2005

Half-yearly Examination

Chemistry

General Instructions

- Reading time – 5 minutes
- Working time – 1.5 hours
- Write using blue or black pen
- Draw diagrams using pencil
- Approved calculators may be used
- Write your student I.D. number on each answer sheet

Total marks   55

Section A   8 multiple choice questions worth 1 mark each
Section B   11 written response questions worth 47 marks in total

Section A

1. Ethyl benzene is the systematic name of a commercially significant monomer. What is the common name of the polymer made from this monomer?

(A) polyethylene

(B) polyvinyl chloride

(C) polyvinyl acetate

(D) polystyrene

2. Which statement is most correct concerning the addition of bromine water to hexane?

(A) The reaction is rapid and the bromine water changes colour.

(B) The reaction is rapid and the hexane changes colour.

(C) The reaction is slow and requires UV light to proceed

(D) The reaction is slow and works best in the dark.

3. When added to water the oxides of group 1 are

(A)   acidic

(B)   basic

(C)   insoluble

(D)   amphoteric.

4. The pH of a 0.0015mol/L solution of HCl is closest to

(A)   1.4
(B)   11.2
(C)   1.5
(D)   2.8

5. Which is the correct IUPAC name for citric acid?

(A)   2-hydroxypropane-1,2,3-tricarboxylic acid
(B)   2-hydroxypropane-triethanoic acid
(C)   1,2,3-tricarboxylic acid
(D)   ascorbic acid

6. Which of the following lists contain the products that result from the fermentation of glucose.

(A) carbon dioxide, water
(B) ethanol and water
(C) ethanol , water and carbon dioxide
(D) ethanol and carbon dioxide.

7. The pH of an acid was found to be 0.27. The concentration of the H^+ ions in this solution is

(A) 0.54 mol/L
(B) 160 mol/L
(C) 5.3 mol/L
(D) 0.27 mol/L

8. Which of the following equations could represent the formation of a transuranic element?

(A) $^{238}_{92}U + ^{4}_{2}He \rightarrow ^{239}_{94}Pu + 3^{1}_{0}n$

(B) $^{238}_{92}U \rightarrow ^{234}_{90}Pu + ^{4}_{2}He$

(C) $^{2}_{1}H + ^{2}_{1}H \rightarrow ^{3}_{1}H + ^{1}_{1}H$

(D) $^{1}_{0}n + ^{238}_{92}U \rightarrow ^{88}_{38}Sr + ^{136}_{54}Xe + 12^{1}_{0}n$

Section B

9.   A student carried out an investigation to monitor the mass changes involved when a soft drink is de-carbonated. The student weighed a sealed can of soft drink and found its mass to be 400 g. The can was then placed on a set of scales connected to a data logger. The can was then opened and the mass of the can and its contents was recorded every hour over a 12 hour period. The following results were obtained.

Time after opening can (hours)	Mass of can and contents (grams)
0	400
1	396
2	393
3	391
4	390
5	390
6	390
7	390
8	390
9	390
10	390
11	390
12	390

(a)   Assuming that all the mass loss was due to the release of carbon dioxide draw a graph of the mass of carbon dioxide released vs the time after opening.   **3 marks**

(b)   Describe what happens to the rate of production of carbon dioxide as time proceeds.   **1 mark**

(c)   Calculate the volume that the carbon dioxide when released, would occupy at STP.   **2 marks**

(d)   In part (a), the law of conservation of matter was applied to assist in the analysis of this investigation. Does this investigation alone validate the law of conservation of matter. Justify your answer.   **1 mark**

(e)   The following reaction describes the equilibrium of carbon dioxide in water

$$CO_{2(g)} + H_2O_{(l)} \leftrightarrow H_2CO_{3(aq)}$$
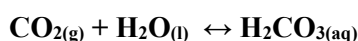
Given that the forward reaction above is exothermic explain in terms of Le Chetalier's principle what would happen to the slope of the graph if the temperature was lowered.   **3 marks**

10.   Outline how you would convert ethylene to ethanol.   **1 mark**

11.   Biopolymers have a long history of use, but much research is proceeding on a new generation of biopolymers. Complete the table below providing information about a recently developed biopolymer you have studied.   **2 marks**

Name of biopolymer	
Specific enzyme or organism used to synthesize the biopolymer	
Possible use of biopolymer	
Property of biopolymer that relates to its use	

12. Identify an isotope used in medicine and explain its use in terms of its chemical properties.   **3 marks**

13. Consider the addition polymerisation of 2-butene. Draw a section of the polymer produced, showing at least 3 repeating units.   **2 marks**

14. The following is a shorthand representation of a galvanic cell.   **5 marks**

$$Zn/Zn^+//Ag^+/Ag$$

(a) Draw a diagram of this cell labelling the anode, cathode and direction of electron flow.

(b) Calculate the initial voltage that could be produced by this cell under standard conditions. (show all working)

15. In class you have studied either the dry cell or the lead-acid cell.   **5 marks**

(a)   identify the cell and the electrolyte

(b)   write the equation for the reaction that occurs at the anode

(c)   write the equation for the reaction that occurs at the cathode

(d)   evaluate its impact on society and the environment

16. (a) identify the major natural source of sulfur dioxide.   **1 mark**

(b)   evaluate reasons for concern about the release of sulfur dioxide into the atmosphere. (use equations to support your answer)   **5 marks**

17. Assess the potential of ethanol as an alternative fuel.   **6 marks**

18. A student carried out an investigation to determine the heat of combustion of propanol. The propanol was placed in a spirit burner and used to heat 100 mL of water in a copper beaker. After 5 minutes of heating the temperature of the water had increased from 20°C to 45°C. During the 5 minutes the mass of the propanol in the spirit burner had decreased by 3 g. Calculate   **4 marks**

(a) the energy released per gram

(b) the heat of combustion in kJ/mol

19. A student measured the pH of an ethanoic acid solution and an hydrochloric acid solution and found them both to have the same pH. Compare the concentrations of the 2 solutions and justify your comparison.   **3 marks**