Centre Number

Student Number

CATHOLIC SECONDARY SCHOOLS
ASSOCIATION OF NEW SOUTH WALES

2007
TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Chemistry

Afternoon Session
Friday 10 August 2007

Total marks – 100

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using blue or black pen
- Draw diagrams using pencil
- Board-approved calculators may be used
- Use the Data Sheet and Periodic Table provided
- Use the Multiple Choice Answer Sheet provided
- Write your Centre Number and Student Number at the top of this page and page 9

Section I Pages 2–24

75 marks
This section has two parts, Part A and Part B

Part A – 15 marks
- Attempt Questions 1–15
- Allow about 30 minutes for this part

Part B – 60 marks
- Attempt Questions 16–29
- Allow about 1 hour and 45 minutes for this part

Section II Pages 25–34

25 marks
- Attempt ONE question from Questions 30–34
- Allow about 45 minutes for this section

Section I
75 marks

Part A – 15 marks
Attempt Questions 1-15
Allow about 30 minutes for this part

Use the Multiple Choice Answer Sheet provided.

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1 Which of the following can be used to identify the presence of an alkene?

(A) Bromine water

(B) Sulfuric acid

(C) Phenolphthalein

(D) Distilled water

2 Why is the maximum yield of ethanol produced by the yeast-catalysed fermentation of 1 litre of a glucose solution approximately 150 mL?

(A) The reaction is limited by the available water.

(B) There is too much heat generated if more ethanol is produced.

(C) Too much oxygen is generated if more ethanol is produced.

(D) The yeast can only tolerate an environment with a maximum 15% alcohol.

3 The reaction in an alkaline cell can be summarised by the following equation:

$Zn + 2MnO_2 \rightarrow ZnO + Mn_2O_3$

In this reaction the change in oxidation state of manganese is

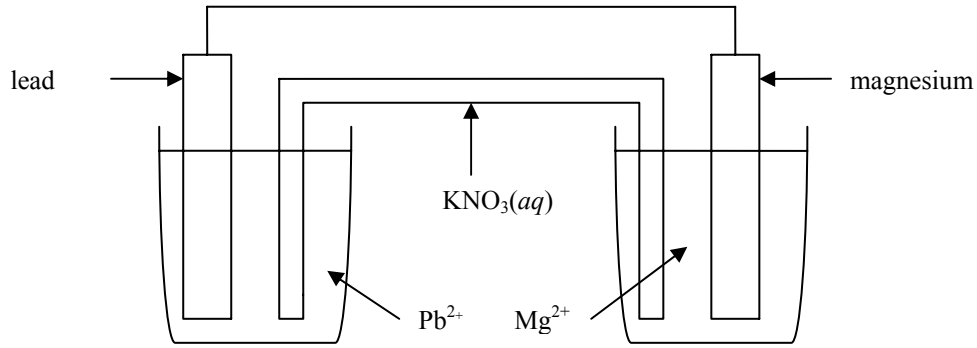
(A) from 0 to +2.

(B) from +4 to +3.

(C) from +4 to +6.

(D) nil, as manganese is neither oxidised nor reduced.

4 The diagram below represents a galvanic cell.



Which of the following half-equations represents the reaction at the cathode?

(A) $Mg^{2+}(aq) + 2e^- \rightleftharpoons Mg(s)$

(B) $Mg(s) \rightleftharpoons Mg^{2+}(aq) + 2e^-$

(C) $Pb^{2+}(aq) + 2e^- \rightleftharpoons Pb(s)$

(D) $Pb(s) \rightleftharpoons Pb^{2+}(aq) + 2e^-$

5 In 2003, physicists bombarded an americium-243 target with a beam of energetic calcium-48 nuclei, producing a new element ununpentium (symbol Uup) containing 115 protons and 173 neutrons.

Which nuclear equation represents this process?

(A) $^{243}_{95}Am + {}^{48}_{20}Ca \rightarrow {}^{173}_{115}Uup + 118\ {}^{1}_{0}n$

(B) $^{243}_{95}Am + {}^{48}_{20}Ca \rightarrow {}^{173}_{58}Uup + {}^{118}_{57}La$

(C) $^{243}_{95}Am + {}^{48}_{20}Ca \rightarrow {}^{288}_{115}Uup + 3\ {}^{1}_{0}n$

(D) $^{243}_{95}Am + {}^{40}_{20}Ca \rightarrow {}^{283}_{115}Uup$

6 A student produced a natural indicator from the petals of a red flower. In order to determine the usefulness of this indicator the student should test the indicator with

(A) dilute hydrochloric acid and dilute sodium hydroxide.

