

TRINITY CATHOLIC COLLEGE

2005

Higher School Certificate Half Yearly Examination

Chemistry

PART A - MULTIPLE CHOICE - 10 MARKS

1. Bromine water can be used to distinguish between which of the two substances below?

- (A) Ethane and octane
(B) Octane and octene
(C) Ethene and octene
(D) Ethane and ethanol

2. Which of the following states what happens to the high molecular weight fractions in crude oil during the process of catalytic cracking?

- (A) They combine to form higher molecular weight compounds
(B) They add together without loss of electrons
(C) They break down into lower molecular weight compounds
(D) They form by the elimination of a small molecule.

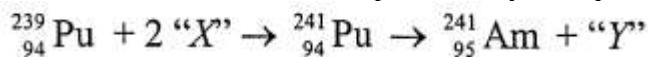
3. The molar heat of combustion of ethanol is $-1367 \text{ kJ mol}^{-1}$. What does this mean?

- (A) It needs 1367 kJ of energy to completely burn one mole of ethanol
(B) 1367 kJ of energy is used up when 46.1 g of ethanol undergoes complete combustion
(C) The chemical energy of ethanol is decreased by 1367 kJ when one mole of ethanol is converted to carbon dioxide and water
(D) There is a transfer of 1367 kJ from the environment to ethanol during the complete combustion of one mole of ethanol

4. Four beakers, each containing a metal chloride solution, were set up in a laboratory. Beaker A contained CuCl_2 , Beaker B contained PbCl_2 , Beaker C contained FeCl_2 and Beaker D contained NaCl . What would happen in each beaker when a piece of steel wool was placed into the beaker?

- (A) No reaction in any beaker
(B) The steel wool would displace the metal ions in Beaker A only
(C) The steel wool would displace the metal ions in Beaker D only
(D) The steel wool would displace the metal ions in Beakers A and B only

5. Americium-241 is a radioisotope used in domestic smoke detectors. The production of this transuranic element in a nuclear reactor is represented by the equation below.



What are the names of the particles represented by the letters "X" and "Y"?

	X	Y
(A)	neutron	electron
(B)	electron	proton
(C)	neutron	proton
(D)	proton	electron

6. The table below shows the colour change of a variety of indicators at different pH values.

Indicators	pH: 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Methyl orange	← red →				← yellow →									
Bromocresol green	← yellow →				← blue →									
Phenol red	← yellow →						← red →							
Phenolphthalein	← colourless →								← red →					

Kim used four indicators to help work out if a liquid was an acid or a base

Each indicator was added to a separate test tube of the same liquid. Kim recorded the final colour in each test tube.

Test tube	Indicator added	Final colour
1	Methyl orange	Yellow
2	Bromocresol green	Blue
3	Phenol red	Yellow
4	Phenolphthalein	Colourless

What is Kim's liquid?

- (A) Acid, pH 6 (B) Base, pH 6
(C) Acid, pH 8 (D) Base, pH 8

7. A can of carbonated soft drink contains some interesting equilibria.

Which of the following sets of conditions favours the formation of $\text{H}_2\text{CO}_3(\text{aq})$?

- (A) Low pH and low pressure (B) Low pH and high pressure
(C) High pH and low pressure (D) High pH and high pressure

8. In the following diagram the elements from the periodic table are arranged into three groups.

Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca		Ge	As	Se	Br
Rb	Sr		Sn	Sb	Te	I
Cs	Ba		Pb	Bi	Po	At
Group X		Group Y		Group Z		

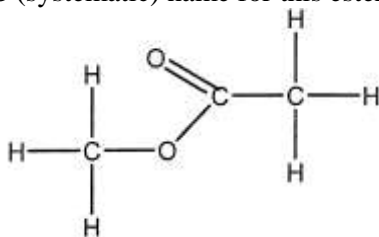
What type of oxides are groups X, Y and Z?

	Group X	Group Y	Group Z
(A)	Amphoteric	Acidic	Basic
(B)	Acidic	Amphoteric	Basic
(C)	Basic	Acidic	Amphoteric
(D)	Basic	Amphoteric	Acidic

9. Which of the following is a dilute, strong acid?

- (A) $0.05 \text{ mol L}^{-1} \text{HCl}$ (B) $5.00 \text{ mol L}^{-1} \text{HCl}$
(C) $0.05 \text{ mol L}^{-1} \text{CH}_3\text{COOH}$ (D) $5.00 \text{ mol L}^{-1} \text{CH}_3\text{COOH}$

10. What is the IUPAC (systematic) name for this ester?



- (A) Ethyl methanoate
(C) Methyl methanoate

- (B) Ethyl ethanoate
(D) Methyl ethanoate

Part B : Total Marks (60)

Question 11 (4 marks)

Discuss the benefits associated with the use of radioisotopes in either industry or medicine. [4]

Question 12 (5 marks)

Chlorine is used for the manufacture of $\text{C}_2\text{H}_3\text{Cl}$, a monomer that undergoes addition polymerisation.

