Class Adm No

Candidate Name: _____

H

millennia institute

2013 Promotional Examination II
Pre-University 2

H1 CHEMISTRY **8872 / 01**

24 September 2013

50 minutes

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Do not turn over this question paper until you are told to do so.
2. Write your name, class and admission number in the spaces provided at the top of this page and on the Answer Sheet provided.
3. Answer **ALL** questions and shade the correct answers on the Answer Sheet provided using a soft pencil.
4. **No extra time** will be given for shading.
5. Hand in the question paper and the Answer Sheet separately.

INFORMATION FOR CANDIDATES

Marks will not be deducted for wrong answers; your total score will be the number of correct answers given.

FOR EXAMINER'S USE	
TOTAL (30 marks)	

This question paper consists of 12 printed pages and 2 blank pages.

[Turn over

Answer all questions on the OMR form provided (30 Marks)

Section A

For each question, there are four possible answers, **A**, **B**, **C** and **D**.

Choose the **one** you consider correct.

1. Which of the following have the same number of particles as 32.0 g of oxygen gas?

A 2.0 g of hydrogen gas

B 11.5 g of sodium metal

C 24.0 g of carbon

D 35.5 g of chlorine gas

2. 10 cm^3 of a hydrocarbon C_xH_y was exploded with 100 cm^3 of oxygen. After cooling to room temperature, the resultant gaseous mixture has a volume of 80 cm^3. When the resultant gaseous mixture was treated with a solution of potassium hydroxide, the volume of the gaseous mixture decreased to 40 cm^3. What is the molecular formula of the hydrocarbon?

[All gas volumes are measured at r.t.p.]

A C_3H_6

B C_3H_8

C C_4H_8

D C_4H_{10}

3. The metallic ion, M^{x+}, is oxidised to MO_4^- by acidified $K_2Cr_2O_7$ solution. A sample of 25.0 cm^3 of 0.280 mol dm^{-3} aqueous M^{x+} requires 23.30 cm^3 of 0.200 mol dm^{-3} acidified $K_2Cr_2O_7$ solution for complete reaction. What is the value of x in M^{x+}?

[$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightleftharpoons 2Cr^{3+} + 7H_2O$]

A 1

B 2

C 3

D 4

4. Which of the following species in their ground states have three unpaired electrons?

A Si

B S

C Fe^{3+}

D Cr^{3+}

5. Which of the following species contains ionic, covalent and dative bonding within itself?

A Al_2Cl_6

B NH_4SO_4

C H_2SO_4

D H_3O^+

6. Which of the following series of substances **does not** show a decreasing trend in boiling point?

A $BaCl_2 > BCl_3 > BF_3$

B $CH_3I > CH_3Br > CH_3Cl$

C $AsH_3 > PH_3 > NH_3$

D $CH_3COONa > CH_3COOH > CH_3CH_2OH$

7. Which of the following reactions has a negative enthalpy change of reaction?

A $KOH(aq) + HCl(aq) \rightarrow KCl(aq) + H_2O(l)$

B $H_2O(l) \rightarrow H_2O(g)$

C $NaF(s) \rightarrow Na^+(g) + F(g)$

D $Cl_2(g) \rightarrow 2Cl(g)$

8. Dinitrogen oxide, N=N=O, reacts with ethyne, H-C≡C-H, in the gaseous phase to produce water vapour, carbon dioxide and nitrogen gases as the only products.

$$5N_2O\,(g) + C_2H_2\,(g) \rightarrow H_2O\,(g) + 2CO_2\,(g) + 5N_2\,(g)$$

The enthalpy change of the reaction is -1710 kJ mol^{-1}.

Using appropriate information from the *Data Booklet*, calculate the N=O bond energy, in kJ mol^{-1}, in dinitrogen oxide.

A 390

B 686

C 784

D 1370

9. The enthalpy change of formation of aluminium oxide and copper(II) oxide is -1676 kJ mol^{-1} and -155 kJ mol^{-1} respectively. What is the enthalpy change of the following reaction?

$$2Al(s) + 3CuO(s) \rightarrow Al_2O_3(s) + 3Cu(s)$$

A -1521 kJ mol^{-1}

B -1211 kJ mol^{-1}

C +1211 kJ mol^{-1}

D +2141 kJ mol^{-1}

10. For the following equilibrium:

$$3Fe\,(s) + 4H_2O\,(g) \rightleftharpoons Fe_3O_4\,(s) + 4H_2\,(g)$$

Which is the correct expression for the equilibrium constant, K_c?

