NATIONAL JUNIOR COLLEGE
PRELIMINARY EXAMINATIONS 2008

CHEMISTRY **9258/01**

Paper 1 Multiple Choice

10 September 2008

1 hour

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 and index number on the answer sheet in the spaces provided unless this has been done for you.

There are **forty** 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 the wrong answer.
Any rough working should be done in this booklet.
You may use a calculator.

This question paper consists of **16** printed pages (including this page).

Section A

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

1 Which of the following particles have more neutrons than protons and more electrons than neutrons?

A NO_2^+

B $^{13}CO_3^{2-}$

C $^{32}S^{2-}$

D $^{14}N_2^+$

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

Which one of the following has the most unpaired electrons?

A the manganese ion in MnO_2

B the ammonium ion in NH_4Cl

C the nickel metal

D the nitride ion in AlN

3 Which of the following electronic configurations represent 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 $1s^2\ 2s^2\ 2p^6 3s^2\ 3p^6\ 4s^2$

D $1s^2\ 2s^2\ 2p^6 3s^2\ 3p^6\ 3d^4\ 4s^2$

4 Which one of the following is planar?

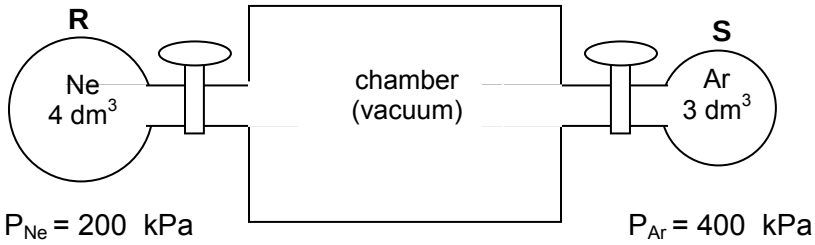
A $CH_3CH{=}CH_2$

B HNO_3

C BCl_4^-

D H_3O^+

5 Two bulbs **R** and **S** are connected to a 9 dm^3 chamber as shown below.



What will be the total pressure in the vessel when the valves are opened at constant temperature?

A 600 kPa
B 286 kPa
C 222 kPa
D 125 kPa

6 When 0.20 moles of compound **D** were strongly heated with a Bunsen flame, 12 dm^3 of gas was collected at room temperature and pressure.

Which one of the following compounds could **D** be?

A $MgCl_2$
B $MgCO_3$
C $Mg(NO_3)_2$
D $Mg(OH)_2$

7 Given the ΔH^o and ΔS^o of vapourization of liquid **E** are $+10.0$ kJ mol^{-1} and $+37.6$ J mol^{-1} K^{-1} respectively, the normal boiling point of liquid **E** is

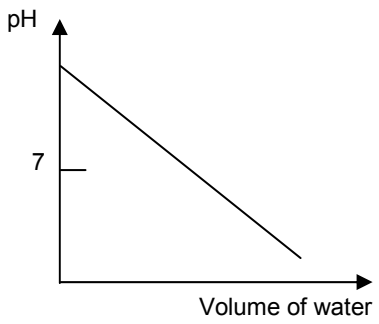
A 240 K
B 266 K
C 300 K
D undeterminable from the data.

8 When propane burns in air, carbon dioxide and water will be formed. How many drops of water will be formed if 0.100 mol of carbon dioxide is produced?
(Assume one drop of water has a volume of 0.05 cm^3 and it contains 1.70×10^{21} water molecules)

