NANYANG JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
Higher 1

CHEMISTRY 8872/01

Paper 1 Multiple Choice **17 September 2008**

50 minutes

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and tutor's name on the Answer Sheet in the spaces provided unless this has been done for you.

There are **thirty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

Section A

For each question there are four possible answers, **A**, **B**, **C** and **D**. Choose the **one** you consider to be correct.

1 In an attempt to establish the formula of an oxide of nitrogen, a known volume of the pure gas was mixed with hydrogen and passed over a catalyst at a suitable temperature. 100% conversion of the oxide to ammonia and water was shown to have taken place.

$$N_xO_y \xrightarrow{H_2(g)} xNH_3 + yH_2O$$

2400 cm^3 of nitrogen oxide, measured at room temperature and pressure, produced 7.20 g of water. The ammonia produced was neutralised by 200 cm^3 of 1.0 mol dm^{-3} of HC*l*.

What is the oxidation number of the nitrogen in the nitrogen oxide?

A +1

B +2

C +3

D +4

2 Which one of the following ions has more electrons than protons, and more protons than neutrons?

[D= ^2_1H]

A D^- **B** He^+ **C** OH^- **D** D_3O^+

3 For which of the following does the 2nd compound has a higher boiling point than the 1st compound?

A pentane and butanone

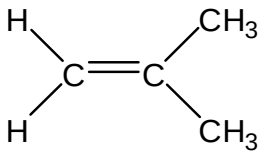
B propene and ethene

C 4-nitrophenol and 2-nitrophenol

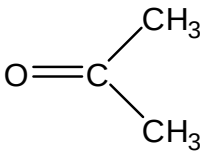
D pentane and 2,2-dimethylpropane

4 Which molecule has the largest dipole?

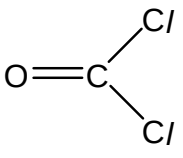
A



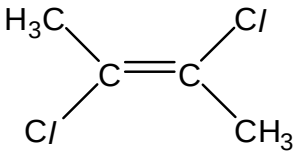
B



C



D



5 The enthalpy change when solid sodium hydroxide dissolves in water is – 44.4 kJ mol^{-1}.

250 g of water is placed in a coffee-cup calorimeter containing 13.9 g of solid NaOH.

If the solution has the same specific heat capacity as liquid water, what is the rise in temperature of the solution?

A $\dfrac{13.9 \times 44.4}{250 \times 4.18}$ K

B $\dfrac{250 \times 4.18}{13.9 \times 44.4 \times 10^{3}}$ K

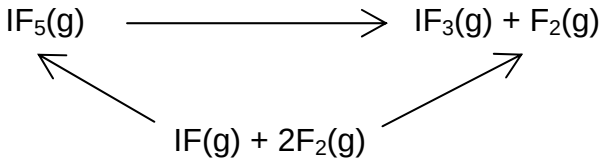
C $\dfrac{13.9 \times 44.4 \times 10^{3}}{40 \times 250 \times 4.18}$ K

D $\dfrac{13.9 \times 44.4 \times 10^{3}}{263.9 \times 4.18}$ K

6 Given the following data and energy cycle, what is the enthalpy change for the following reaction?

$$IF_5(g) \rightarrow IF_3(g) + F_2(g)$$

$IF(g) + F_2(g) \rightarrow IF_3(g)$; $\Delta H = -390$ kJ mol^{-1}
$IF(g) + 2F_2(g) \rightarrow IF_5(g)$; $\Delta H = -745$ kJ mol^{-1}



A –355

B +355

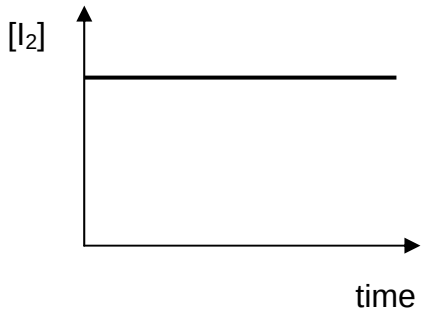
C –1135

D +1135

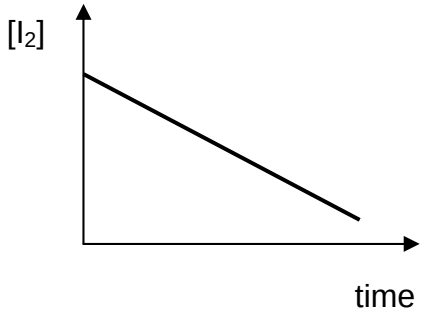
7 The reaction of iodine with propanone in the presence of aqueous acid is zero order with respect to iodine.

Which diagram represents the variation of $[I_2]$ with time?

