Class Adm No

Candidate Name: _____

H

millennia institute

2015 Promotional Examination II

Pre-university 2

H1 CHEMISTRY **8872 / 01**

Paper 1 Multiple Choice **23 Sept 2015**

50 minutes

Additional materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Do not turn over this question paper until you are told to do so

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and admission number in the spaces provided at the top of this page and on the Multiple Choice Answer Sheet 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 Multiple Choice Answer Sheet provided.

Read the instructions on the Multiple Choice 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 question paper.

The use of an approved scientific calculator is expected, where appropriate.

Section A

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

1 Given the following isotopic composition of **X**, what is the relative atomic mass of a sample of **X**?

Isotope	Percentage abundance/ %
^{54}**X**	5.8
^{56}**X**	91.6
^{57}**X**	2.2
^{58}**X**	0.4

A 55.9 **B** 56.0 **C** 56.1 **D** 56.2

2 What volume of O_2 is used up when **b** cm^3 of a 50:50 mixture by volume of methane and propane are completely burnt?

A 3**b** cm^3

B $\frac{7\mathbf{b}}{2}$ cm^3

C 6**b** cm^3

D 7**b** cm^3

3 Which one of the following equations shows the smallest increase in the oxidation state of the underlined element?

A $2HgCl_2 + \underline{Sn}Cl_2 \rightarrow Hg_2Cl_2 + SnCl_4$

B $I_2 + 2Na_2\underline{S}_2O_3 \rightarrow Na_2S_4O_6 + 2NaI$

C $Cl_2 + \underline{Mn}O_4^{2-} \rightarrow 2MnO_4^- + 2Cl^-$

D $Br_2 + 2K\underline{I} \rightarrow 2KBr + I_2$

4 Which of the following could be the proton number of an element that has 2 unpaired electrons in its ground state?

A 11 **B** 13 **C** 23 **D** 28

5 Which of the following sequences show the compounds, $CH_3CH_2NH_2$, H_2O, $Mg(CH_3COO)_2$, and Cl_2 in order of increasing volatility?

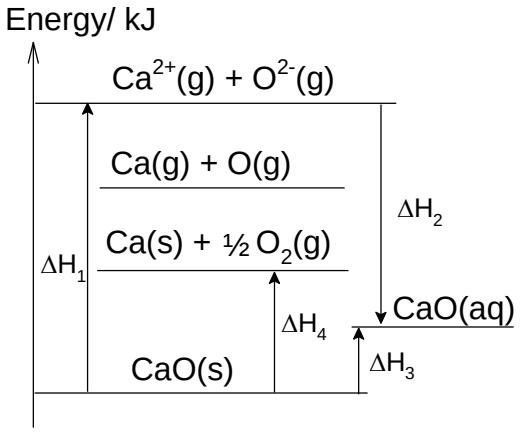
A Cl_2, $CH_3CH_2NH_2$, H_2O, $Mg(CH_3COO)_2$

B $CH_3CH_2NH_2$, $Mg(CH_3COO)_2$, H_2O, Cl_2

C $Mg(CH_3COO)_2$, H_2O, $CH_3CH_2NH_2$, Cl_2

D $Mg(CH_3COO)_2$, Cl_2, H_2O, $CH_3CH_2NH_2$

6 In the energy level diagram below, what does ΔH_4 represent?



A $-\Delta H_f(CaO(s))$

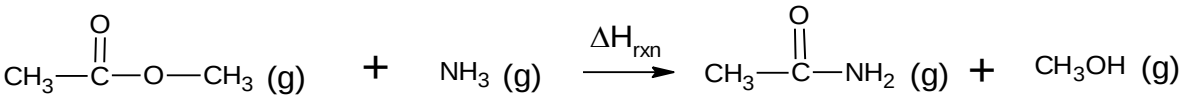
B $\Delta H_f(CaO(s))$

C – L.E(CaO(s))

D L.E(CaO(s))

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

What is the enthalpy change of reaction, ΔH_{rxn}, for the reaction shown below?



A +15 kJ mol^{-1}

B –15 kJ mol^{-1}

C +1515 kJ mol^{-1}

D –1515 kJ mol^{-1}

8 The rate of reaction of a strip of magnesium and 30 cm^3 of 1.20 mol dm^{-3} HC*l* is determined at 30 °C. In which case would **both** new conditions contribute to an increase in the rate of reaction?