A $\dfrac{[Fe]^3\,[H_2O]^4}{[Fe_3O_4]\,[H_2]^4}$

B $\dfrac{[Fe_3O_4]\,[H_2]^4}{[Fe]^3\,[H_2O]^4}$

C $\dfrac{[H_2O]^4}{[H_2]^4}$

D $\dfrac{[H_2]^4}{[H_2O]^4}$

11. Consider the following equilibrium:

$$PCl_5\,(g) \rightleftharpoons PCl_3\,(g) + Cl_2\,(g) \qquad \Delta H > 0$$

Which of the following statements is correct?

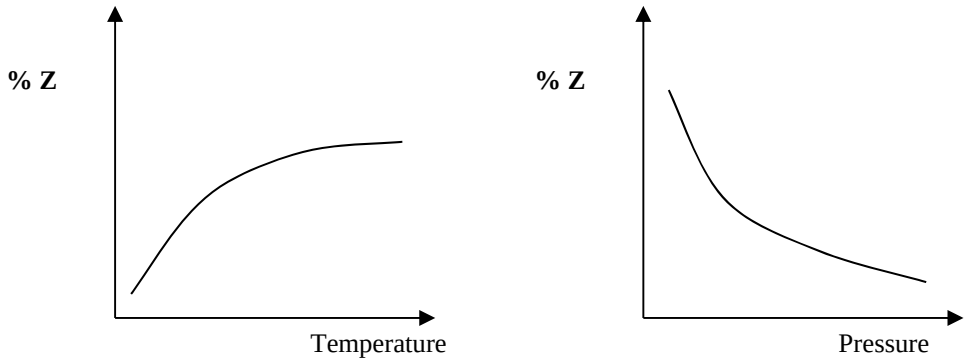
A Increasing the temperature will decrease the yield of Cl_2.

B Increasing the pressure will decrease the yield of Cl_2.

C The equilibrium constant has a unit of $mol^2\ dm^{-6}$.

D The presence of a catalyst will increase the yield of Cl_2.

12. A compound **Z** is formed during a gas phase reaction. The graphs below show how the percentage of **Z** present at equilibrium varies with temperature and pressure.



Which of the following responses concerning the equilibrium is correct?

	Enthalpy change of reaction	$\frac{\textbf{No. of gaseous particles in product}}{\textbf{No. of gaseous particles in reactant}}$
A	Exothermic	> 1
B	Exothermic	< 1
C	Endothermic	> 1
D	Endothermic	< 1

13. What is the pH of a solution prepared by dissolving 5.0 g of NaOH in 500 cm^3 of water?

A 0.6

B 3.6

C 10.4

D 13.4

14. The following data was obtained from the studies of the reaction between O_2 and N_2O_5 in a vessel at constant temperature.

Experiment	**1**	**2**	**3**
Initial **total** volume of O_2 and N_2O_5 / cm^3	1.00	1.60	2.00
Initial volume of O_2 / cm^3	0.60	1.20	1.20
Initial rate of reaction / $cm^3\ s^{-1}$	2.06	4.12	16.48

Which of the following statements is correct regarding the above system?

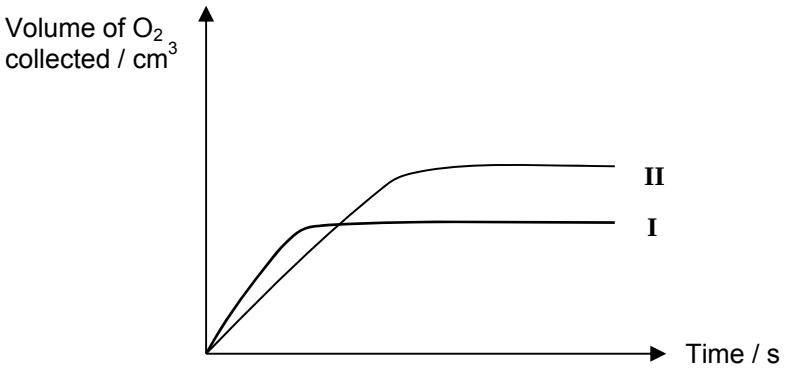
A The rate equation is rate = $k\ [O_2]^2$.

B The overall order of the reaction is three.

C The rate constant k has units of $cm^{-3}s^{-1}$.

D The reaction is first order with respect to N_2O_5.

15. In the diagram below, curve **I** was obtained from the decomposition of 250 cm^3 of 2.0 mol dm^{-3} hydrogen peroxide in the presence of manganese(IV) oxide as a catalyst at 25 °C.



