Candidate Name: _____ Class: _____

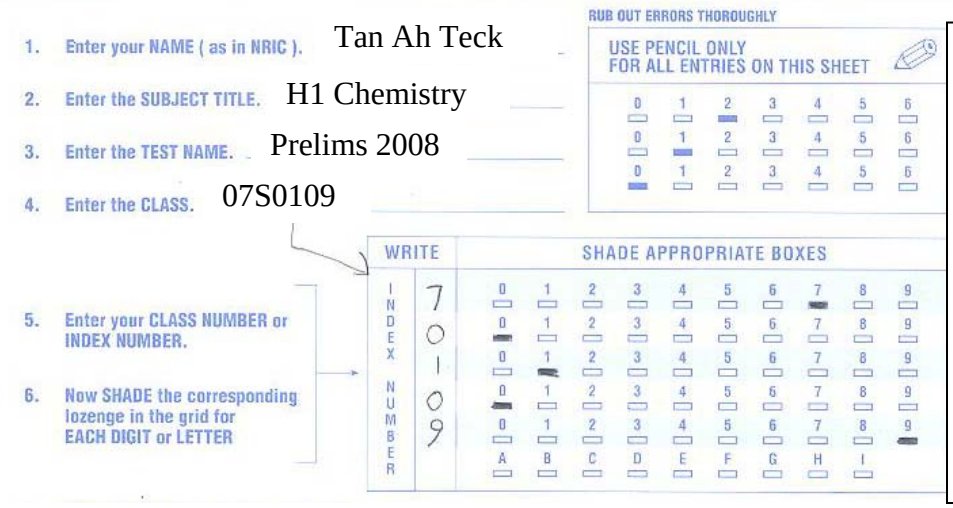
National Junior College
JC2/IP4 Preliminary Examination 2008

H1 CHEMISTRY (8872/1) Paper 1
10 September 2008 TIME: 50 mins

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your **NAME**, the **SUBJECT TITLE**, your **class** and **registration number** on the optical mark sheet provided.



Shade the index no. in 5 digit format (ABCDE)

A: Year of admission
7 = JC2 (2007)
5 = IP (2005)

BC: civics class
DE: registration no.

Eg: 07S0109 = 70109
04IP0215 = 50215

There are **30** questions in this paper. **Answer <u>ALL</u> 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 **2B pencil** in the optical mark sheet.

Submit the optical mark sheet at the end of the examination.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

A *Data Booklet* is provided. You may use a calculator.

This question paper consists of **<u>12</u>** printed pages (including this page)

1 Which one of the following has the same number of particles as one mole of copper atoms?

A The number of ions in 2 dm^3 of 0.25 mol dm^{-3} of aqueous nitric acid.

B The number of delocalised electrons in one mole of magnesium metal.

C The number of atoms in 71 g of chlorine gas.

D The number of ions in 58.5 g of sodium chloride.

2 *Use of the Data Booklet is relevant to this question.*

The components of a 100 g sample of fertilizer is as shown in the table below:

Element	Mass / g
N	15
P	30
K	15
Other Elements	40

The recommended usage of fertilizer is 14 g of fertilizer per 5 dm^3 of water.

What is the concentration of nitrogen atoms in this recommended solution?

A 0.03 mol dm^{-3}

B 0.05 mol dm^{-3}

C 0.42 mol dm^{-3}

D 0.75 mol dm^{-3}

3 Which one of the following pairs of ions contains two underlined elements having the same oxidation number?

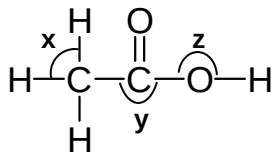
A $\underline{\mathbf{Cl}}O_4^-$ $\underline{\mathbf{S}}O_4^{2-}$

B $\underline{\mathbf{Mn}}O_4^-$ $\underline{\mathbf{Mn}}O_4^{2-}$

C $\underline{\mathbf{Cr}}O_4^{2-}$ $\underline{\mathbf{Cr}}_2O_7^{2-}$

D $\underline{\mathbf{C}}O_3^{2-}$ $\underline{\mathbf{N}}O_3^-$

4 Which one of the following shows the correct bond angles **x**, **y** and **z** for ethanoic acid as shown below?



	x	y	z
A	90	180	180
B	90	90	180
C	109.5	120	120
D	109.5	120	105

5 Which one of the following pairs of molecules have the same shape?

A CO_2 and H_2O

B BF_3 and NH_3

C NH_3 and PF_3

D CH_4 and SF_4

6 Which one of the following **cannot** be explained by hydrogen bonds?

A CH_3CHO has a higher boiling point than C_2H_6.

