TEMASEK JUNIOR COLLEGE
Preliminary Examinations
Higher 1

CHEMISTRY 8872/01

Paper 1 Multiple Choice 19th 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, CG and index number on the Answer Sheet in the spaces provided.

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 Ethanonitrile, CH_3CN, was boiled with NaOH and the NH_3 gas evolved was passed into 50 cm^3 of 1.00 mol dm^{-3} of HC*l*. The excess acid required 26.00 cm^3 of 1.00 mol dm^{-3} NaOH solution for neutralization. What was the mass of ethanonitrile used?

(M_r of CH_3CN = 41)

A 0.492g

B 0.984g

C 1.07g

D 1.97g

2 Thallium(III) ions can oxidize iodide ions to iodine.

25.0 cm^3 of a 0.0480 mol dm^{-3} solution of Tl^{3+} ions was added to excess potassium iodide solution. The liberated iodine is titrated against 0.106 mol dm^{-3} sodium thiosulphate. 22.60 cm^3 of sodium thiosulphate solution was required to react with iodine in the following reaction.

$$I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$$

What was the oxidation state of T*l* after its reaction with potassium iodide?

A -1

B 0

C +1

D +2

3 Which of the following species has an electronic configuration of $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$?

A Cr^+

B Mn

C V

D Fe^{2+}

4 Which of the following has the most number of unpaired electrons?

A A*l*

B Co^{3+}

C NO

D V^{2+}

5 In which of the following pairs does the first species have a larger bond angle than the second?

A ClO_3^-, BrO_3^-

B SO_3^{2-}, SO_4^{2-}

C PCl_3, $AlCl_3$

D H_2O, H_3O^+

6 Antimony, Sb, is in Group V of the Periodic Table. It forms salts which contain the SbF_5^{n-} anion, the shape of which is square pyramidal. What is the value of n?

A 2

B 3

C 4

D 5

7 Which of the following compounds is the least volatile?

A $CH_3CH_2CH_2CH_2OH$

B $(CH_3)_3COH$

C $CH_3CH_2CH_2CH_2NH_2$

D $(CH_3)_3CNH_2$

8 When 0.15 g of magnesium was added an excess of dilute sulphuric acid in a calorimeter (with negligible heat capacity), a maximum temperature rise of 6.2 ^oC was recorded. What is the enthalpy change for the reaction?

(heat capacity of dilute sulphuric acid = 494 J K^{-1})

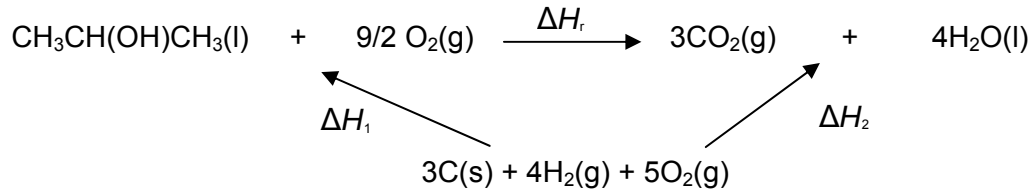
A - 3.06 kJ mol^{-1}

B - 496 kJ mol^{-1}

C - 632 kJ mol^{-1}

D - 744 kJ mol^{-1}

9 Consider the energy cycle below involving propan-2-ol.



Using the following data, calculate ΔH_r.

enthalpy change of combustion of carbon = -393.5 kJ mol^{-1}
enthalpy change of combustion of hydrogen = -285.5 kJ mol^{-1}
enthalpy change of formation of propan-2-ol = -316.5 kJ mol^{-1}

A -77 kJ mol^{-1}

B -362.5 kJ mol^{-1}

C -1003 kJ mol^{-1}

D -2006 kJ mol^{-1}

10 Each of the following equilibria is subjected to two changes carried out separately:

(i) the volume of vessel is increased at constant temperature;

(ii) the temperature is increased at constant pressure.

For which equilibrium will both of these changes result in an increase in the proportion of products?