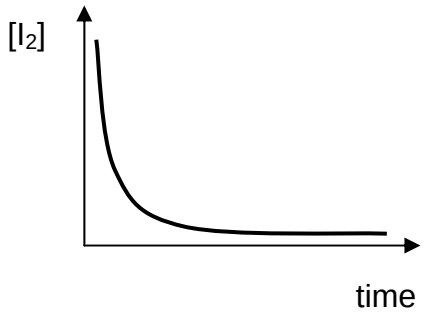
A



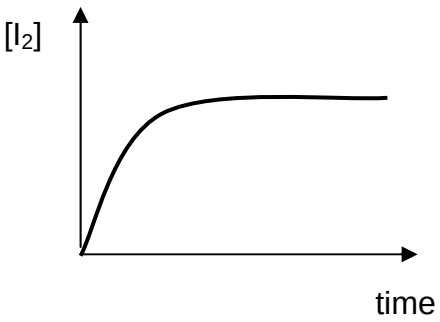
B



C



D



8 Two equilibria are shown below.

Reaction **I**: $2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$

Reaction **II**: $NO(g) + \frac{1}{2}O_2(g) \rightleftharpoons NO_2(g)$

The numerical value of K_c for reaction **I** is 4. Under the same conditions, what is the numerical value of K_c for reaction **II**?

A -4 **B** $\frac{1}{4}$ **C** $\frac{1}{2}$ **D** 2

9 When the system $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ is in equilibrium at 444°C and 1 atm, the value of the equilibrium constant, K_c, is 50.

What is the value of K_c if the pressure is increased to 2 atm at the same temperature?

(Pressure of a gas is directly proportional to its concentration.)

A 25 **B** 50 **C** 100 **D** 200

10 For the reaction:

$$NH_4^+(aq) + CO_3^{2-}(aq) \rightleftharpoons HCO_3^-(aq) + NH_3(g)$$

Which of the following statements is correct?

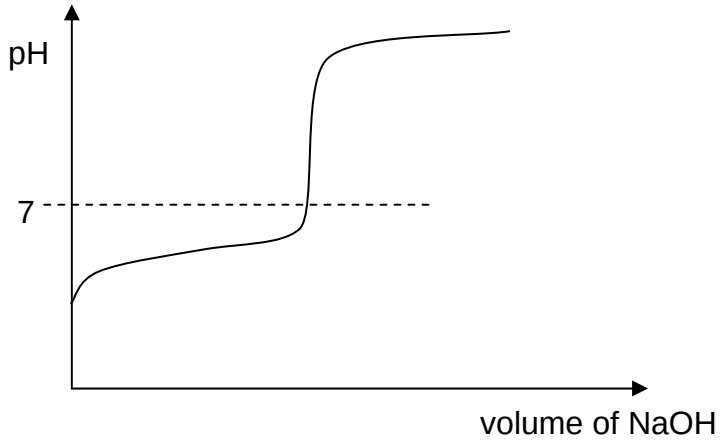
A CO_3^{2-} is a proton donor.

B NH_3 is a proton donor.

C HCO_3^- is the conjugate base of CO_3^{2-}.

D NH_4^+ is the conjugate acid of NH_3.

11 A titration was carried out between a weak acid, HA, and aqueous sodium hydroxide. The graph obtained was shown below:



A suitable indicator for the above titration is

	Indicator	**pH range**
A	Thymol blue	1.5 to 2.5
B	Bromocresol green	3.8 to 5.5
C	Bromothymol blue	6.0 to 7.5
D	Thymolphthalein	9.3 to 10.5

12 Ethanedioate ions, $C_2O_4^{2-}$, is oxidised by acidified, aqueous potassium manganate (VII) according to the equation:

$$2MnO_4^-(aq) + 5C_2O_4^{2-}(aq) + 16H^+(aq) \rightarrow 2Mn^{2+}(aq) + 10CO_2(g) + 8H_2O(l)$$

What volume of 0.0200 moldm^{-3} potassium manganate (VII) is required to oxidise completely 1.0×10^{-3} mol of the salt $KHC_2O_4 \cdot H_2C_2O_4$?

A 20 cm^3

B 40 cm^3

C 50 cm^3

D 80 cm^3

13 In which of the following reactions is the acid acting as an oxidant?

A $Cu + 2H_2SO_4 \rightarrow CuSO_4 + 2H_2O + SO_2$

B $KBr + H_3PO_4 \rightarrow HBr + KH_2PO_4$

C $12HClO_4 + P_4O_{10} \rightarrow 6Cl_2O_7 + 4H_3PO_4$

D $ZnO + 2HNO_3 \rightarrow Zn(NO_3)_2 + H_2O$

14 Which property decreases from Na_2O to SiO_2 and also from SiO_2 to P_4O_{10}?

A covalent character

B melting point

C pH when mixed with water

D solubility in aqueous alkali

15 The first ionisation energies, in kJ mol^{-1}, of a sequence of elements of increasing proton (atomic number) are given below:

519 900 799 1090 1400

Where in the Periodic Table is this sequence of elements likely to be located?

