

REVISION QUESTIONS FOR CHEMISTRY A LEVEL

- Write equations to show how the following conversions can be effected.
 - Bromo benzene from Ethyne
 - Propyne from ethanol
 - Phenylethyne from phenyl ethanol
 - Hexane from propene
 - propan-2-ol from propan-1-ol
- An organic compound **T** on complete combustion yielded 13.2g of carbon dioxide and 2.7g of water. When 4.7g of **T** was vaporized at 273°C and at 760mmHg, it occupied a volume of $2.7 \times 10^{-3} m^3$.
 - Calculate empirical formula of **T**
 - Determine the molecular formula of **T**
 - T** burns with a sooty flame. Identify **T**.
 - Discuss the reactions of **T** with
 - Bromine
 - Propene
 - Ethanoyl bromide
(You answer should include conditions for the reactions and mechanisms for the reactions where possible)
 - Write equation to show how **T** can be synthesized from benzaldehyde
- Carbon, silicon, germanium, tin and lead are elements of Group (IV) of the Periodic Table.
 - Write the electronic configuration of the outer most energy level of group (IV) elements
 - Describe how:
 - Carbon, silicon and lead react with water.
 - Oxides of the elements in b(i) react with sodium hydroxide.
 - Dilute nitric acid was added to trileadtetraoxide (Pb_3O_4) and the mixture warmed.
 - State what would be observed.
 - Write equation for the reaction that took place.
 - The resultant mixture in (c) above was filtered and the residue was added to a solution of manganese (II) sulphate followed by few drops of concentrated nitric acid and the mixture warmed.
 - State what would be observed.
 - Write equation for the reaction.
- Define the following terms.

- (i) Lattice energy
(ii) Hydration energy.
- (b) Given the following thermodynamic data.
- | | |
|--|----------------------------|
| Standard enthalpy of formation of aluminium fluoride | = -1301kJmol ⁻¹ |
| Standard enthalpy of atomization of aluminium | = +314kJmol ⁻¹ |
| Standard enthalpy of bond dissociation of fluorine gas | = +158kJmol ⁻¹ |
| First ionization energy of aluminium | = +577kJmol ⁻¹ |
| Second ionization energy of aluminium | = +1820kJmol ⁻¹ |
| Third ionization energy of aluminium | = +2740kJmol ⁻¹ |
| First electron affinity of fluorine | = -348kJmol ⁻¹ |
- (i) Draw an energy level diagram for the formation of aluminium fluoride and use it to determine the lattice energy of aluminium fluoride.
- (ii) Given that the hydration energies of aluminium ions and fluoride ions are -4690 and -364kJmol⁻¹ respectively. Calculate the enthalpy of solution of aluminium fluoride and hence comment on its solubility in water. (4marks)

(d) State and explain **two** factors that affect the lattice energy.

(e) Would you expect the lattice energy of aluminium chloride to be less than, greater than or equal to that of aluminium fluoride. Explain your answer.

- 5.(a) Describe an experiment that can be carried out to determine the relative molecular mass of benzoic acid in benzene by depression of freezing point method. (Your answer should include a diagram of the apparatus that can be used and the treatment of results).
- (b) State four limitations of the depression of freezing point as a method for determination of molecular mass of a substance.
- (c) A solution containing 0.368g of methanoic acid (HCOOH) in 50g of benzene froze at 5.093°C. Calculate the molecular mass of methanoic acid (The freezing point constant of benzene is 5.5°Cmol⁻¹kg⁻¹ and the freezing point of benzene is 5.533°C)
- (d) Comment on your answer in (c). The molecular mass of methanoic acid is 46).

6. (a) State:

(i) What is meant by the term ideal solution?

(ii) Any two pairs of liquids which form ideal solution when mixed.

(b) A mixture of liquids X and Y at 50°C is an ideal solution. The partial vapour pressure of X in the vapour above the solution varies according to Raoult's law as shown in the table below.

	40.0	100.0	200.0	260.0	320.0
Partial vapour pressure of X (mmHg)					
Mole fraction of X in the solution	0.10	0.25	0.50	0.65	0.80

(i) State Raoult's law.