- (a) Draw the full structural formula for $\text{C}_2\text{H}_3\text{Cl}$ and give the systematic name for the monomer. [2]
(b) Evaluate the usefulness of the polymer formed from $\text{C}_2\text{H}_3\text{Cl}$. [3]

Question 13 (5 marks)

During your practical work you performed a first-hand investigation to carry out the fermentation of glucose.

- (a) Describe the conditions under which this fermentation was carried out. [2]
(b) Explain how mass changes were used to monitor the fermentation process. A suitable equation should be included in your answer. [3]

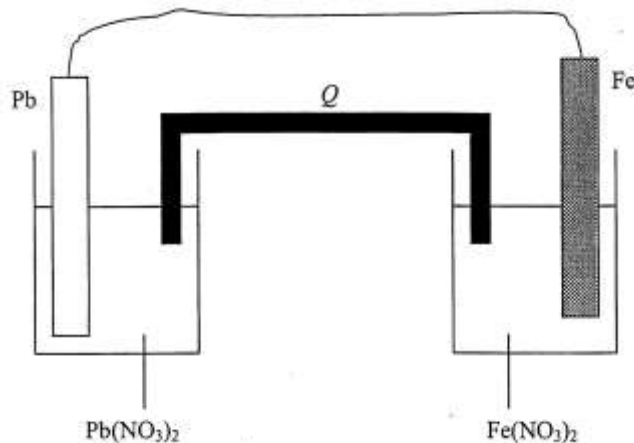
Question 14 (5 marks)

Ethanol is widely used as a solvent. Most ethanol required for industrial use is produced using raw materials obtained from the refining of petroleum.

- (a) Write an equation for the production of ethanol, identifying any catalysts required. [2]
(b) Describe and account for two uses of ethanol as a solvent. [3]

Question 15 (5 marks)

A simple galvanic cell can be made using a lead electrode standing in a lead nitrate solution and an iron electrode standing in an iron nitrate solution.



- (a) Suggest materials that could be used to make Q. Explain your choice. [2]
(b) Determine the cell voltage under standard conditions. [3]

Question 16 (6 marks)

Evaluate the use or potential use of a specific named biopolymer that you have studied. [6]

Question 17 (5 marks)

A student determined the concentration of acetic acid (ethanoic acid) in some white vinegar by titrating a sample of the vinegar that had been diluted, accurately, by a factor of 5. A standardised $0.0950 \text{ mol L}^{-1}$ sodium hydroxide solution was used for the titration. The student's results are shown below.

Volume of diluted vinegar = 25.0 mL	
Volume of standardised sodium hydroxide solution (mL):	
1 st titration	34.2
2 nd titration	33.5
3 rd titration	33.7
4 th titration	33.6

(a) The following indicators were available for the student to use.

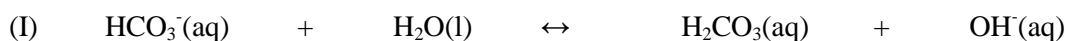
<i>Indicator</i>	<i>Colour Change</i>	<i>pH range</i>
Methyl orange	red-yellow	3.1 - 4.4
Bromocresol green	yellow-blue	3.8 - 5.4
Bromothymol blue	yellow-blue	6.2 - 7.6
Phenolphthalein	colourless-red	8.3 - 10.0

Explain which of these indicators would be best for this titration. [2]

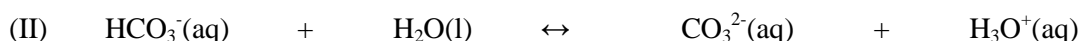
(b) Calculate the concentration of acetic acid (ethanoic acid) in the undiluted vinegar. [3]

Question 18 (3 marks)

A student dissolved some NaHCO_3 in a small amount of water. She knew that $\text{HCO}_3^-(\text{aq})$ could react in each of the following ways.



OR :



(a) Name the type of behaviour being shown by $\text{HCO}_3^-(\text{aq})$. [1]

(b) Describe a simple test you could perform to determine whether reaction I or II is more likely to occur. Give the expected result for your test. [2]

Question 19 (3 marks)

Explain the purpose of the apparatus below for preparing an ester.



Question 20 (6 marks)

A sample of lignite, a high sulfur content coal, was analysed and found to contain 4.32% sulfur.

(a) Calculate the volume of sulfur dioxide, at 25°C and 100 kPa that would be produced by burning 1.0 kg of lignite coal. [3]

(b) Assess the impact, on the environment, of using lignite as a fuel. [3]

Question 21 (6 marks)

Different theories of acids and bases were developed by Lavoisier, Davy, Arrhenius and Bronsted-Lowry. Sulfuric acid, H_2SO_4 was classified as an acid by all of these scientists.

Explain how each of their theories predicts that H_2SO_4 is an acid. Support your answer by using equations where appropriate. [6]

Question 22 (7 marks)

You planned and performed a first-hand investigation to measure the pH of identical concentrations of strong and weak acids.

(a) Describe the procedure carried out. Identify the independent and dependent variables as well as those that needed to be kept constant. [5]

(b) Identify a hazard in this experiment and outline a precaution to minimise this hazard. [2]