A Group II

B Group VII

C from Li to N inclusive

D from N to Na inclusive

16 A student isolated an organic compound with the molecular formula C_4H_8. The total number of possible isomers (including structural and geometrical isomers) he can deduce from the molecular formula is

A 3

B 4

C 5

D 6

17 Which substance in a vehicle exhaust results from incomplete combustion of a hydrocarbon fuel?

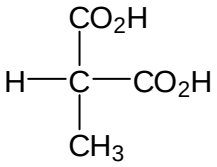
A CO

B H_2O

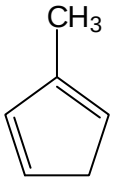
C N_2

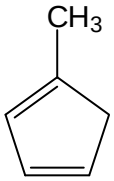
D NO

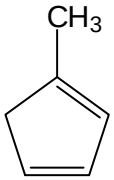
18 A hydrocarbon C_6H_8 on refluxing with acidified potassium manganate (VII) produces the structure below as the only organic product.

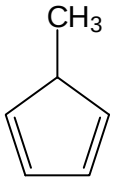


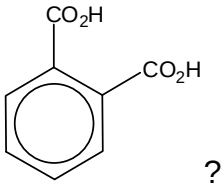
What could be a possible structure of the hydrocarbon?

A


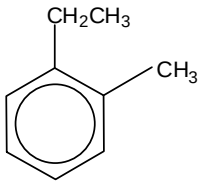
B


C


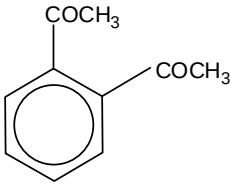
D


19 Which of the following reactions would **not** produce 

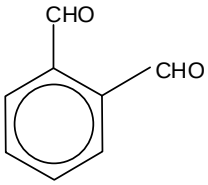
?

A 

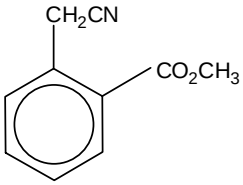
+ acidified $KMnO_4$, reflux

B 

+ alkaline aqueous iodine, warm followed by acidification

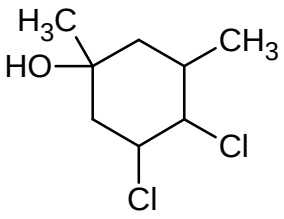
C 

+ Tollens' reagent, warm followed by acidification

D 

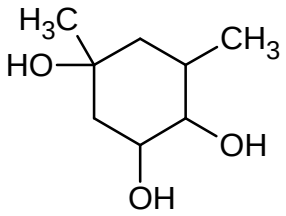
+ aqueous H_2SO_4, reflux

20 The following compound was heated with alcoholic potassium hydroxide.

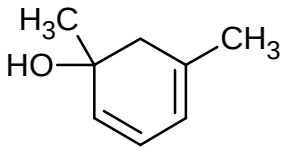


Which of the following represents the structure of the organic product?

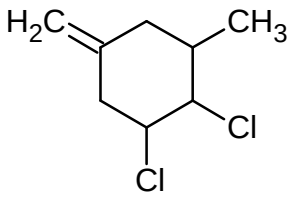
A



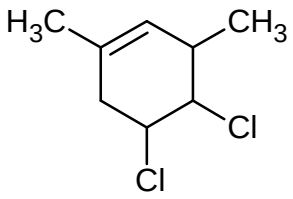
B



C



D



21 Which one of the following substances will give an alcohol upon heating under reflux with aqueous sodium hydroxide?

A $(CH_3CH_2)_2O$

B $CH_3CH_2CO_2CH_3$

C $CH_3CH{=}CH_2$

D C_6H_5Br

22 Which one of the following compounds is unaffected by hot acidified potassium manganate (VII) and gives hydrogen when treated with sodium?

A $(CH_3)_3COH$

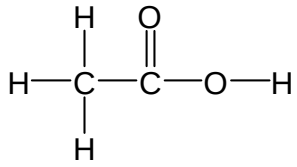
B $(CH_3)_2CHCH_2OH$

C $CH_3CH_2CH(OH)CH_3$

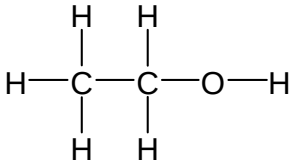
D $(CH_3)_2CHCOCH_3$

23 Which of the following compounds can undergo the tri-iodomethane test?

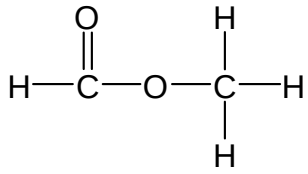
A



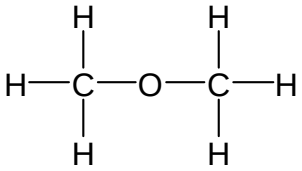
B



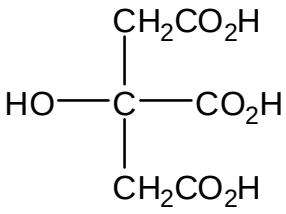
C



D



24 Citric acid, which causes the sharp taste of lemon juice, has the following formula.



Which of the following reacts completely with 1 mol of citric acid?