A Mg powder and 100 cm^3 of 1.20 mol dm^{-3} HC*l*

B Mg powder and 30 cm^3 of 1.0 mol dm^{-3} HC*l*

C 100 cm^3 of 1.20 mol dm^{-3} HC*l* at 40 °C

D 30 cm^3 of 1.50 mol dm^{-3} HC*l* at 40 °C

9 The table gives data for the reaction between reactants **D** and **E** at constant temperature.

Experiment	[D] /mol dm^{-3}	[E] /mol dm^{-3}	Initial rate / mol dm^{-3} s^{-1}
1	0.055	0.330	1.50×10^{-3}
2	0.110	0.330	6.00×10^{-3}
3	0.110	0.160	6.00×10^{-3}

What is the rate equation for the reaction?

A rate = k[**D**]^2

B rate = k[**E**]^2

C rate = k[**D**]^2[**E**]

D rate = k[**D**][**E**]^2

10 Consider the following equilibrium reaction:

$$2Al(s) + 3MnSO_4(aq) \rightleftharpoons Al_2(SO_4)_3(aq) + 3Mn(s)$$

Which of the following gives the correct units for the equilibrium constant K_c?

A mol dm^{-3}

B mol^{-1} dm^3

C mol^2 dm^{-6}

D mol^{-2} dm^6

11 Which of the following statements concerning the equilibrium below is **incorrect**?

$$2CrO_4^{2-}(aq) + 2H^+(aq) \rightleftharpoons Cr_2O_7^{2-}(aq) + H_2O(l) \qquad \Delta H = 0 \text{ kJ mol}^{-1}$$

A The forward and backward reactions are proceeding at the same rate.

B The position of equilibrium shifts to the right with an addition of CrO_4^{2-} ions.

C The position of equilibrium shifts to the left with an increase in pH.

D The equilibrium constant changes when there is an increase in temperature.

12 Compound **X** decomposes on heating according to the following equation:

$$3\mathbf{X}(g) \rightleftharpoons 2\mathbf{Y}(g) + \mathbf{Z}(g)$$

When 3 mol of **X** were put into a 1 dm^3 vessel and heated, the equilibrium mixture contained 0.3 mol of **Z**.

What is the numerical value of the equilibrium constant, K_c?

A $\dfrac{0.3\times0.3^2}{5^3}$

B $\dfrac{0.3\times0.6^2}{5^3}$

C $\dfrac{0.3\times0.6^2}{0.9^3}$

D $\dfrac{0.3\times0.6^2}{2.1^3}$

13 A 1.00 dm^3 solution was made by mixing 0.00400 mol of HC*l* (aq) and 0.00250 mol of NaOH (aq).

What is the pH of the resulting solution?

A 2.19 **B** 2.40 **C** 2.60 **D** 2.82

14 For the equilibrium,

$$HSO_4^-(aq) + HPO_4^{2-}(aq) \rightleftharpoons SO_4^{2-}(aq) + H_2PO_4^-(aq)$$

Which one of the following is a conjugate Bronsted-Lowry acid-base pair?

	Base	Conjugate Acid
A	HPO_4^{2-}	$H_2PO_4^-$
B	HPO_4^{2-}	PO_4^{3-}
C	HSO_4^-	SO_4^{2-}
D	HSO_4^-	HPO_4^{2-}

15 An element of the third period (Na to S) is heated in chlorine. The product is purified and then added to water. The resulting solution is found to be neutral.

What is the element?

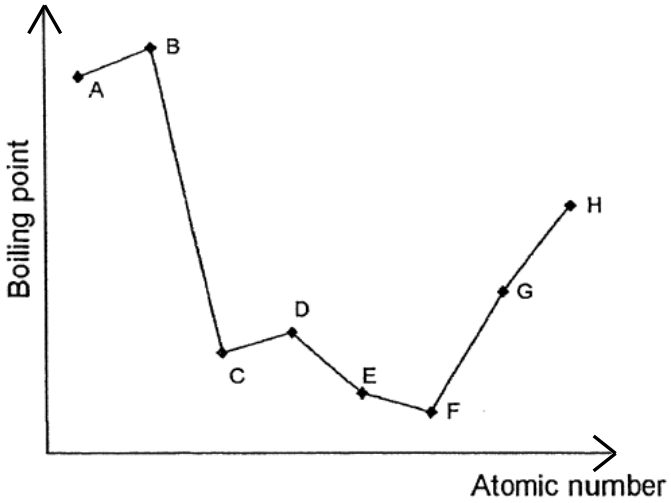
A Aluminium

B Phosphorus

C Silicon

D Sodium

16 The graph below shows the variation in the boiling points for eight consecutive elements in the Periodic Table, all with atomic number between 10 and 20.