(ii) Plot on the same axes

- Vapour pressure of X
- Total vapour pressure above the solution against mole fraction of X
(The composition of X in the vapour is 50% when its mole fraction in the solution is 0.19)

(c) Use your graph in b(ii) to determine the vapour pressures of pure X and Y at 50°C

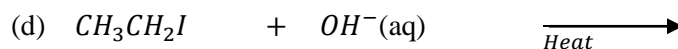
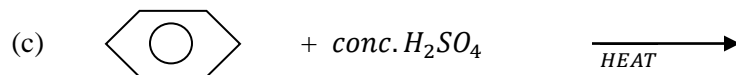
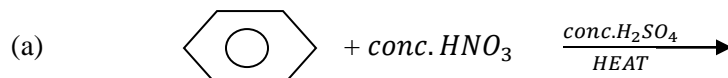
(d) State which of the two liquids is more volatile. Give a reason for your answer.

(e) A mixture of liquids A and B have total vapour pressure of 2.9kpa at 20°C. Given the vapour pressures of A and B are 1.5kpa and 3.5kpa respectively. Assume the mixture obeys Raoult's law. Calculate the:

(i) Mole fraction of A and B.

(ii) Composition of the vapour above the solution.

8. Complete the following equations and in each case outline a mechanism for the reaction.



9. (a) (i) Define the term radioactivity.

(ii) Name three types of radiations emitted during radioactivity and state how they affect the nucleus of the radioisotope.

(b) The table below shows how the mass of a radioisotope of element Z varies with time.

Mass of Z (g)	60.0	38.5	26.0	17.2	11.1
Time (s)	0	40	80	120	160

(i) Plot a graph of logarithm of mass of Z against time.

(ii) Calculate the radioactive decay constant of Z.

(iii) Use your graph to determine the half life of Z.

(iv) Determine the time taken for 8g of Z to decay to 1g.

(c) The half life of carbon 14 is 5600years. Calculate the age of wood in ancient tomb if the initial count is 19counts per minute and the count rate from the ancient wood is 14 counts per minute.

10. (a) Define the term isotopes.

(b) Describe the main steps involved in the operation of a mass spectrometer. (Diagram not required).

(c) The table below shows the information from amass spectrum of lead sample.

Isotope	Deter current /mA
204	0.16
206	2.72
207	2.50
208	5.92

Calculate:

(i) The relative abundance of the different isotopes of Lead in the sample used.

(ii) The relative atomic mass of lead.

(d) State two advantages of using mass spectrometer for determination of relative masses.

(e) The initial count of a radioactive nucleus was 680 per second. After 350 seconds the count rate was 125 per second, calculate the:

(i) Decay constant

(ii) Half life of the nucleus.

11. (a) Define the term

(i) Order of reaction.

(ii) Molecularity of a reaction.

(b) Describe an experiment that can be carried out to determine the rate of decomposition of hydrogen peroxide.

(c). the table below the variation in the volume of potassium manganate (VII) with time when added to 25cm³ of a solution of hydrogen peroxide at intervals.

Time(minutes)	5	10	20	30	50
Volume of $KMnO_4(cm^3)$	37.1	29.8	19.6	12.3	5.0

(i) Plot a graph of volume of potassium manganate (VII) against time.

(ii) Use your graph to determine the half life for the decomposition of hydrogen peroxide.

(iii) Calculate the rate constant for the decomposition of hydrogen peroxide and state its units.

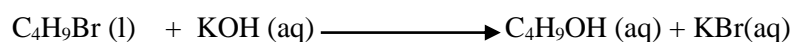
(d) State the effect of addition of iron (III) chloride and sodium hydroxide solution on the decomposition of hydrogen peroxide.

12. (a) What is meant by the terms.

- (i) order of reaction
(ii) half-life of a reaction
- (b) The rate equation for the reaction.

$$\text{S}_2\text{O}_3^{2-}(\text{aq}) + 2\text{H}^+(\text{aq}) \longrightarrow \text{SO}_2(\text{g}) + \text{S}(\text{s}) + \text{H}_2\text{O}(\text{l})$$
is
Rate = $k [\text{S}_2\text{O}_3^{2-}][\text{H}^+]^2$
- (i) State how the rate will be affected if the concentrations of the reactants are both doubled.
- (ii) Describe an experiment to determine the order of the reaction with respect to $\text{S}_2\text{O}_3^{2-}$ in the laboratory.

