

KARATU SECONDARY SCHOOL

CHEMISTRY FORM FIVE AND SIX HOME PACKAGE

Instructions

Answer all questions and submit to chemistry department when the school is open or submit through

Email: maxcanthony@gmail.com

Mwl.Maxcmillian Anthony

Contact: 0763-903 667

1. (a) Under what conditions and by what mechanism does phenol react with i.

Bromoethane

- ii. Benzenediazonium chloride iii.

Bromine water

- iv. Benzenecarbonyl chloride

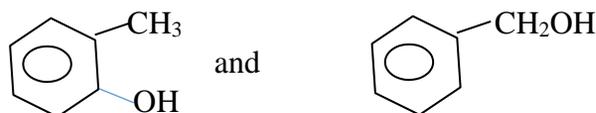
- v. Dilute nitric acid

- (b) Compare and contrast the reaction of alcohols, aromatic alcohols, and phenols by considering the reactions (if any) of ethanol, phenylmethanol and phenol respectively with;

- Aq. Na_2CO_3
- Aq. NaOH
- Na Metal
- $\text{CH}_3\text{CO}(\text{OH})$
- Acidified KMnO_4

(c)

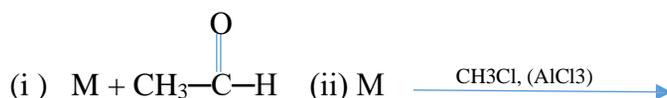
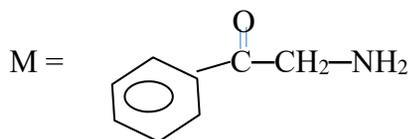
- i. Give one chemical test (in each case) which will distinguish between the following compounds $\text{CH}_3\text{CH}_2\text{OH}$ and $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$; CH_3OH and $\text{CH}_3\text{CH}_2\text{OH}$;

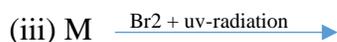


- ii. Account for the following observations:

- The rate of reaction of alcohols with HBr gas increases from 1° , 2° to 3°
- The rate of reaction of alcohols with sodium metal and ethanoic acid decreases from 1° , 2° to 3°

2. (a) write the structural formula for each of the organic compounds formed when Compound M reacts as shown below:





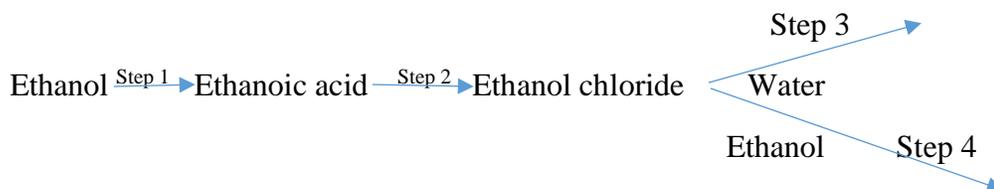
(b) On analysis, a compound Q of r.m.m 59 was found to be of the following percentage composition : 40.67% C, 8.5% H, 23.27% N, with the remainder oxygen. What is the molecular formula of Q? What is its structural formula and name? How and under what conditions does Q react with;

- (i) NaOH
- (ii) P₂O₅
- (iii) Br₂/NaOH

(c) Explain which of the following pairs of compounds are likely to give polymeric products when allowed to react under appropriate conditions

- (i) C₆H₅-C(O)Cl and HO-CH₂CH₂-OH
- (ii) NaO-CH₂CH₂-ONa and Br-CH₂CH₂-Br
- (iii) CH₃-(CH₂)₁₀-CO (OH) and HO-(CH₂)₁₂-CH₃

3. (a) Examine the following reaction scheme:



- (i) Name a suitable reagent, or reagents, for step 1
- (ii) Name a suitable reagent, or reagents, for step 2
- (iii) Give the structural formula of the organic product in step 3 and name it
- (iv) Write down the structural formula of organic product in step 4 and name it

(b) The following three compounds are sparingly soluble in water but very soluble in ether.