A $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ $\Delta H = +53$ kJ mol^{-1}

B $4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(g)$ $\Delta H = -950$ kJ mol^{-1}

C $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ $\Delta H = +57$ kJ mol^{-1}

D $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ $\Delta H = -92$ kJ mol^{-1}

11 Compounds **Q** and **R** react according to the following equation

$$\mathbf{Q}(s) + \mathbf{R}(g) \rightleftharpoons \mathbf{U}(g) + 2\mathbf{V}(g)$$

The value of the equilibrium constant, K_C, is 7.3 at 200 °C and 22.8 at 400 °C. Which of the following statements is true?

A The production of **U** and **V** is an exothermic process.

B The activation energy of the forward reaction is higher than the activation energy of the backward reaction.

C The position of equilibrium shifts to the right when more **Q** is added.

D The addition of a catalyst will increase the value of the equilibrium constant, K_C.

12 Which set of solutions below will **not** give a buffer solution when they are mixed?

A 50 cm^3 of 0.10 mol dm^{-3} CH_3CO_2H and 50 cm^3 of 0.10 mol dm^{-3} CH_3CO_2Na

B 100 cm^3 of 0.10 mol dm^{-3} CH_3CO_2H and 50 cm^3 of 0.10 mol dm^{-3} NaOH

C 50 cm^3 of 0.10 mol dm^{-3} CH_3CO_2Na and 100 cm^3 of 0.10 mol dm^{-3} HC*l*

D 100 cm^3 of 0.10 mol dm^{-3} CH_3CO_2Na and 50 cm^3 of 0.10 mol dm^{-3} HC*l*

13 Hydrofluoric acid, HF, dissociates according to the following equation:

$$HF + H_2O \rightleftharpoons H_3O^+ + F^- \qquad K_a = 7.2 \times 10^{-4} \text{ mol dm}^{-3}$$

Which one of the following statement is correct when 0.05 mole of HF is dissolved in 1 dm^3 of water?

A The strength of the H-F bond is weak.

B The pH of the resulting solution is 1.30.

C The acid dissociation constant, K_a, can be expressed as $\dfrac{[H_3O^+][F^-]}{[HF][H_2O]}$.

D Phenolphthalein is a suitable indicator for the reaction between HF and NaOH.

14 The table below gives data for the reaction between **P** and **Q** at constant temperature.

Experiment	[**P**] / mol dm^{-3}	[**Q**] / mol dm^{-3}	Initial rate / mol dm^{-3} s^{-1}
1	0.2	0.3	4.0×10^{-4}
2	0.4	0.6	1.6×10^{-3}
3	0.8	0.6	6.4×10^{-3}

What is the rate equation for the reaction?

A Rate = $k[\mathbf{P}]^2[\mathbf{Q}]$

B Rate = $k[\mathbf{P}][\mathbf{Q}]^2$

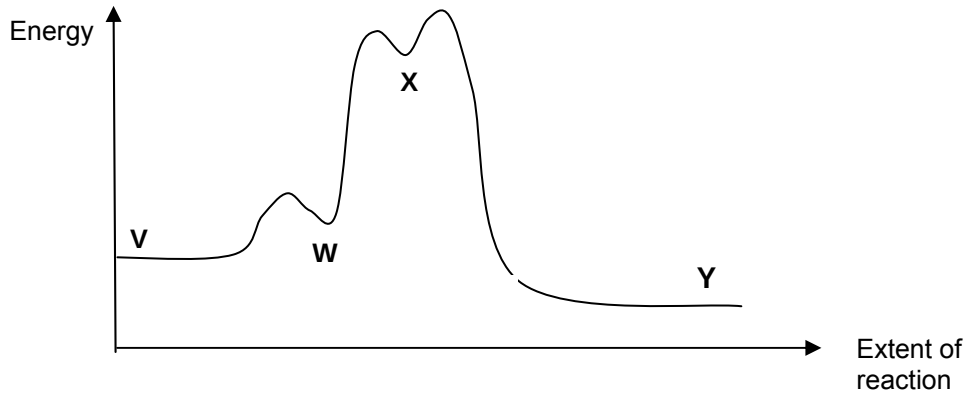
C Rate = $k[\mathbf{Q}]^2$

D Rate = $k[\mathbf{P}]^2$

15 Compound **V** is converted into compound **Y** in three steps:

Step 1:	**V** $\rightarrow$ **W**	ΔH_1
Step 2:	**W** $\rightarrow$ **X**	ΔH_2
Step 3:	**X** $\rightarrow$ **Y**	ΔH_3
Overall:	**V** $\rightarrow$ **Y**	ΔH_r