B CH_3COOH has a M_r of 120 in benzene.

C HF has a higher boiling point than HCl.

D CH_3COCH_3 is miscible with water.

7 Which one of the following electronic configuration represents an element that forms a simple ion with a charge of –2?

A $1s^2\ 2s^2\ 2p^6\ 3s^2$

B $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$

C $1s^2\ 2s^2\ 2p^6\ 3s^1$

D $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

8 How many electrons can an atom with principal quantum number n=1 and n=2 accommodate?

A 2

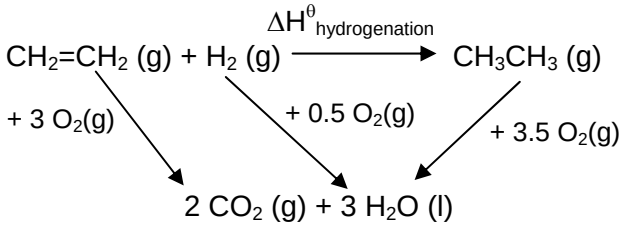
B 8

C 10

D 18

9 Given the following data and energy cycle, determine the enthalpy of hydrogenation of ethene, $CH_2=CH_2$ to ethane, CH_3CH_3.

Compound	Enthalpy change of combustion ΔH_c^{θ}
$CH_2=CH_2$ (g)	–1411
H_2 (g)	–286
CH_3CH_3 (g)	–1560



A +137 kJ mol^{-1}

B –137 kJ mol^{-1}

C +1084 kJ mol^{-1}

D –1084 kJ mol^{-1}

10 In an experiment, 1.00 g of solid K_2CO_3 was added to a polystyrene cup containing 25 cm^3 of 1.0 mol dm^{-3} aqueous HCl. It was found that the temperature of the solution rose by 2.1 ^oC. The equation for the reaction is as follows.

K_2CO_3 (s) + 2 HCl (aq) → 2 KCl (aq) + CO_2 (g) + H_2O (l)

Which one of the following is the correct value for the enthalpy of reaction above? (Assume that the heat capacity of the solution is 4.2 J $^oC^{-1}$ cm^{-3})

A – 8.82 kJ mol^{-1}

B – 9.17 kJ mol^{-1}

C – 30.5 kJ mol^{-1}

D – 31.7 kJ mol^{-1}

11 Which one of the following equations represents the lattice energy of magnesium bromide?

A $Mg^{2+}(s) + 2Br^{-}(s) \rightarrow MgBr_2(s)$

B $Mg^{2+}(aq) + 2Br^{-}(aq) \rightarrow MgBr_2(aq)$

C $Mg^{2+}(g) + 2Br^{-}(g) \rightarrow MgBr_2(g)$

D $Mg^{2+}(g) + 2Br^{-}(g) \rightarrow MgBr_2(s)$

12 What is the effect of adding an iron catalyst on the rate constants, k_f for the forward reaction and k_r for the reverse reaction and on the equilibrium constant K_c for the following reaction?

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

	k_f	k_r	K_c
A	Increase	Decrease	Increase
B	Increase	Increase	Increase
C	Increase	Increase	No change
D	Increase	Decrease	No change