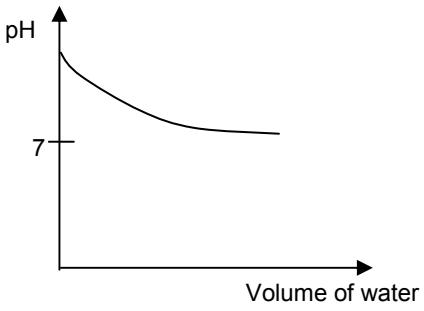
A 26.6
B 35.4
C 47.2
D 142

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

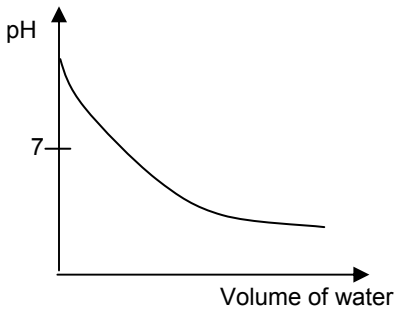
A



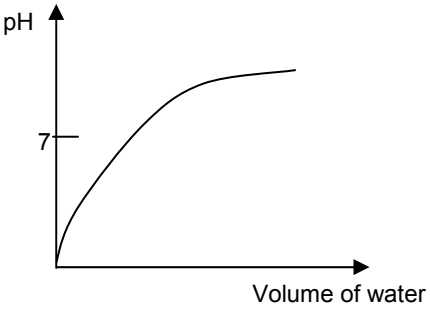
C



B



D



10 When the system $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ is in equilibrium at 444 ^oC, at 1 atm pressure, the value of the equilibrium constant, K_p, is 40.

What is the value of K_p at a pressure of 2 atm at the same temperature?

A 20 **B** 40 **C** 80 **D** 120

11 The rate information below was obtained for the reaction P + Q → 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}

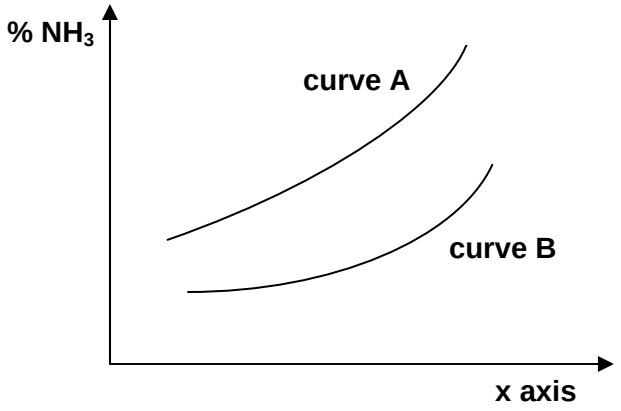
If the rate constant doubles for each 10^{o} C rise in temperature, which of the following sets of conditions will give the greatest rate of reaction?

	[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	0.1	30
D	0.4	0.4	20

12 The graph shows the equilibrium percentage of ammonia present during the formation of ammonia by the Haber process:

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

Which one of the following are correct labels for the graph?



	x axis	**curve A**	**curve B**
A	temperature	high pressure	low pressure
B	temperature	low pressure	high pressure
C	pressure	high temperature	low temperature
D	pressure	low temperature	high temperature

13 When a large current was passed through acidified aqueous copper(II) sulphate, there was simultaneous liberation, at the cathode, of ***x*** mol of copper and ***y*** dm^3 of hydrogen (measured at r.t.p.)?

How many moles of electrons were passed through the solution?

A x + y/24
B 2x + y/12
C x + y/12
D 2x + y/24

14 All of the following about Period 3 elements and compounds are true **except**:

A Atomic radius decreases across the Period.
B Electronegativity increases across the Period.
C The pH of the chlorides generally decreases across the Period.
D Melting point of oxides decreases across the Period.

15 Both chlorine and bromine can oxidize iron(II) ions but not iodine.
All the following may be reasons for the observations **except**:

A the electronegativity of the halogens decreases down the group.
B the oxidizing power of the halogens decreases down the group.
C chlorine and bromine have a greater attraction for electrons than Fe^{2+} has
D the oxidising power of iodine is stronger than Fe^{3+}.

16 When drops of aqueous ammonia are added to a solution of $Cu(NO_3)_2$, a pale blue precipitate is formed. This precipitate dissolved when excess aqueous ammonia is added, forming a deep blue solution. On addition of dilute hydrochloric acid, the pale blue precipitate is reformed.

Which process **does not** occur in the above?

A Dative bond formation
B Formation of a complex ion.
C Reduction of copper(II) ions.
D Precipitation of copper(II) hydroxide.

17 Which one of the statements of the Group II elements (magnesium to barium) or their compounds is **correct**?

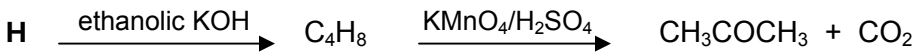
A The stability of the carbonate to heat decreases on descending the group.

