (15)

Which of the above processes is the major one in the Sun? (6)

Write a short note on the benefits that arise from nuclear fission. (12)

SECTION II – CHEMISTRY (200 marks)

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

- (a) What element is represented by the following electronic structure: $1s^2 2s^2 2p^6 3s^2 3p^3$?
- (b) In the equation $E_2 - E_1 = hf$; what does h represent?
- (c) How many moles are there in 9 grams of water? ($H = 1$; $O = 16$)
- (d) What is meant by *hydrogen bonding*?
- (e) Complete the statement: "Isotopes of an element have the same number of _____ and have different numbers of _____"
- (f) Arrange the metals sodium, silver and zinc in order of increasing activity.
- (g) Give an example of a basic oxide.
- (h) Calculate the percentage carbon in benzene C_6H_6 . ($C = 12$; $H = 1$).
- (i) Sketch the structural formula of ethanoic acid (acetic acid).
- (j) Copy, complete and balance the following equation:

$$CaCO_3 + HCl = CaCl_2 + \text{_____} + \text{_____}.$$
- (k) What is meant by a *strong acid*?
- (l) Give an example of an *exothermic reaction*.
- (m) Name an oxide which is a major cause of atmospheric pollution.
- (n) Mention one practical application of electrolysis. (11 x 6)

8. (a) Compare electrons and protons under the headings (i) charge, (ii) mass, (iii) location in the atom. (18)

Explain the term *orbital*.

Sketch the shape of a p-orbital. (18)

(b) What is meant by *relative atomic mass*? (12)

Chlorine consists of 75% $^{35}_{17}Cl$ and 25% $^{37}_{17}Cl$.

Calculate the relative atomic mass of chlorine. (18)

9. (a) Explain the term *ionisation energy*. (9)

Account for the variation in the values of ionisation energy

- (i) *across* a Period in the Periodic Table,
- (ii) *down* a Group in the Periodic Table. (24)

(b) Show how a covalent bond is formed in CO_2 . (12)

Give the name and formula of two other covalent compounds (12)

List three general properties of covalent compounds. (9)

10. Define the *pH* of a solution. (6)

Calculate the pH of a **0.05 M** solution of hydrochloric acid. (12)

What volume of **0.05 M** hydrochloric acid would neutralise 20 cm³ of **0.08 M** sodium hydroxide? (18)

Describe how you would carry out this titration. State two precautions that you would take. (24)

Name a suitable indicator for this titration. (6)

11. (a) Alkanes are a homologous series of saturated hydrocarbons.

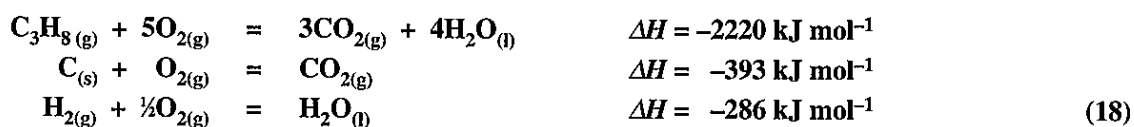
Explain the underlined terms. (18)

Name and give the structural formulae for any two alkanes. (12)

(b) State *Hess's law*. (9)

Define the *heat of formation of a substance*. (9)

Calculate the heat change for $3\text{C}_{(\text{s})} + 3\text{H}_{2(\text{g})} = \text{C}_3\text{H}_{6(\text{g})}$ from the following data:



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

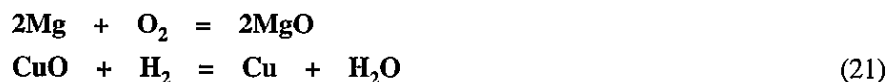
- (a) What is (i) an acid, (ii) a base, (iii) a conjugate pair, in terms of the Bronsted-Lowry theory? (18)

Indicate the acid, the base, the conjugate acid, the conjugate base and a conjugate pair in the following reaction:



- (b) Define (i) oxidation (ii) oxidising agent, in terms of electron transfer. (12)

Identify the substance oxidised and the oxidising agent in **each** of following reactions:



- (c) Fig. 5 shows the apparatus used in the preparation of sulphur dioxide.

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

What is the function of the concentrated H_2SO_4 in jar C? (6)

Why is the gas collected by upward displacement of air? (6)

State one physical property, one chemical property and one use of SO_2 . (9)

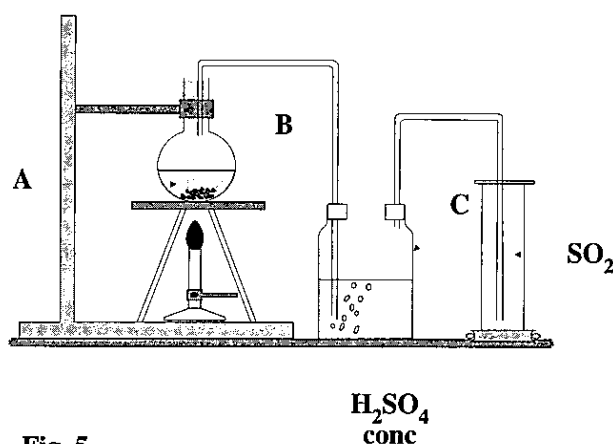


Fig. 5