

AN ROINN OIDEACHAIS

LEAVING CERTIFICATE EXAMINATION, 1967

CHEMISTRY - HONOURS

MONDAY, 19th 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, K = 39, Mn = 55, Ag = 108.

1. What do you understand by (i) atomic orbits, (ii) atomic orbitals, (iii) electron energy levels? Describe fully what you understand by 1s, 2s and 2p, respectively.

Write the s, p configurations for (i) lithium, (ii) nitrogen, (iii) fluorine.

(66 marks)

2. Describe and discuss the shape of each of the following molecules:- (i) hydrogen, (ii) hydrogen chloride, (iii) water, (iv) ammonia, (v) methane, (vi) ethylene.

(66 marks)

3. Use equations to illustrate one example of each of the following:-

- (i) the preparation of an aldehyde from an alcohol,
- (ii) the oxidation of an aldehyde,
- (iii) the chlorination of a saturated hydrocarbon,
- (iv) the addition of a halogen to an unsaturated hydrocarbon,
- (v) an addition reaction of an aldehyde,
- (vi) the preparation of an unsaturated hydrocarbon from an alcohol.

Mention the conditions under which each reaction takes place and name the products. Write the structural formula for your product in (v) above.

(66 marks)

4. Select any three of the following compounds and in the case of each of the compounds you select describe its principal physical and chemical properties: (i) lactic acid, (ii) glycerol, (iii) ethyl acetate, (iv) glucose, (v) aniline.

(66 marks)

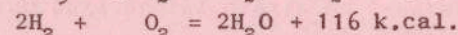
OR

4. What do you understand by the law of mass action?

Describe and discuss the hydrolysis (i) of a salt formed from a strong acid and a weak base, (ii) of a salt formed from a weak acid and a strong base. Give an example in each case. (66 marks)

5. What do you understand by (i) the heat of combustion of an element, (ii) the heat of formation of a compound, (iii) the heat of neutralisation of an acid?

Calculate the heat of formation of ammonia from the following data:-



How would you explain that for strong acids and strong bases in dilute solution, the heat of neutralisation is constant?

(66 marks)

6. (i) What do you understand by a normal solution of (a) sodium hydroxide, (b) sodium carbonate, (c) potassium permanganate?

A solution containing 0.535 gm. ammonium chloride was treated with excess alkali and the ammonia evolved was absorbed in 25 c.c. normal sulphuric acid. What volume of 1.2 N sodium hydroxide would be required to neutralise the remaining sulphuric acid?

(ii) Explain how an indicator works. Name an indicator which could be used in the titration of a strong acid with a weak base; name, also, an indicator which would be unsuitable for this titration.

(66 marks)

7. (i) A mixture contains sodium chloride and potassium chloride. 0.270 gm. of this mixture gave 0.594 gm. of silver chloride by precipitation with silver nitrate solution. Calculate the percentage of sodium chloride in the mixture.

(ii) Describe how you would prepare and collect hydrogen sulphide. Use equations to show the action of hydrogen sulphide on (a) a solution containing copper ions, (b) a solution containing zinc ions, (c) a solution containing ferrous ions. Refer to the conditions under which the reaction takes place in each case.

(67 marks)

OR

7. Show, in the form of a table, the chief properties of (i) electrovalent compounds, (ii) covalent compounds. Classify each of the following under (i) or (ii) and justify your answer in each case:- HCl, BaCl₂, SO₂, CS₂, CH₄, CCl₄.

How could a knowledge of electronegativities be used to support your answer?

(67 marks)

8. The following table gives the standard electrode potentials (in volts) for a number of elements:

Ca/ Ca ²⁺	Mg/ Mg ²⁺	Zn/ Zn ²⁺	Fe/ Fe ²⁺	H ₂ / H ⁺	I ₂ / I ⁻	Br ₂ / Br ⁻	Cl ₂ / Cl ⁻	F ₂ / F ⁻
-2.76	-2.40	-0.76	-0.44	0	+0.58	+1.07	+1.36	+2.85

Discuss the use and importance of this series of elements under the following headings:

- (i) affinity between elements in combination,
- (ii) displacement of elements, (iii) oxidisers and reducers, (iv) discharge of ions in electrolysis, (v) occurrence of metals.

(67 marks)

9. State what you understand by a catalyst and give the chief characteristics of catalytic reactions.

Describe (i) homogeneous catalysis, (ii) heterogeneous catalysis, (iii) autocatalysis, (iv) negative catalysis. Give an example in each case.

Suggest an explanation of how the rate of a chemical reaction is affected by a catalyst.

(67 marks)

10. Outline the principal assumptions on which the kinetic theory of gases is based.

Given the kinetic theory equation $p = \frac{nm\bar{c}^2}{3}$

(where p is the pressure of the gas, n is the number of molecules per unit volume of the gas, m is the mass of a molecule and \bar{c}^2 is the mean square velocity of the molecules) deduce

- (i) Boyle's Law,
- (ii) Graham's Law of Diffusion.

(67 marks)