B The magnitude of the enthalpy change of hydration of the metal ion increases on descending the group.

C The most suitable method for extracting Group II elements is to reduce their oxides with carbon.

D The lattice energy of the Group II sulphates is less exothermic on descending the group.

18 Compound **H** undergoes the following reactions:



Compound **H** could be

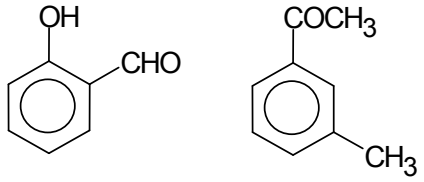
A $CH_3CH_2CH_2CH_2I$

B $CH_3CH_2CHICH_3$

C $CH_3CHICHICH_3$

D $(CH_3)_2CHCH_2I$

19 Which one of the following CANNOT be used to distinguish between the following compounds?



A Hot acidified $K_2Cr_2O_7$

B Neutral iron(III) chloride

C Sodium carbonate

D Silver diammine complex

20 Under identical conditions, reaction 1 proceeds faster than reaction 2 even though the mechanisms for both reactions are the same.

reaction 1 $CH_3CHBrCH_3 + NaCN \rightarrow CH_3CH(CN)CH_3 + NaBr$
reaction 2 $CH_3CHBrCH_3 + NaI \rightarrow CH_3CHICH_3 + NaBr$

What factor will explain this result?

A The C — I bond is a stronger bond than the C — Br bond.
B The C — N bond is a stronger bond than the C — I bond.
C The cyanide ion is a stronger nucleophile than the iodide ion.
D The cyanide ion is a weaker nucleophile than the iodide ion.

21 Under identical conditions, which one of the following gives the order for the ease of hydrolysis for 1-chloropropane, propanoyl chloride and 1-chloropropene?

Least readily hydrolysed → Most readily hydrolysed

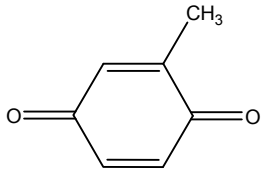
A	propanoyl chloride	1-chloropropene	1-chloropropane
B	1-chloropropane	1-chloropropene	propanoyl chloride
C	1-chloropropene	1-chloropropane	propanoyl chloride
D	1-chloropropene	propanoyl chloride	1-chloropropane

22 2-methylpropane can react with chlorine in the presence of sunlight to give two monosubstituted halogenoalkanes, 1-chloro-2-methylpropane and 2-chloro-2-methylpropane. What is the expected ratio of 1-chloro-2-methylpropane to 2-chloro-2-methylpropane given the relative rates of abstracting H atoms are:

Type of H atom	primary	secondary	tertiary
Relative rate of abstraction	1	4	6

A 9 : 1
B 3 : 2
C 1 : 6
D 1 : 2

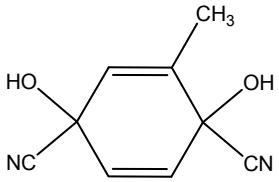
23 The unsaturated diketone as shown below is excreted by the bombardler beetle.



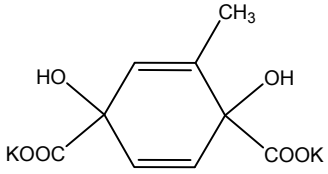
What is the final product formed when this compound is reacted via the following steps?

Step 1: Add HCN with small amount of aqueous KCN.
Step 2: Add aqueous KOH, reflux

A



B



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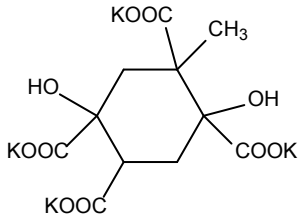
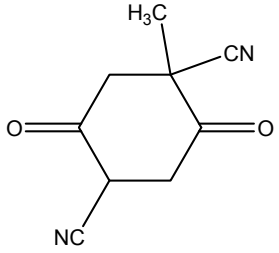
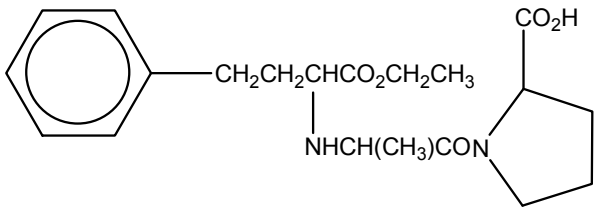