(B) bromothymol blue, phenolphthalein and methyl orange.

(C) a range of household substances.

(D) a pH probe.

7 A 4 mol L^{-1} solution of an acid, HX, was found to have a pH of 2.6. This solution would best be described as a

(A) concentrated solution of a strong acid.

(B) concentrated solution of a weak acid.

(C) dilute solution of a strong acid.

(D) dilute solution of a weak acid.

8 The Haber process is an important industrial process used to produce ammonia gas, NH_3, according to the equation

$$N_2\,(g) + 3H_2\,(g) \rightleftharpoons 2NH_3\,(g)$$

What volume of hydrogen gas, measured at 100kPa and 25ºC, would have reacted to produce 51.10 g of ammonia?

(A) 16.53 L

(B) 24.79 L

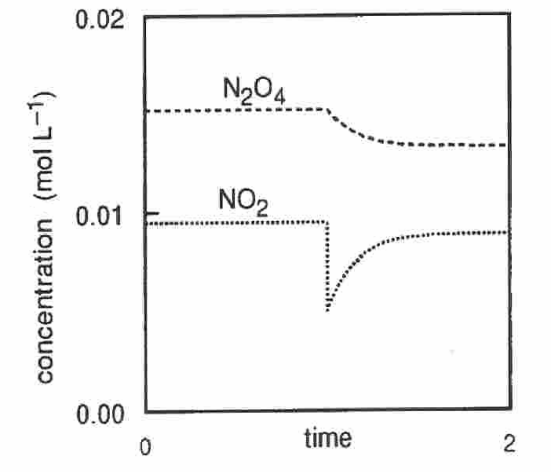
(C) 102.2 L

(D) 111.6 L

9 The decomposition of dinitrogen tetroxide can be summarised by the following equilibrium equation:

$N_2O_4(g) \rightleftharpoons 2NO_2(g) \quad \Delta H = 58.0 \text{ kJ mol}^{-1}$

The graph below shows this equilibrium system undergoing a disturbance and shifting to re-establish a new equilibrium.



The disturbance shown in this graph was caused by

(A) the removal of NO_2 gas.

(B) an increase in temperature.

(C) a shift to the right.

(D) an increase in volume of the container.

10 An orange flavoured ester called octyl ethanoate can be prepared by refluxing.

Which of the following correctly represents this reaction?

(A) $CH_3(CH_2)_6CH_2OH + CH_3COOH \rightleftharpoons CH_3(CH_2)_6COOCH_2CH_3 + H_2O$

(B) $CH_3(CH_2)_6CH_2OH + CH_3COOH \rightleftharpoons CH_3COOCH_2(CH_2)_6CH_3 + H_2O$

(C) $CH_3CH_2OH + CH_3(CH_2)_6COOH \rightleftharpoons CH_3COOCH_{2(}CH_{2)6}CH_3 + H_2O$

(D) $CH_3(CH_2)_6CH_2OH + CH_3COOH \rightleftharpoons CH_3(CH_2)_6COOCH_2CH_3$

11 A catalyst is used in the Haber process, synthesising ammonia from nitrogen and hydrogen, because the catalyst

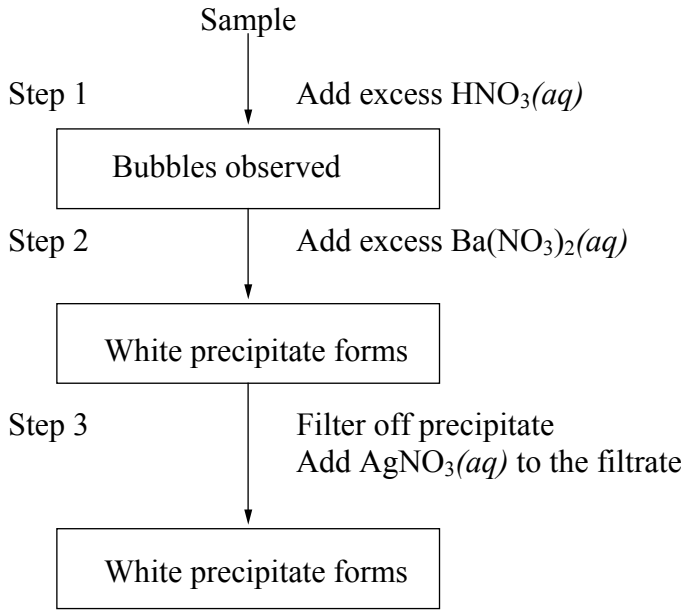
(A) increases the amount of ammonia produced.