Which alteration to the original experiment would produce curve **II**?

A Using more manganese(IV) oxide.

B Increasing the temperature.

C Adding 50 cm^3 of 1.0 mol dm^{-3} hydrogen peroxide.

D Adding 200 cm^3 of water.

16. Which of the following statements about the rate constant of a chemical reaction is **not** true?

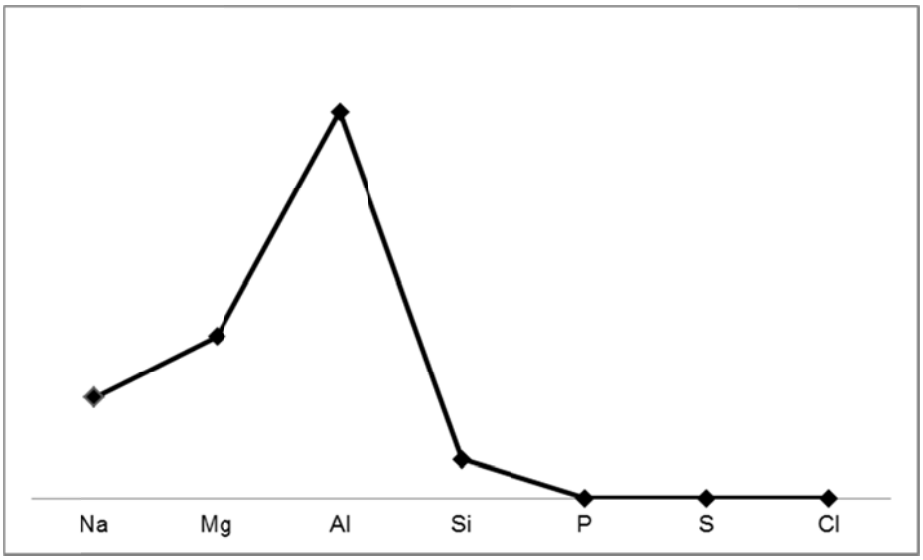
A Increase in concentration of reactants will increase the rate constant.

B The rate constant decreases when the activation energy of the reaction is increased.

C The rate constant of different reactions can have different units.

D The rate constant increases when a catalyst is used.

17. The graph shows how a property of the elements Na to C*l* varies across the period.



What is the property?

A Electrical conductivity

B Atomic radius

C Melting point

D Electronegativity

18. A mixture of an oxide and a chloride of elements in Period 3 is added to water. The resulting solution has a pH of 2.

What could be the constituents of the mixture?

A Na_2O and $MgCl_2$

B NaC*l* and Na_2O

C $SiCl_4$ and SiO_2

D Al_2O_3 and NaC*l*

19. Methyl butanoate, $CH_3OCOCH_2CH_2CH_3$, is responsible for the smell of pineapples. What are the products formed when methyl butanoate undergoes alkaline hydrolysis?

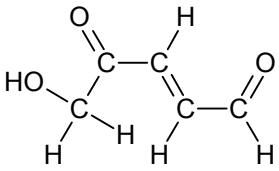
A CH_3COOH and $CH_3CH_2CH_2OH$

B $CH_3CH_2CH_2COOH$ and CH_3OH

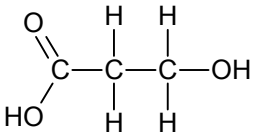
C $CH_3CH_2CH_2COO^-$ and CH_3O^-

D $CH_3CH_2CH_2COO^-$ and CH_3OH

20. Which of the following reagents can be used to distinguish between compounds **R** and **S** shown below?



Compound **R**



Compound **S**

A Na_2CO_3

B PCl_5

C $LiAlH_4$ in dry ether

D acidified $K_2Cr_2O_7$

21. 0.02 mol of alkene **F** requires 1.92 dm^3 of gaseous HBr for complete reaction at room temperature and pressure. How many double bonds are present in one molecule of **F**?