The compounds are such as N-phenylethanamide, 4-methylbenzoic acid and

4-methylphenylamine. A mixture of all three compounds given above was dissolved in

ether. The solution was put into a separating funnel and shaken with excess dilute

hydrochloric acid. The aqueous layer was collected in flask "A". Next ether was shaken

with excess aqueous sodium bicarbonate solution. The new aqueous layer was collected in

flask labelled "B". The remaining layer was transferred into a flask labelled "C".

- (i) With the help of chemical equations where necessary, which of three compounds is

contained in flask A, B and C

(ii) An organic compound has a relative molecular mass of 88. It was found to have two isomers, an aliphatic carboxylic acid and aliphatic ester. Write the structural formulae of the two isomers and give their IUPAC names.

4. The standard electrode potentials of some electrodes are

$$E^\circ(\text{Zn}^{2+}/\text{Zn}) = -0.76\text{V}; E^\circ(\text{Cd}^{2+}/\text{Cd}) = -0.40\text{V}; E^\circ(\text{Ag}^+/\text{Ag}) = 0.80\text{V};$$

$$E^\circ(\text{Fe}^{2+}/\text{Fe}) = -0.44\text{V}$$

Which of the following cells will be feasible and which will not be feasible. Explain your

(a) $\text{Zn}/\text{Zn}^{2+} // \text{Cd}^{2+}/\text{Cd}$ (b) $\text{Fe}/\text{Fe}^{2+} // \text{Zn}^{2+}/\text{Zn}$ (c) $\text{Cd}/\text{Cd}^{2+} // \text{Ag}^+/\text{Ag}$ (d) $\text{Fe}/\text{Fe}^{2+} // \text{Ag}^+/\text{Ag}$

5. Given the standard electrode potentials $E^\circ\text{Al}^{3+}/\text{Al} = -1.66\text{V}$ and $E^\circ\text{Ag}^+/\text{Ag} = +0.80\text{V}$

Out of aluminium and silver vessel, which one will be more suitable to store 1M HCl Solution and why?

6. 15.0cm^3 of 0.05M SeO_2 reacts with 30.6cm^3 of 0.1M CrSO_4 solution. If during the reaction CrSO_4 gets oxidized to $\text{Cr}_2(\text{SO}_4)_3$, to what oxidation state does selenium get converted?

7. SiCl_4 forms SiCl_6^{2-} while CCl_4 does not form CCl_6^{2-} . Explain.

8. SiF_6^{2-} is known but SiCl_6^{2-} is not known

9. Account for the following:

(a) PbX_2 is more stable than PbX_4 ($\text{X} = \text{Cl}, \text{Br}$)

(b) PbCl_4 is less stable than SnCl_4 but PbCl_2 is more stable than SnCl_2

10. The enthalpy of formation of hypothetical $\text{CaCl}(\text{s})$ theoretically found to be -188kJmol^{-1} and

$\Delta_f H^\circ$ for $\text{CaCl}_2(\text{s})$ is -795kJmol^{-1} . Calculate the $\Delta_f H^\circ$ for the disproportionation reaction:



11. Magnesium metal burns in air to form a white ash. On treating the white ash with water, odour of ammonia is detected

12. (a) mention three differences between solubility product and ionic product

(b) The concentration of sulphide ion in 0.01M HCl solution saturated with hydrogen sulphide is $1.0 \times 10^{-19}\text{M}$. If 10cm^3 of this solution is added to 5cm^3 of 0.04M of the following:

FeSO₄, MnCl₂, ZnCl₂ and CdCl₂, in which of these solutions precipitation will take place?

Given K_{sp} values: FeS = 6.3 × 10⁻¹⁸, MnS = 2.5 × 10⁻¹³, ZnS = 1.6 × 10⁻²⁴,

CdS = 8.0 × 10⁻²⁷.