- (c) The table below shows the kinetic data for the reaction between hot aqueous potassium hydroxide and alkyl bromide ($\text{C}_4\text{H}_9\text{Br}$)



Experiment	$[\text{C}_4\text{H}_9\text{Br}]$ (mol dm^{-3})	$[\text{KOH}(\text{aq})]$ (mol dm^{-3})	Initial rate ($\text{mol dm}^{-3} \text{s}^{-1}$)
1	1.0×10^{-3}	1.0×10^{-3}	5.0×10^{-8}
2	2.0×10^{-3}	1.0×10^{-3}	1.0×10^{-7}
3	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-7}

- (i) determine the overall order of reaction.
(ii) determine the rate constant for the reaction and state its units.
(iii) identify the alkyl bromide.
- (d) Write the mechanism for the reaction in (c) above.
- (e) Draw a well labelled energy level diagram for the reaction mechanism illustrated in (d) above.
13. (a) state what is meant by the terms;
- (i) Rate constant.
(ii) Molecularity of a reaction.
- (b) Describe an experiment to show that the reaction of Propanone with iodine is a zero order reaction with respect to iodine.

- (c) Sucrose reacts with water in acidic condition to form glucose according to the following equation.



The kinetic data for the reaction is shown below.

Time(minutes)	0	2.0	4.0	7.0	10.0	14.0	20.0
$[\text{sucrose}]/\text{mol dm}^{-3}$ reacted	0	0.18	0.330	0.51	0.628	0.76	0.859

The initial concentration sucrose is 1.0mol dm^{-3}

- (i) Plot a graph of concentration of sucrose remaining against time
- (ii) Use the graph to determine the order of the reaction and rate constant.
- (d) Apart from concentration state any other two factors which affect the rate of reaction.

14. (a) Describe how iron can be extracted from iron pyrite.

(your answer should include equations for the relevant reactions)

(b) write equations and state the conditions for the reactions of iron and

(i) oxygen.

(ii) water.

(c) state how the following chlorides can be prepared in the laboratory in the anhydrous forms.(your answers should include equations)

(i) Iron (II) chloride

(ii) Iron (III) chloride

(d) State what would be observed and write equation for the reaction that would take place if solutions of iron (II) ions and iron (III) ions were separately treated with potassium thiocyanate (KSCN) solution.

15. A white crystalline solid Q is sparingly soluble in water and has relative molecular mass 122. When dissolved in benzene the apparent molecular mass is 240. Compound Q contains 68.8% carbon, 4.92% hydrogen and the rest oxygen.

(a) (i) determine the empirical formula of Q

(ii) Determine the molecular formula of Q

(iii) Explain the difference in molecular masses of Q in aqueous solution and in benzene.

(b) A 0.001M solution of Q in water has a pH =3.2 and reacts with sodium hydroxide to form salt

(i) Explain why aqueous solution of Q has pH=3.2

(ii) Identify Y

(c) Q reacts with ethanol in the presence of an acid catalyst to give X

(i) Write the equation for the reaction and give IUPAC name of X

(ii) Suggest a mechanism for the reaction above

(d) (i) suggest one method of synthesis of Q

(ii) Name one reagent that can be used to distinguish between Q and hydroxybenzene and state what would be observed.

16. (a) Write the name and formula of the main ore of aluminium.
- (d) Describe how pure aluminium can be obtained from the named ore.
- (c) Describe the reactions of aluminium with
- (i) Sulphuric acid
 - (ii) Chlorine
 - (iii) Sodium hydroxide
- (d) Write equation for the reaction between aluminium and
- (i) Chromium (III) oxide
 - (ii) Trimanganese tetra oxide
17. (a) (i) explain why fluorine shows some differences in its properties from the rest of the elements of group(VII) in the periodic Table.
- (ii) state four properties in which fluorine differs from chlorine
- (b) state the conditions and write equations for the reactions between sodium hydroxide and
- (i) chlorine
 - (ii) fluorine
- (c) write equation for the reaction between hydrofluoric acid and silicon(IV) oxide.
18. (a) state (i) what is meant by azeotropic mixture
- (ii) properties of azeotropic mixture
- (b) two liquids X and Y of boiling points 100 and 85 respectively shows negative deviation from Raoult's law. Explain.
- (i) the cause of negative deviation when the two liquids are mixed
 - (ii) what happens to temperature and volume of the system on mixing.
- (c) sketch a labeled boiling composition diagram for the mixture in (b) and explain the shape the curve
- (d) (i) state one similarity and one difference between azeotropic mixture and a compound.
- (ii) describe what would happen if a mixture containing about 80 of X is fractionally distilled.
- (e) describe an experiment that can be carried out in the laboratory determine the distribution coefficient of ammonia between water and chloroform.

END