D



24 Enalapril as shown below is used to treat hypertension.

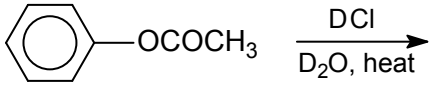


Which of the following is **true** of Enalapril?

A It decolourises aqueous bromine.
B It forms 1 mole of hydrogen when reacted with a mole of sodium.
C It has 3 chiral centres.
D It reacts with 2,4-dinitrophenylhydrazine.

25 Which reactions yield a carbon compound incorporating deuterium, D? [D = ^{2}H]

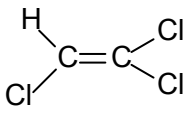
I $CH_3CH_2CN \xrightarrow[D_2O]{NaOH}$

II 

III $CH_3COCI_3 \xrightarrow[D_2O]{NaOD}$

A I, II and III
B I and III
C II and III
D II only

26 Trichloroethene is widely used as a dry-cleaning agent.



With which of the following does trichlorethene react to give a chiral product?

A ICl

B HCl

C NaCN (aq)

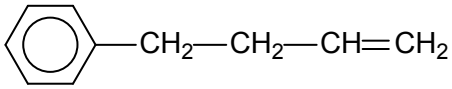
D NaOH (aq)

27 Compound **J**

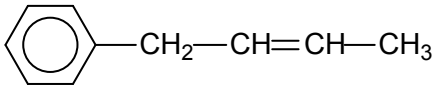
- has the molecular formula $C_{10}H_{14}O$;
- is unreactive towards mild oxidising agents.

What is the structure of the compound formed by the dehydration of **J**?

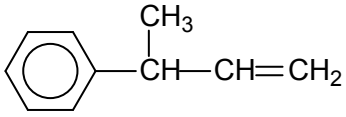
A



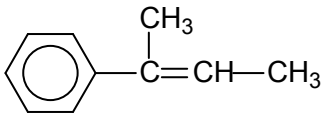
B



C



D



28 A student treated chloromethyl benzene, $C_6H_5CH_2Cl$, with two reagents **K** and **L** in succession to yield phenyl ethanoic acid, $C_6H_5CH_2COOH$. Which of the following gives the correct reagents used?

	K	**L**
A	Aqueous KOH	Acidified $K_2Cr_2O_7$
B	Ethanolic KOH	Acidified $K_2Cr_2O_7$
C	Ethanolic KCN	Dilute H_2SO_4
D	HCN	Dilute H_2SO_4

29 Which one of the following can act as an oxidising agent but not as a reducing agent?

A CH_3CH_2CHO

B Fe^{2+}

C I^-

D $Ag(NH_3)_2^+$

30 Compound **N** was refluxed with aqueous sodium hydroxide and the resulting mixture then distilled. The distillate gave a positive tri-iodomethane test; the residue in the distillation flask, after acidification, gave a white precipitate.

Which of these could be **N**?

A $C_6H_5CONHCH_2CH_3$

B $C_6H_5CO_2CH_3$

C $CH_3CH_2OCOC_6H_5$

D $CH_3CONHC_6H_5$

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.

31 Boron nitride is formed by the direct combination between boron and nitrogen when heated. It has a structure similar to graphite. It is likely to be

1 a semi-conductor of electricity

2 a lubricant

3 very hard

32 At 35° C, $K_c = 1.6 \times 10^{-5}$ mol dm^{-3} for the reaction

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

Which of the following statements are correct?

1 [NO] < [NOCl] at equiliibrium

2 K_c will increase with an increase in temperature.

3 Position of equilibrium will shift to the right when argon is introduced at constant pressure.

33 Which of the following has the same value as the standard enthalpy change of formation of carbon monoxide?

1 $\Delta H_{combustion}(C) - \Delta H_{combustion}(CO)$

2 $\Delta H_{formation}(CO_2) - \Delta H_{combustion}(CO)$

3 ½ $\Delta H_{formation}(CO_2)$

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.