(c) Calculate the molar solubility of Ni(OH)₂ in 0.10M NaOH. The solubility product of

Ni(OH)₂ is 2.0 × 10⁻¹⁵

(d) The pH of a 0.1 M solution of NH₄Cl is 5.127. Calculate

(i) The degree of hydrolysis

(ii) The hydrolysis constant

(iii) Dissociation constant of the base

13. (a) State the following laws

(i) Mendeleev's periodic law

(ii) Modern periodic law

(iii) Newland's law of octaves

(iv) Dobereiner's triads

(b) Assign the position of the element in the periodic table having outer electronic

configuration:

(i) ns² np⁴ for n = 3

(ii) (n-1) d² ns² for n = 4

(iii) (n-2) f⁷ (n-1) d² for n = 6

14. (a) What are basic oxides and acidic oxides

(b) Describe clearly how you would prepare crystals of copper (ii) sulphate from copper (ii) oxide

(b) Describe using chemical equation, a chemical test that can be used to identify sulphates in Solution

(c) Explain any six uses of metal sulphates

15. (a) State the two thermochemical laws
- (b) 50cm³ of 0.5M NaOH solution were required 20 cm³ of 0.5M H₂SO₄ for neutralization. The temperature rise of 3.4K was observed that both solutions and the calorimeter were initially at the same temperature. Calculate the standard enthalpy of neutralization of NaOH and H₂SO₄. [Given the heat capacity of the calorimeter is 39JK⁻¹ and the specific heat capacity of solutions is 4.2 Jg⁻¹K⁻¹]
16. (a) Explain the following with one example to each
- (i) Wurtz fitting reaction
 - (ii) Wurtz reaction
- (b) (i) What is isomerism
- (ii) Write all isomers of C₅H₁₀
- (c) With reference to CH₄, explain the following terms
- (i) Chain initiation
 - (ii) Chain propagation
 - (iii) Chain termination
17. (a) Explain why alkyl chloride are not friendly to environment
- (b) Mention any four uses of haloalkanes
18. (a) Explain why tertially haloalkane are resistant to SN₂
- (b) The Nucleophilic substitution reaction of haloalkane follow the order I>Br>Cl>F. Explain why this order
19. (a) Define the following
- (i) Ozone layer depletion
 - (ii) Global warming
20. (a) Using chemical equations, show how ozone is formed
- (b) With the aid of chemical equations, describe how ozone layer destruction occurs in the atmosphere and what measures can be taken to reduce the ozone layer depletion
21. Outline, with equations how the following changes may be affected.

(a) Ethanol to 1,2-dibromoethane (b) Ethylamine to ethanoic acid

(c) Ethyne to bromoethane (d) 1,2-dibromoethane to ethanedioic acid

22. Explain, with balanced equations, how four of the following conversions may be brought

About

(a) Methanol to ethanol (b) Propanone to 2,4,6-tribromophenylamine

(c) Ethanoic acid to ethanonitrile (d) Calcium dicarbide to copper(i) carbide (acetylide)

23. Explain, with the aid of examples taken from commercial plastics, the principles involved in

(a) Addition polymerization (b) Condensation polymerization

24. Indicate the properties needed by a polymer to make it suitable for use in one of the

Following

(a) A fishnet (b) Soles of shoes (c) insulation of an electrical cable (d) A cup

(e) A cheap plastic container eg for liquid soap (f) Heat insulation for fridges

25. Define what is meant by the glass Transition temperature T_g . Give three features of a

polymer's molecular structure which can influence T_g . Would you expect the T_g for

Polyethyldibenzene-1, 4-dicarboxylate (Terylene) to be higher or lower than the T_g for nylon

6? Explain your answer

26. What volume of concentrated aqueous sulphuric acid which is 98.0% H_2SO_4 by mass and has

a density of 1.84g mL^{-1} is require to prepare 10.0L of 0.200M H_2SO_4 solution.

27. Calculate the value of Rydberg constant, R if for He^+ ions the difference between the longest

wavelength line of balmer series and Lyman series is 133.8nm

28. When would the wavelength associated with an electron become equal to the wavelength

associated with proton? (mass of electron = $9.1095 \times 10^{-27}\text{kg}$)

29. The balmer series in the hydrogen spectrum corresponds to the transition from $n_1 = 2$ to

$n_2 = 3, 4, \dots$. This series lies in the visible region. Calculate the wave number of line associated with the transition in Balmer series when the electron moves to $n = 4$ orbit.

30. 1 mole of sulphur dioxide occupies a volume of 350ml at 27°C and $5 \times 10^6\text{Pa}$. Calculate the compressibility factor of the gas. It is less or more compressible than an ideal gas