(B) increases the rate of the process so that a greater percentage of ammonia can be produced.

(C) lowers the activation energy so that the bonds within the molecules are broken more easily.

(D) reduces the amounts of reactants required to produce the product.

12 The flow diagram below shows 3 steps that can be used to identify carbonate, chloride and sulfate ions present in a sample.



The products formed in the 3 steps, in order, are

(A) hydrogen gas, barium chloride, silver sulfate.

(B) carbon dioxide gas, barium sulfate, silver chloride.

(C) hydrogen gas, barium sulfate, silver chloride.

(D) carbon dioxide gas, barium chloride, silver sulfate.

13 The quantity of flocculant added to a water supply was less than the amount required to effectively treat that supply. What would be the effect on the water quality?

(A) A high value of TDS (total dissolved solids)

(B) A pH between 5 and 6

(C) Turbid water

(D) A high bacterial count

14 Identify the correct statement comparing an oxygen free radical and an oxygen atom.

(A) The free radical has unpaired electrons, whereas the atom does not.

(B) The free radical has fewer electrons than the atom.

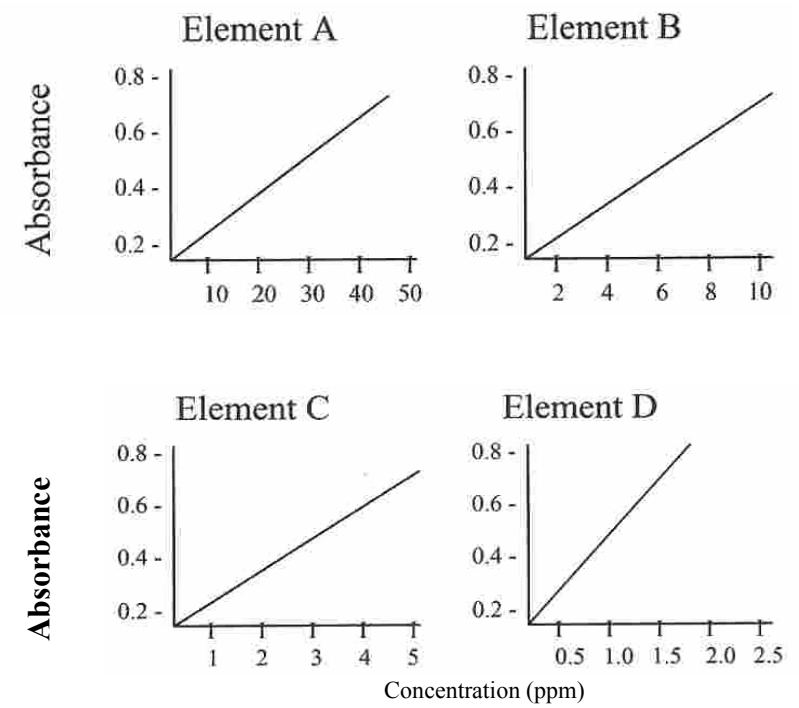
(C) The free radical has more electrons than the atom.

(D) There is no difference in the electron arrangement.

15 The wavelengths of light absorbed by four elements are as follows:

Element	Wavelength (nm)
A	354.8
B	551.9
C	443.7
D	587.4

Using Atomic Absorption Spectroscopy (AAS), standard solutions of these elements produced the following calibration curves.



A sample of waste water from a factory was analysed and the following results were obtained:

Wavelength emitted by sample	Absorbance
551.9	0.35
443.7	0.40
587.4	0.65
354.8	0.30

The element present with a concentration of 1.5 ppm in the waste water is:

(A) A

(B) B

(C) C

(D) D