The energy profile diagram is as shown:

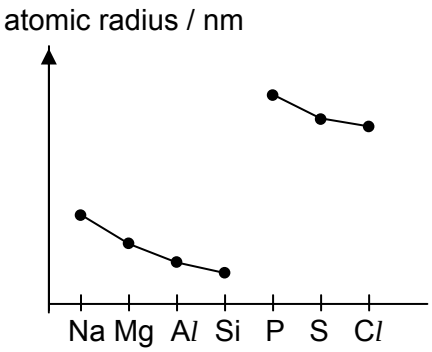


Which of the following is correct?

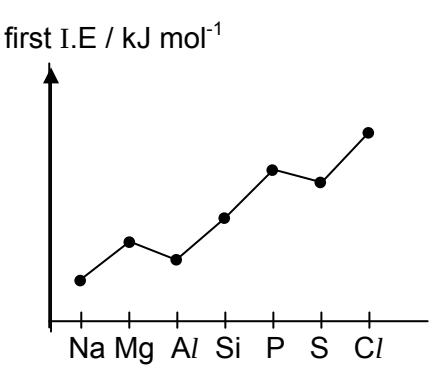
	ΔH_1	ΔH_r	rate determining step
A	Endothermic	Exothermic	Step 3
B	Endothermic	Endothermic	Step 3
C	Endothermic	Exothermic	Step 2
D	Exothermic	Endothermic	Step 2

16 Which of the following sketches shows the correct trend in the stated property, for the elements in the third period of the Periodic Table?

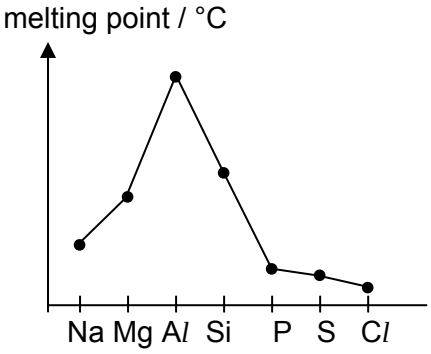
A



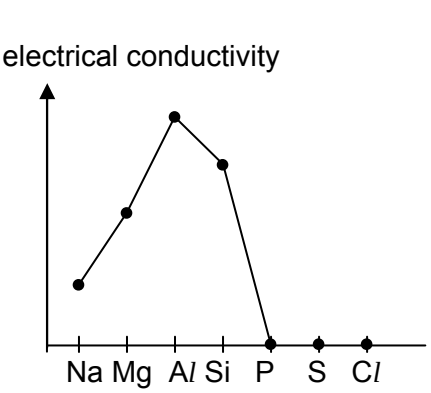
C



B



D



17 Which of the following properties decreases for the sequence of oxides:

Na_2O, SiO_2 and P_4O_{10} ?

A Melting point

B Covalent character

C Solubility in aqueous alkali

D pH of resultant solution when mixed with water

18 Compound **R**

- will not cause a depletion of ozone layer
- is flammable.

What could **R** be?

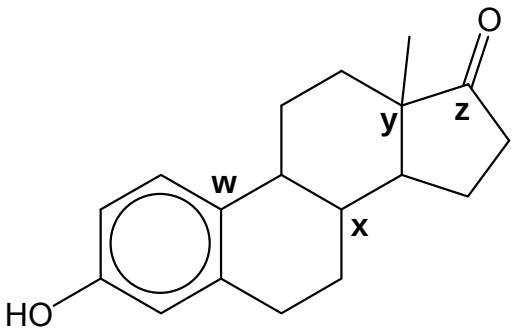
A CCl_2F_2

B $CHClF_2$

C CH_2FCF_3

D CH_3CBr_3

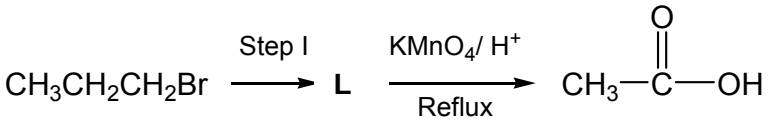
19 Estrone is an estrogenic hormone secreted by the ovary.