13 The rate information below was obtained for the reaction P + Q $\rightarrow$ products.

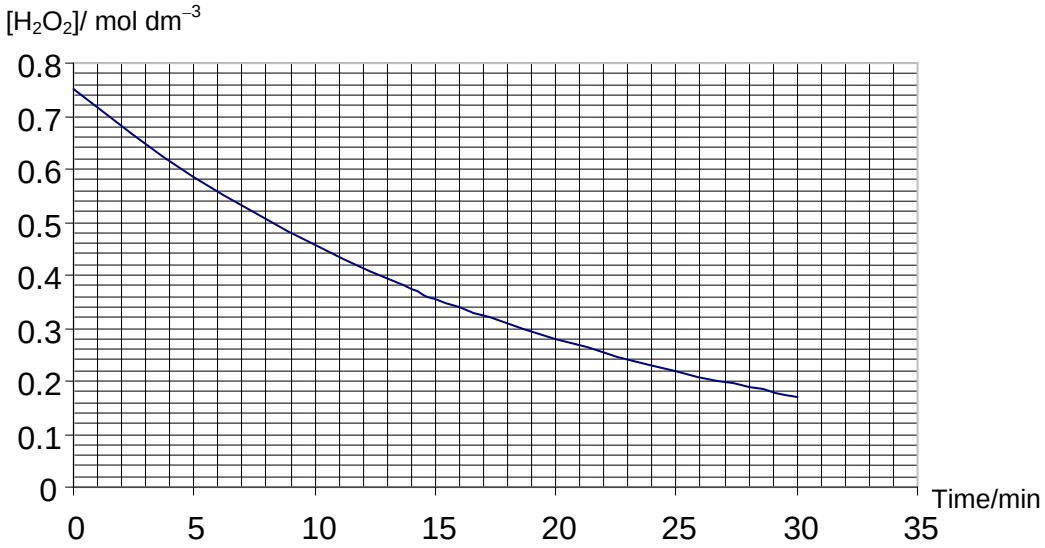
[P] / mol dm^{-3}	[Q] / mol dm^{-3}	Rate / mol dm^{-3} s^{-1}
0.01	0.05	1.9×10^{-4}
0.02	0.05	3.9×10^{-4}
0.02	0.01	4.0×10^{-4}

If the rate constant doubles for each 10 ^{o}C rise in temperature, which one of the following sets of conditions will give the greatest rate of reaction?

	[P] / mol dm^{-3}	[Q] / mol dm^{-3}	Temperature /^{o}C
A	0.1	0.2	40
B	0.2	0.2	30
C	0.3	0.4	20
D	0.4	0.1	30

14 The following graph was obtained for the decomposition of 0.75 mol dm^{-3} H_2O_2, given by the equation below.

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$



What would be the half-life of H_2O_2 when the experiment was repeated with 1.5 mol dm^{-3} of $H_2O_2(aq)$?

A 3.5 min

B 7 min

C 14 min

D 28 min

15 Which one of the following is the correct pH for 20 cm^3 of 0.02 mol dm^{-3} of $Ca(OH)_2$ (aq)?

A 10.6

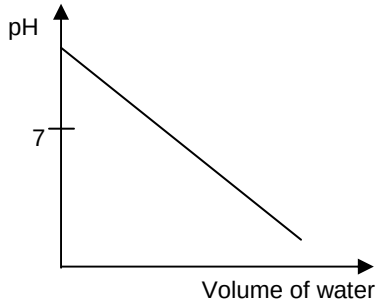
B 10.9

C 12.3

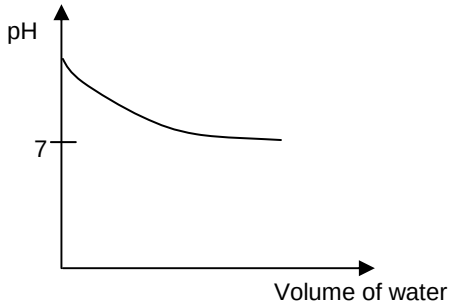
D 12.6

16 Which one of the following graphs shows the changes in pH when water is gradually added to a sample of aqueous sodium hydroxide?

