Phone: +442081445350
www.chemistryonlinetuition.com
Email: asherrana@chemistryonlinetuition.com

CHEMISTRY

PHYSICAL CHEMISTRY

LEVEL & BOARD:	OCR (AS - LEVEL)
TOPIC:	AMOUNT OF SUBSTANCE
PAPER TYPE:	QUESTION PAPER 2
TOTAL QUESTIONS	10
TOTAL MARKS	50

Amount of Substance

1. Zinc reacts with hydrochloric acid, HCl(aq), as shown in the following equation.

$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$

A student investigates the rate of this reaction. The student plans to react 50.0 cm^3 of 0.100 mol dm^{-3} HCl with 0.200 g of zinc (an excess).

Calculate the volume, in cm^3, of hydrogen that should be produced at RTP. [3]

2. An aqueous solution of aluminium chloride can be prepared by the redox reaction between aluminium metal and dilute hydrochloric acid.

(a) A student reacts 0.0800 mol of aluminium completely with dilute hydrochloric acid to form an aqueous solution of aluminium chloride. The equation for this reaction is shown below.

$2Al(s) + 6HCl(aq) \rightarrow 2AlCl_3(aq) + 3H_2(g)$

Calculate the volume of hydrogen gas formed, in dm^3, at room temperature and pressure. [2]

(b) Calculate the mass of AlCl3 formed. Give your answer to three significant figures. [2]

(c) Calculate the volume, in cm3, of 1.20 mol dm-3 hydrochloric acid needed to react completely with 0.0800 mol of aluminium. [2]

3. A student reacts 35.0 cm^3 of 3.00×10^{-2} mol dm^{-3} $H_2SO_4(aq)$ with an excess of Al. An equation for this reaction is shown.

$2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$

Calculate the mass, in g, of $Al_2(SO_4)_3$ formed in solution. Give your answer to three significant figures. Show your working. [4]

4. Europium reacts with dilute sulfuric acid, forming a solution of europium sulfate and hydrogen gas.

(a) A chemist reacts 0.608 g of europium with an excess of $H_2SO_4(aq)$ and collects 144 cm^3 of hydrogen gas at room temperature and pressure. Analyse the chemist's results to write the overall equation for the reaction between europium and sulfuric acid. Show all your working. Equation.[6]

(b) Calculate the number of europium atoms in 0.0019 g of europium. [2]

5. Alkenes can be prepared from alcohols. Cyclopentene can be prepared from cyclopentanol as shown in the equation below.

A student plans to prepare 5.00 g of cyclopentene from cyclopentanol. The percentage yield of this reaction is 45.0%.

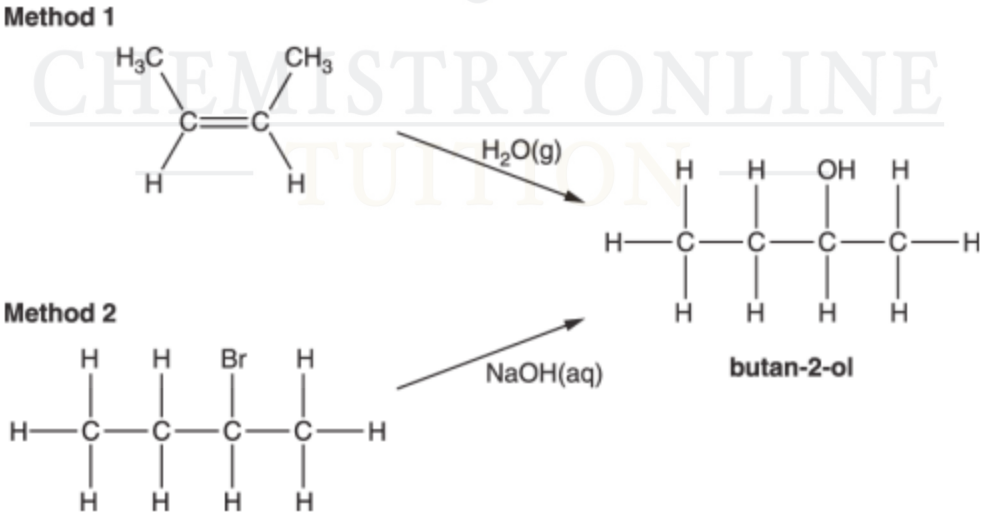
(a) What is the name of this type of reaction? [1]

(b) Calculate the mass of cyclopentanol that the student should use. Show your working. [3]

6. 1.00 tonne of ammonia is reacted with carbon dioxide to prepare the fertiliser urea.
$NH_2CONH_2.2NH_3(g) + CO_2(g) \rightarrow NH_2CONH_2(s) + H_2O(1)$
1.35 tonnes of urea are formed. Calculate the percentage yield of urea. Show all your working. [3]

7. An alkene D is a liquid at room temperature and pressure but can easily be vaporised. When vaporised, 0.1881 g of D produces 82.5 cm^3 of gas at 101 kPa and 373 K. Determine the molar mass and molecular formula of alkene D. Show all your working. [5]

8. This question is about alcohols.
(a) Butan-2-ol can be prepared using two different methods.



Comment on the atom economy of each method, giving your reasons. [2]

(b) A student uses Method 2 to prepare 3.552 g of butan-2-ol from 2-bromobutane. The percentage yield of butan-2-ol is 80.0%. Calculate the mass of 2-bromobutane that the student uses. [3]

9. When magnesium nitrate, $Mg(NO_3)_2$, is heated, it decomposes as shown. $2Mg(NO_3)_2(s) \rightarrow 2MgO(s) + 4NO_2(g) + O_2(g)$

A student heats 2.966 g of $Mg(NO_3)_2$, which decomposes as above.

Calculate the total volume of gas formed, in cm3, at room temperature and pressure, RTP. [3]

10. Barium combines with oxygen, chlorine and nitrogen to form ionic compounds

(a) Barium oxide, BaO, has a giant ionic lattice structure.

i. State what is meant by the term ionic bond. [1]

ii. Draw a 'dot-and-cross' diagram to show the bonding in barium oxide. Show outer electrons only. [1]

iii. Calculate the number of barium ions in 1.50 g of barium oxide. Give your answer in standard form and to three significant figures. [1]

(b) Barium chloride, $BaCl_2$, is soluble in water.

i. Compare the electrical conductivities of solid and aqueous barium chloride. Explain your answer in terms of the particles involved. [2]

ii. Describe the use of aqueous barium chloride in qualitative analysis. [2]

iii. Hydrated barium chloride can be crystallised from solution. Hydrated barium chloride has the formula $BaCl_2.xH_2O$ and a molar mass of 244.3 g mol^{-1}. Determine the value of x in the formula of $BaCl_2.xH_2O$. [2]

www.chemistryonlinetuition.com

DR. ASHAR RANA (M.B.B.S)

- Founder & CEO of Chemistry Online Tuition Ltd.
- Completed Medicine(MBBS) in 2007
- 15 years of teaching experience in London
- CIE & EDEXCEL Examiner since 2015
- Chemistry, Physics, Maths and Biology Tutor.

CONTACT US

Phone: +442081445350
Email: asherrana@chemistryonlinetuition.com
Web: chemistryonlinetuition.com

REQUEST TUITION

Dr. Ashar Rana www.chemistryonlinetuition.com asherrana@chemistryonlinetuition.com