Which of the following statements best describes the element based on the graph above?

A Element **H** does not conduct electricity.

B Element **C** forms an acidic oxide.

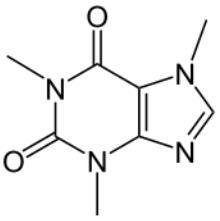
C Element **D** is in Group V.

D Element **B** has a smaller atomic radius than element **C**.

17 CH_3COOCH_3 and CH_3CH_2COOH have the same molecular formula.
Which of the following statements about both compounds is correct?

A They are cis-trans isomers.
B They are structural isomers.
C Both compounds react with PCl_5 to produce white fumes.
D Both compounds contain carboxylic acid functional group.

18 Caffeine is found in coffee. It acts as a stimulant, temporarily warding off drowsiness and restoring alertness. The structure of caffeine is shown below.



caffeine

Which statement about caffeine is **incorrect**?

A It has a molecular formula $C_8H_{10}N_4O_2$.
B It decolourises cold, dilute alkaline $KMnO_4$.
C It contains three sp^3 hybridised carbons.
D It exhibits cis-trans isomerism.

19 In which of these reactions is the **organic product** a gas at room temperature and pressure?

A Dehydration of ethanol
B Esterification of ethanoic acid by ethanol
C Oxidation of ethanol
D Substitution of ethanol by PCl_5.

20 Compound **Z** has the following properties.

- Changes acidified potassium dichromate(VI) from orange to green
- Produces an orange precipitate with 2,4-dinitrophenylhydrazine

Which of the following compounds can **Z** be?

A CH_3COCH_2COOH

B $CH_3COCH_2COCH_3$

C $CH_3COCH_2CH_2OH$

D $CH_2(OH)CH_2CH_2COOH$

21 In the 2-step synthesis to convert propan-1-ol to 2-chloropropane, which of the following pairs of **sequential reactions** is involved?

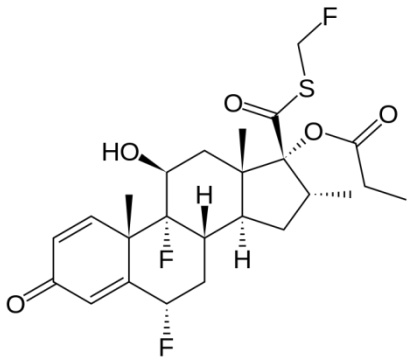
A Elimination, substitution

B Elimination, addition

C Free radical substitution, oxidation

D Substitution, reduction

22 Fluticasone propionate is used to treat asthma.



fluticasone propionate

Which of the following reagents reacts with fluticasone propionate to give an **observable** change?

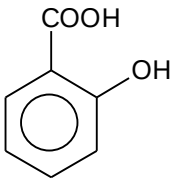
A Br_2 (aq)

B CH_3COOH in the presence of concentrated H_2SO_4

C $H_2(g)$, Ni catalyst

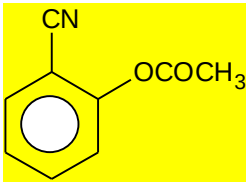
D Tollen's reagent

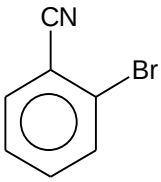
23 Salicylic acid has the structure shown below.

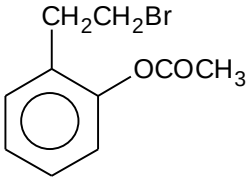


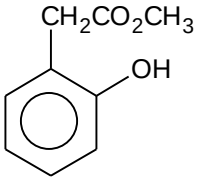
salicylic acid

Which of the following compounds gives salicylic acid on acid hydrolysis?

A 

B 

C 

D 

24 Ethanoic acid has a K_a value of 1.80×10^{-5} mol dm^{-3}. Which of the following compounds will have a K_a value smaller than that of ethanoic acid?