A 3 mol of PCl_5(s)

B 4 mol of HCl(g)

C 4 mol of Na(s)

D 4 mol of NaOH(aq)

25 Why is propanoic acid, CH_3CH_2COOH, a stronger acid than propanol, $CH_3CH_2CH_2OH$?

A The negative charge on $CH_3CH_2CO_2^-$ anion is delocalised over two electronegative oxygen atoms and destabilises the anion.

B The negative charge on $CH_3CH_2CO_2^-$ anion is delocalised over two electronegative oxygen atoms and stabilises the anion.

C The propyl group is electron-donating and stabilises the $CH_3CH_2CH_2O^-$ anion.

D The propyl group is electron-withdrawing and destabilises the $CH_3CH_2CH_2O^-$ anion.

Section B

For each of the questions in this section one or more of the three numbered statements **1** to **3** may be correct.

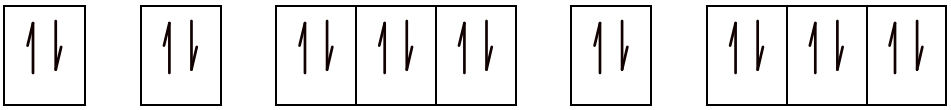
Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements which you consider to be correct).

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are Correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

No other combination of statements is used as a correct response.

26 A species ***X*** has the following electronic configuration. What could ***X*** be?



1 Ca^{2+}

2 Cl^-

3 Ar^{2+}

27 Water ionises as follows:

$$2\ H_2O \rightleftharpoons H_3O^+ + OH^- \qquad \Delta H, \text{ positive}$$

Which of the following statement(s) are true?

1 Water dissociates more at higher temperatures.

2 The pH of pure water at 80ºC is less than 7.

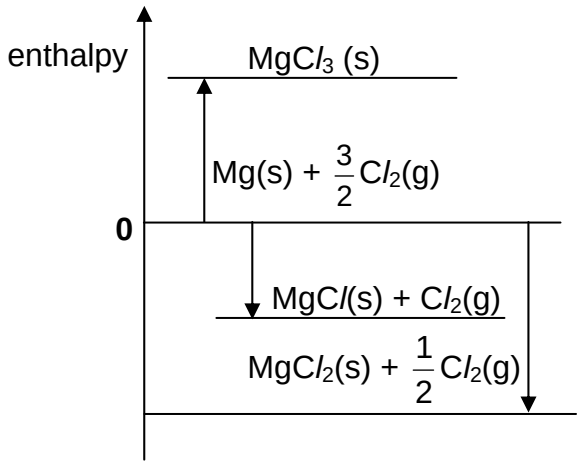
3 K_w of water is numerically smaller than 1×10^{-14} at 15ºC.

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

No other combination of statements is used as a correct response.

28 The energy level diagram shown represents the formation of MgC*l*, MgCl_2 and MgCl_3.



Which of the following statement(s) can be correctly inferred from the above energy level diagram?

1 MgCl_3 is the least stable relative to MgC*l* and MgCl_2.

2 The enthalpy change of formation of MgC*l* is exothermic.

3 MgCl_2 is the most stable because the enthalpy change of formation of MgCl_2 is the most endothermic.

29 An organic compound, **A**, reacts with 2,4-dinitrophenylhydrazine but not Tollens' reagent. It can be reduced to an alcohol of formula C_4H_9OH.

Which of the following compound(s) could be a possible structure for **A**?

1 $CH_3COCH_2CH_3$

2 $CH_3CH_2CH_2CHO$

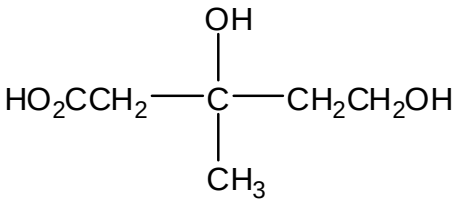
3 $(CH_3)_2CH_2COCH_3$

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

No other combination of statements is used as a correct response.

30 **X** is an intermediate in the biosynthesis of cholesterol, and is shown below.



Which of the following statement(s) about **X** are correct?

1 Its aqueous solution is acidic.

2 It can be esterified both by ethanoic acid and by ethanol, in the presence of H^+ ions.

3 It contains both primary and secondary alcohol functional groups.

End of Paper