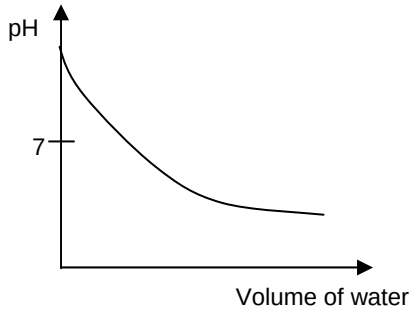
A



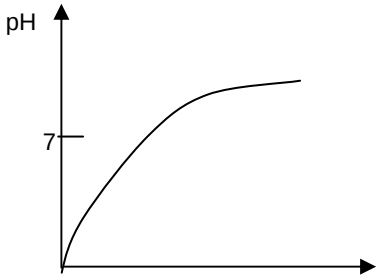
C



B



D



17 Which element is expected to show the greatest tendency to form some covalent compounds?

A Beryllium

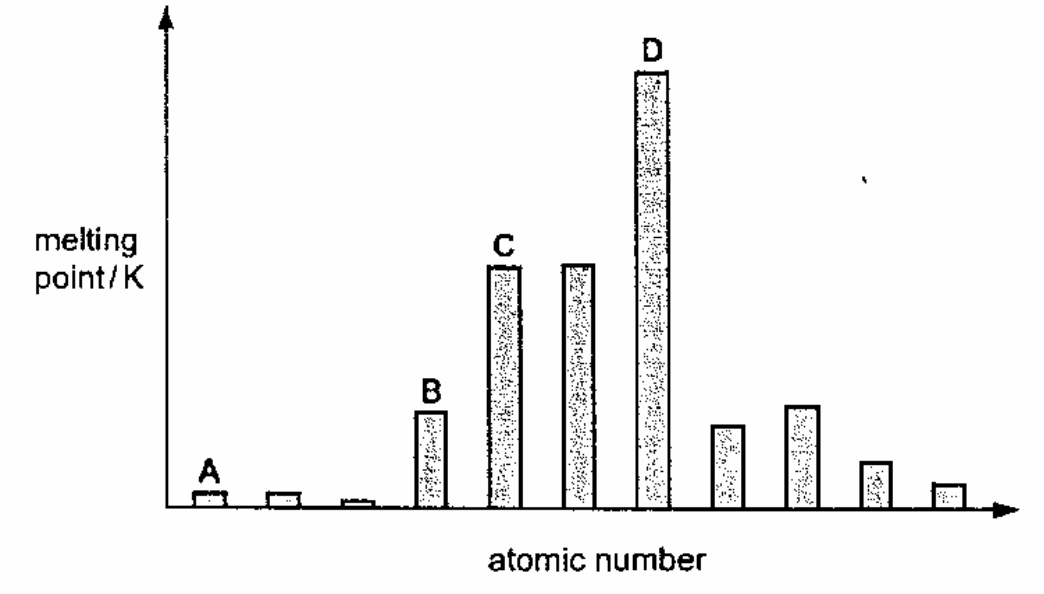
B Calcium

C Magnesium

D Sodium

18 The bar chart shows the melting points of a series of consecutive elements arranged in order of increasing atomic number. The elements sodium to chlorine form part of this series.

Which bar represents sodium?



19 How many isomers of molecular formula C_8H_{10} contain a benzene ring?

A 2

B 3

C 4

D 5

20 2-methylpropylamine can be produced by the following reaction scheme starting with compound **B**.

$$\mathbf{B} \xrightarrow[\text{ethanol}]{\text{KCN in}} \mathbf{C} \xrightarrow{\text{reduction}} \text{2-methylpropylamine}$$

Which one of the following compounds is **B** likely to be?

A $CH_3CH_2CH_2Br$

B $CH_3CHBrCH_3$

C CH_3CH_2CHO

D CH_3COCH_3

21 Samples of 10 cm^3 of the first four members of the alkane series are each mixed separately with 70 cm^3 of oxygen. Each is then burned and the total volume, V, of residual gas was measured again at room temperature and pressure.

Which one of the following represents the total volume of the residual gases that would be obtained for each of the alkanes?

	$CH_4(g)$	$C_2H_6(g)$	$C_3H_8(g)$	$C_4H_{10}(g)$
A	60	55	45	35
B	60	55	50	45
C	10	20	35	60
D	10	20	40	60

22 Reaction of compound **R** with excess concentrated H_2SO_4 at 170^oC gives 2-methylpropene. Compound **R** was warmed with acidified potassium dichromate(VI) and the resulting vapour was passed into a test-tube containing diammine silver(I) ions. A silver mirror was obtained.

Which one of the following could be compound **R**?

A $CH_3CH_2CH_2CH_2OH$

B $CH_3CH_2CH(OH)CH_3$

C $(CH_3)_2CHCH_2OH$

D $(CH_3)_3COH$

23 The reaction of ethanal, CH_3CHO with HCN in the presence of NaOH is an example of

A electrophilic addition

B electrophilic substitution

C nucleophilic addition

D nucleophilic substitution

24 The length of a carbon-carbon single bond is 0.154 nm, whereas that of the carbon-carbon double bond is 0.134 nm. Within the benzene molecule, the interatomic distance between adjacent carbon atoms is likely to be

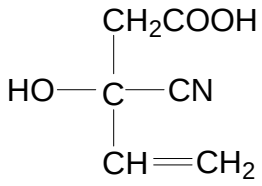
A 0.134 nm

B 0.139 nm

C 0.154 nm

D 0.154 nm for three bonds and 0.134 nm for the remaining three.