34 *Use of the Data Booklet is relevant to this question.*
Which statements of the electrochemical cell shown below are **correct**?

$$Pt(s) \mid OH^-(aq) \mid O_2(g) \,\|\, NO_3^-(aq) \mid N_2O\,(g) \mid Pt(s) \qquad E^o_{cell} = 0.7\ V$$

1 The standard electrode potential of the $NO_3^-(aq)/N_2O\,(g)$ half cell is 1.1 V.

2 Decreasing the partial pressure of oxygen gas at the anode will increase the E_{cell} value.

3 The oxidation state of nitrogen changes from +5 to +1

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

Which of the following pairs does the first member decompose more easily than the second member?

1 $CaCO_3$ and $SrCO_3$

2 HI and HCl

3 $Cu(NO_3)_2$ and $Ca(NO_3)_2$

36 The number of moles of chlorine that react with 1 mol of **X** is twice the number of moles of chlorine that react with 1 mol of **Y**.

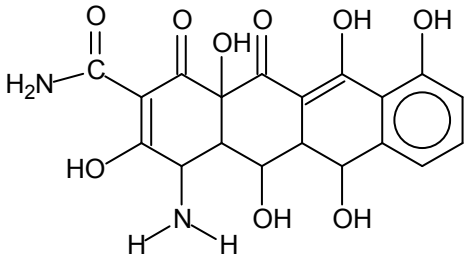
Which of these pairs could be **X** and **Y**?

	X	**Y**
1	Mg(s)	Na(s)
2	H_2	KBr(aq)
3	cold NaOH (aq)	hot NaOH (aq)

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.

37 Oxytetracycline, whose structure is given below, is a class of antibiotics that is used to treat many common and rare infections.



One mole of oxytetracycline reacts with

1 3 moles of phosphorus pentachloride

2 2 moles of hydrochloric acid at room temperature.

3 6 moles of ethanoyl chloride

38 Which of the following pairs gives the same product when treated with hot acidified $KMnO_4$?

1 CH_3CH_2OH and $CH_3CH{=}CHCH_3$

2 $C_6H_5CH_2CH_3$ and C_6H_5CHO

3 CH_3OH and $CH_2(OH)CH_2OH$

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.

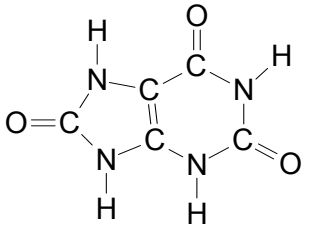
39 Fly paper which contains *Muscalure* with the following structure

$$CH_3(CH_2)_{12}CH=CH(CH_2)_{12}CH_3$$

is used as a non-toxic method of trapping houseflies.
Which of the following statements about *Muscalure* are **correct**?

1 It exists as a pair of geometrical isomers
2 It gives a diol with cold, dilute potassium manganate(VII).
3 It can be extracted from the fly paper by soaking the paper in benzene.

40 Gout is a disease caused by the buildup of uric acid in the blood stream.



uric acid

Correct statements about uric acid include

1 it decolourises bromine water.
2 it produces NH_3 when heated with aqueous sodium hydroxide.
3 it forms orange precipitate with 2, 4-dinitrophenylhydrazine.

Answers

1	**B**	**11**	**C**	**21**	**C**	**31**	**B**
2	**A**	**12**	**D**	**22**	**B**	**32**	**A**
3	**B**	**13**	**B**	**23**	**B**	**33**	**B**
4	**B**	**14**	**D**	**24**	**C**	**34**	**A**
5	**D**	**15**	**D**	**25**	**C**	**35**	**A**
6	**C**	**16**	**C**	**26**	**A**	**36**	**B**
7	**B**	**17**	**D**	**27**	**D**	**37**	**D**
8	**C**	**18**	**D**	**28**	**C**	**38**	**A**
9	**C**	**19**	**C**	**29**	**D**	**39**	**A**
10	**B**	**20**	**C**	**30**	**C**	**40**	**B**