Which one of the following gives the correct hybridisation of carbons **w**, **x**, **y** and **z**?

	w	**x**	**y**	**z**
A	sp^2	sp^3	sp^3	sp^2
B	sp^2	sp^2	sp^3	sp^2
C	sp^2	sp^3	sp^2	sp^2
D	sp^3	sp^2	sp^3	sp^3

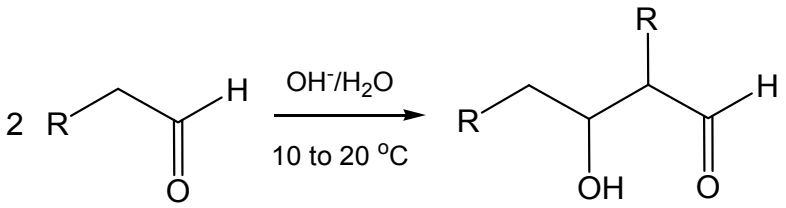
20 The reaction scheme below shows the formation of ethanoic acid.

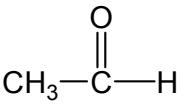


The reagent and condition required in step I and the structure of **L** are:

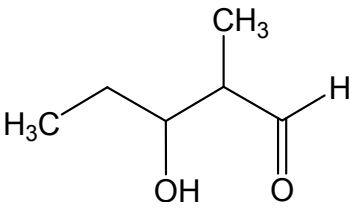
	Reagent and condition in Step I	Structure of **L**
A	Aqueous KOH, reflux	$CH_3CH_2CH_2OH$
B	Alcoholic KOH, reflux	$CH_3CH{=}CH_2$
C	Aqueous KOH, reflux	CH_3CH_2OH
D	Alcoholic KOH, reflux	CH_3CH_2OH

21 The aldol reaction is important in organic synthesis because it provides a method to link two small molecules together. Two molecules of an aldehyde can be linked together in the aldol reaction as shown below.

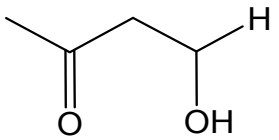


Which of the following compounds is formed when  undergoes aldol reaction?

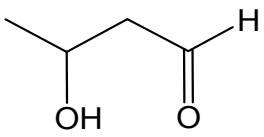
A



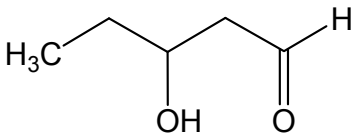
B



C



D



22 i) Both **M** and **N** are able to react with PCl_5 to liberate fumes of HCl.

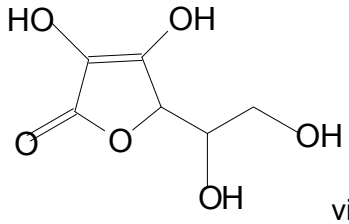
ii) Only **N** reacts with excess NH_3 in a sealed tube.

iii) Only **M** gives a yellow precipitate with aqueous alkaline iodine.

What are the identities of **M** and **N**?

	M	**N**
A	$CH_3CO_2CH_2OH$	$CH_3CH(OH)CH_2Cl$
B	$CH_3CH(OH)COCH_3$	$(CH_3)_2C(OH)CH_2Cl$
C	$CH_3CO_2CH_2CN$	$CH_2=CHCH_2OH$
D	$CH_3CH(OH)CH=CH_2$	$CH_2=CHCH_2CN$

23 Citrus fruits like oranges contain vitamin C which is essential to prevent scurvy, a deadly illness which plagued sailors in the 19th century.



vitamin C

Which one of the following statements involving vitamin C is correct?

A It can react with 2,4-dinitrophenylhydrazine to form a bright orange precipitate.