25 A molecule **X** has the following structure.



One mole of **X**

A requires 3 moles of $SOCl_2$ for complete reaction.

B requires 2 moles of NaOH for complete reaction at room temperature.

C reacts completely with 1 mole of HBr.

D requires 3 moles of H_2 for complete reaction.

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.

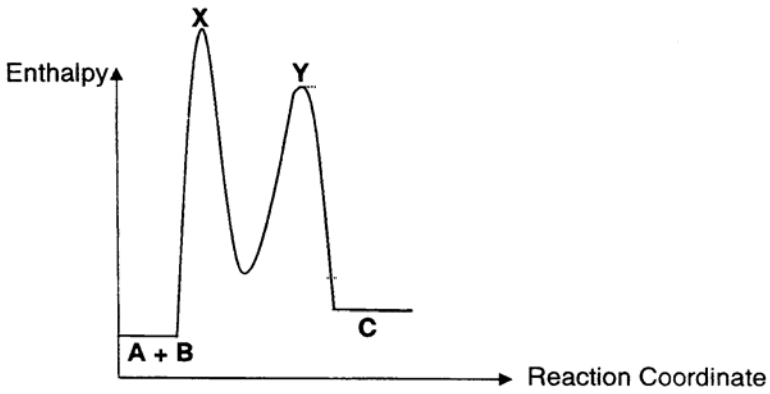
26 Which of the following are conjugate acid-base pairs?

1 NH_3 and NH_2^-

2 OH^- and O^{2-}

3 H_2SO_4 and SO_4^{2-}

27 For the reaction **A + B** $\rightarrow$ **C**



Which of the following statements about the reaction are true?

1 The overall reaction is endothermic.

2 The addition of a catalyst changes the activation energy.

3 **X** and **Y** are the transition states of the reaction.

28 At 35^oC, $K_c = 1.6 \times 10^{-5}$ mol dm^{-3} for the following reaction

$$2\ NOCl\ (g) \rightleftharpoons 2\ NO\ (g) + Cl_2\ (g) \qquad \Delta H > 0$$

1 [NO] < [NOCl] at equilibrium

2 K_c will increase with an increase in temperature.

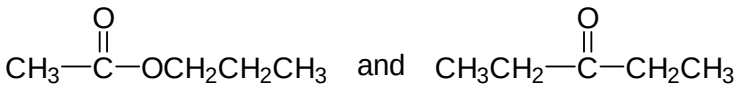
3 Position of equilibrium will shift to the right when total pressure of the system increases.

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.

29 Which of the following reagents could be used to distinguish between the following compounds?

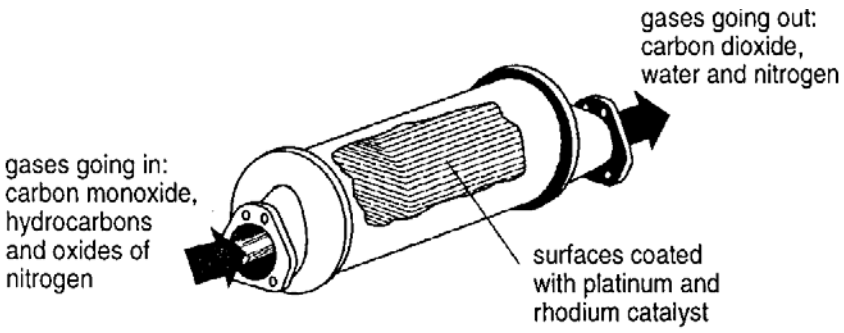


1 2,4-dinitrophenylhydrazine

2 Aqueous alkaline iodine

3 Alkaline copper(II) complex

30 The diagram shows the structure of a catalytic converter as fitted into the exhaust system of a car. It also describes the substances involved in the exhaust gases.



Which reactions between the stated compounds could take place on the surface of the catalyst?

1 hydrocarbons + oxides of nitrogen $\rightarrow$ carbon dioxide + water + nitrogen

2 carbon monoxide + oxides of nitrogen $\rightarrow$ carbon dioxide + nitrogen

3 carbon monoxide + hydrocarbons $\rightarrow$ carbon dioxide + water