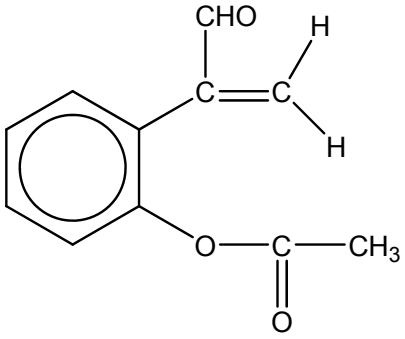
A 2

B 3

C 4

D 5

22. Which of the following is **not** correct for compound **A**?



compound **A**

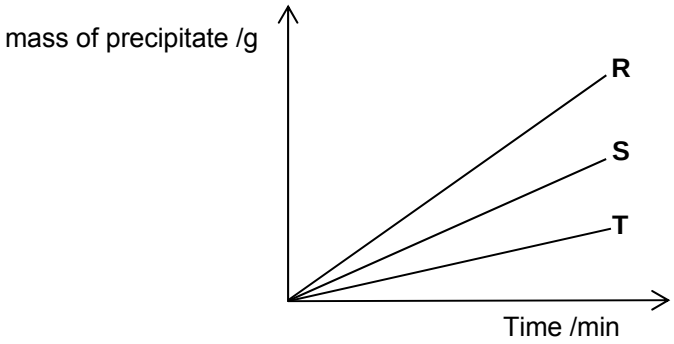
A It decolourises aqueous bromine.

B It can be reduced by $NaBH_4$ in ethanol.

C It reacts with Fehling's solution to give a brick-red ppt.

D It reacts with hot ethanolic KOH.

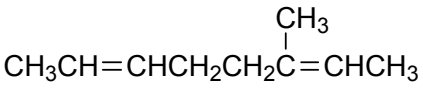
23. Three different halogenoalkanes, **R**, **S** and **T** were separately hydrolysed in hot aqueous alkali, followed by treatment with acidified silver(I) nitrate solution. The mass of the precipitate formed was collected and weighed. The following graph was obtained.



Which of the following sets gives the possible identities of compounds **R**, **S** and **T**?

	R	**S**	**T**
A	$CH_3CH(CH_3)CH_2F$	$CH_3CH(CH_3)CH_2Cl$	$CH_3CH(CH_3)CH_2Br$
B	$CH_3CH(CH_3)CH_2Cl$	$CH_3CH(CH_3)CH_2Br$	$CH_3CH(CH_3)CH_2F$
C	$CH_3CH(CH_3)CH_2Br$	$CH_3CH(CH_3)CH_2F$	$CH_3CH(CH_3)CH_2Cl$
D	$CH_3CH(CH_3)CH_2Br$	$CH_3CH(CH_3)CH_2Cl$	$CH_3CH(CH_3)CH_2F$

24. How many cis-trans isomers would be possible for the following molecule?



A 2

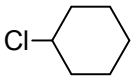
B 4

C 6

D 8

25. Which of the following compounds could undergo an elimination reaction when treated with hot ethanolic sodium hydroxide?

A $C(CH_3)_3OH$

B 

C CH_2=CHOH

D CH_3Br

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 that 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

26. The boiling point of ethylamine, $CH_3CH_2NH_2$, is 16.6°C.

Which bond(s) is/are broken when ethylamine is boiled?

1 Covalent bonds

2 Hydrogen bonds

3 Temporary dipole-induced dipole interactions

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

27. A metal hydroxide dissolves partially in water as shown:

$$M(OH)_2(s) + aq \rightleftharpoons M^{2+}(aq) + 2OH^-(aq) \qquad \Delta H > 0$$

Which of the following statements is/are true as temperature increases?

1 pH increases

2 More $M(OH)_2$ (s) dissolves.

3 Equilibrium is reached at a faster rate

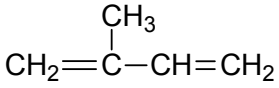
28. Which of the following series of species show(s) an increase in the radii?

1 $Ca^{2+} < K^+ < Ar$

2 $Cl^- < S^{2-} < P^{3-}$

3 $Na < Mg < Al$

29. 2-methylbuta-1,3-diene is used to make synthetic rubber. The structure of the molecule is shown.



2-methylbuta-1,3-diene

Which of the following statements about 2-methylbuta-1,3-diene is/are **not** correct?

1 It has two C atoms which are sp^2 hybridised.

2 It reacts with hot acidified $K_2Cr_2O_7$ to give CO_2.

3 It can exhibit cis-trans isomerism.

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

30. Which of the following synthetic routes can produce ethanoic acid?

1 $CH_3CH(OH)CH_3 \xrightarrow[\text{warm}]{\text{aqueous alkaline iodine}} \xrightarrow[\text{r.t.p.}]{\text{dilute } H^+}$

2 $CH_3Br \xrightarrow[\text{reflux}]{\text{alcoholic KCN}} \xrightarrow[\text{heat}]{\text{dilute } H^+}$

3 $CH_3CHO \xrightarrow[\text{warm}]{[Ag(NH_3)_2]^+} \xrightarrow[\text{r.t.p.}]{\text{dilute } H^+}$

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