B It can react with sodium carbonate to give carbon dioxide gas.

C It can react with hot sodium hydroxide.

D There is no observable reaction with bromine water.

24 Which property of benzene may be directly attributed to the stability associated with its delocalised electrons?

A It has a low boiling point.

B It does not conduct electricity.

C It is susceptible to attack by an electrophile.

D It tends to undergo substitution rather than addition.

25 For which one of the following pairs of compounds can **both** members react with cyanide ions under suitable conditions?

A CH_3COCH_3 and $CH_3CHCICH_3$

B $CH_3CH_2CO_2H$ and $CH_3CH{=}CH_2$

C $HCOCH_2CH_3$ and $CH_3CH_2CH_2OH$

D C_6H_6 and $C_6H_5CH_3$

Section B

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

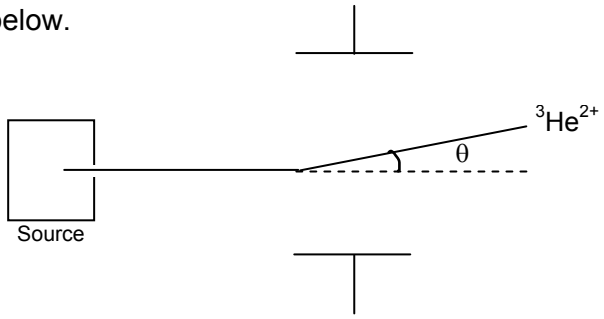
Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements which you consider to be correct).

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 On passing a beam of $^{3}He^{2+}$ through an electric field, its path deflects as shown in the diagram below.



Which of the following ions would cause a smaller deflection than that of $^{3}He^{2+}$ when passed through the same electric field?

1 $^{9}Be^{2+}$

2 $^{2}H_{2}^{+}$

3 $^{4}He^{+}$

27 In which of the following pairs can the members be distinguished by their different solubilities in water?

1 propyl propanoate and sodium propanoate

2 ethanol and ethanoic acid

3 hexane and benzene

28 Compound **P** has the following properties

- It does not conduct electricity in liquid state.
- It produces a solution that readily conducts electricity when added to water.

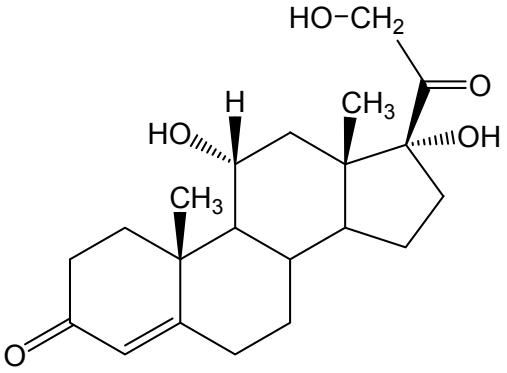
What could **P** be?

1 $MgCl_2$

2 $SiCl_4$

3 PCl_3

29 Hydrocortisone is involved in the regulation of glucose metabolism and in the control of inflammation.



Which statements about the reactions of hydrocortisone are correct?

1 Hydrocortisone does not react with aqueous diamminesilver ions

2 Hydrocortisone decolorizes potassium manganate(VII) on heating

3 1 mole of hydrocortisone reacts with excess sodium to give three moles of hydrogen gas

30 A mixture contains butanone and ethyl ethanoate.

Which reagents will **not** react with the above mixture?

1 Tollens' reagent

2 alkaline aqueous iodine

3 2,4-dinitrophenylhydrazine

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1	**B**	**7**	**A**	**13**	**D**	**19**	**A**	**25**	**A**
2	**C**	**8**	**B**	**14**	**D**	**20**	**B**	**26**	**A**
3	**A**	**9**	**D**	**15**	**C**	**21**	**C**	**27**	**D**
4	**B**	**10**	**C**	**16**	**C**	**22**	**B**	**28**	**C**
5	**A**	**11**	**B**	**17**	**D**	**23**	**C**	**29**	**B**
6	**A**	**12**	**C**	**18**	**C**	**24**	**D**	**30**	**D**