AN ROINN OIDEACHAIS

LEAVING CERTIFICATE EXAMINATION, 1965

CHEMISTRY — HONOURS

FRIDAY, 25th JUNE — AFTERNOON, 2.30 to 5

Not more than six questions may be attempted.

Chemical reactions should be expressed by
equations as well as in words.

Gram—molecular volume = 22·4 litres.

Atomic weights:- H = 1, C = 12, O = 16, Na = 23,
S = 32, Cl = 35·5, Ca = 40, Ba = 137.

1. Describe and discuss the shape of each of the
following molecules:- (i) hydrogen, (ii) water,
(iii) ammonia, (iv) boron trifluoride.

(66 marks)

2. Give an account of the kinetic theory of gases.
Indicate the principal assumptions on which it is
based.
Show how (i) the evaporation of liquids,
(ii) the diffusion of gases, may be explained on
the basis of the kinetic theory.

(66 marks)

OR

2. Describe, with the aid of a diagram, how you
would prepare and collect sulphur dioxide and give
a full account of its properties.
Illustrate, by means of equations, the action
of sulphur dioxide on any two of the following:-
(i) potassium permanganate, (ii) potassium iodate,
(iii) potassium dichromate. Refer to the conditions
under which the reactions take place.

(66 marks)

3. State what you understand by osmotic pressure
and describe fully how you would measure the osmotic
pressure of a given solution.
An aqueous solution containing 4 gm. of cane
sugar per litre has an osmotic pressure of 199 mm.
of mercury at 0°C. Find the molecular weight of
cane sugar. Find, also, what the osmotic pressure
of the above solution would be at 27·3°C.

(66 marks)

4. Explain what is meant by the letters K, L, M,
s, p, d, f, as used in describing the structures
of elements.
Name the elements represented by the following
electronic configurations:- (a) $1s^2$, $2s^1$,
(b) $1s^2$, $2s^2$, $2p^4$, (c) $1s^2$, $2s^2$, $2p^6$, $3s^1$,
(d) $1s^2$, $2s^2$, $2p^6$, $3s^2$, $3p^6$.
Write the s, p, d, electronic configuration
for (i) nitrogen, (ii) magnesium, (iii) phosphorus.

(66 marks)

OR

4. Give an account of the element aluminium,
referring to its ocurrence, preparation, physical
and chemical properties, and also to the
properties of some of its compounds.
Describe any two tests for the identification
of aluminium ions.

(66 marks)

5. What is meant by (i) ionization potential,
(ii) electron affinity ?
The first ionization potentials, in electron-
volts, for the elements of the second period are
as follows:-

Li	Be	B	C	N	O	F	Ne
5·4	9·3	8·3	11·3	14·5	13·6	17·4	21·6

With two exceptions there is a gradual increase in
ionization potential from left to right. State
and discuss the factors which would account for
this increase.
Account for the gradual decrease in ionization
potential found in Group I (alkali metals).

(66 marks)

6. State what you understand by (i) strong acids,
(ii) weak acids, and give an account of their
characteristic properties. Give two examples of
each type.
Define pH. What substances are normally used
as indicators ? Explain how they function in
finding the end-point of a reaction.
What is the pH of a solution that contains
0·4 gm. of sodium hydroxide per litre of water ?

(66 marks)

OR

6. (a) A precipitate of barium sulphate weighing
0·932 gm. was obtained when all the
barium in a given solution was precipitated.
The solution had been made up by dissolving
0·976 gm. of barium chloride crystals in
distilled water. Use this information to
find the formula for crystalline barium
chloride.

(b) 22 c.c. of decinormal silver nitrate
solution were required to precipitate
completely the chloride ion in 25 c.c.
of a given sodium chloride solution.
Calculate the concentration of the
sodium chloride solution in grams per
litre. Describe how you would carry
out the above titration and mention
the 'indicator' you would use.

(66 marks)

7. Write the structural formula for each of any
four of the following compounds:- (i) ethylene,
(ii) ethyl acetate, (iii) chloroform, (iv) glycerol,
(v) methyl alcohol, (vi) nitrobenzene.
Outline the principal properties of any two of
the above compounds and describe briefly how these
two compounds may be prepared.

(67 marks)

OR

7. (a) An organic acid has the following gravimetric
composition:- carbon 40%, hydrogen 6·66%, oxygen
53·33%. The calcium salt of the acid contains
25·31% calcium. Name the acid, write its
structural formula and give an account of its
principal physical and chemical properties.
(b) When 75 c.c. of a mixture of methane and
ethane were exploded with excess oxygen 100 c.c.
of carbon dioxide were obtained. What was the
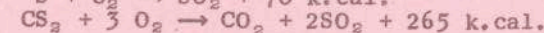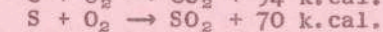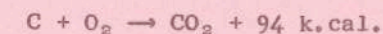composition of the mixture ?

(67 marks)

8. What do you understand by (i) atomic orbitals,
(ii) hybridised orbitals ?
With reference to the hybridisation of carbon
explain what is meant by each of any two of the
following:- (a) sp^3, (b) sp^2, (c) sp. Use
diagrams to illustrate your answer.

(67 marks)

9. Explain the following terms:- (i) an
exothermic reaction, (ii) heat of formation,
(iii) heat of neutralisation.
Describe how you would measure the heat of
neutralisation of hydrochloric acid.
Calculate the heat of formation of carbon
disulphide from the following data:-

$$C + O_2 \longrightarrow CO_2 + 94 \text{ k.cal.}$$
$$S + O_2 \longrightarrow SO_2 + 70 \text{ k.cal.}$$
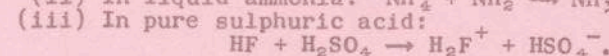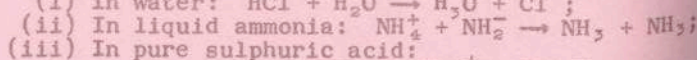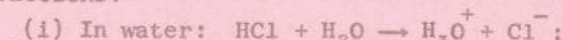$$CS_2 + 3 O_2 \longrightarrow CO_2 + 2SO_2 + 265 \text{ k.cal.}$$

(67 marks)

OR

9. Discuss how the chemical properties of the
elements within a group in the periodic table are
related to their electronic structures. In your
answer confine yourself to any three groups.

(67 marks)

10. Show clearly how the terms (a) Bronsted acid,
(b) Bronsted base, (c) conjugate acid,
(d) conjugate base, apply to the following
reactions:-

(i) In water: $HCl + H_2O \longrightarrow H_3O^+ + Cl^-$;
(ii) In liquid ammonia: $NH_4^+ + NH_2^- \longrightarrow NH_3 + NH_3$;
(iii) In pure sulphuric acid:
$HF + H_2SO_4 \longrightarrow H_2F^+ + HSO_4^-$.

Describe briefly why traditional definitions
of acids and bases are considered inadequate.

(67 marks)