A HCOOH

B $ClCH_2COOH$

C C_6H_5COOH

D CH_3CH_2COOH

25 Compound **Y** is boiled with aqueous sodium hydroxide and the resulting mixture cooled and acidified with dilute sulfuric acid. The resulting products include propanoic acid and an alcohol. This alcohol gives a yellow precipitate with iodoform test.

What is the formula of compound **Y**?

A $CH_3CH_2CO_2CH_3$

B $CH_3CH_2CO_2CH_2CH_2CH_3$

C $CH_3CH_2CO_2CH_2CH_3$

D $CH_3CO_2CH_2CH_2CH_3$

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 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

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

26 Which pairs of the compounds contain one that is giant molecular and one that is simple molecular?

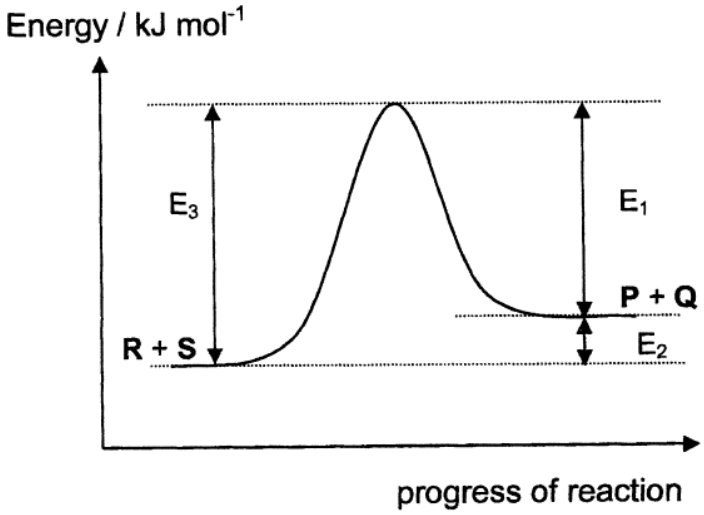
1 Si and $AlCl_3$

2 C and CO_2

3 Cu and HBr

27 The diagram below shows the energy profile for the following reversible reaction:

$$\mathbf{R} + \mathbf{S} \rightleftharpoons \mathbf{P} + \mathbf{Q}$$



It can be inferred from the diagram that

1 the forward reaction is endothermic.

2 the addition of a catalyst would not alter the value of E_2.

3 increasing temperature decreases the value of E_3 and favours the forward 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.

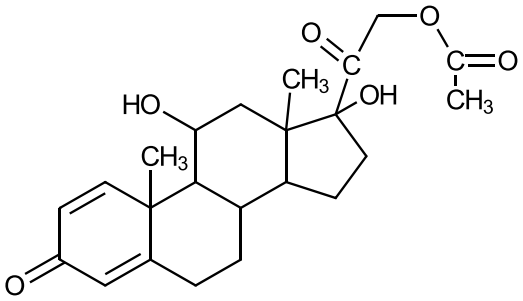
28 Which of the following statements about period 3 elements are **correct**?

1 Electronegativity increases across the period.

2 The ionic radii of the elements decrease across the period.

3 The melting points of the elements decrease across the period.

29 Prednisolone ethanoate is used to reduce swelling, redness, itching and allergic reactions affecting the eye.



prednisolone ethanoate

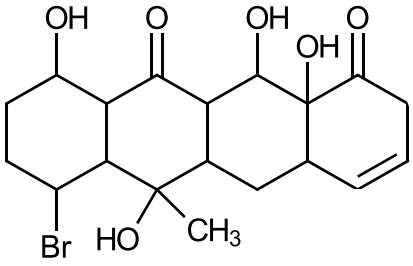
What functional groups are present in the molecular structure of prednisolone ethanoate?

1 Ester

2 Ketone

3 Tertiary alcohol

30 The structure of Compound **X** is shown below.



Compound **X**

Which of the following statements are true for compound **X**?

1 Compound **X** gives an orange precipitate with 2,4-dinitrophenylhydrazine.

2 1 mole of compound **X** reacts with excess sodium metal to produce 2 moles of hydrogen gas.

3 Upon heating with aqueous sodium hydroxide, compound **X** gives a yellow precipitate with aqueous silver nitrate.

END OF PAPER 1

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