Name: _____ **Class:** _____ **Reg Number:** _____

MERIDIAN JUNIOR COLLEGE
JC2 Preliminary Examination
Higher 1

CHEMISTRY 8872 / 01

Paper 1 Multiple Choice **23 September 2011**

50 minutes

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces at the top of this page.

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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.

Use of Answer Sheet

Ensure you have written your name, class register number and class on the OMR Answer Sheet.

Use a **2B** pencil to shade your answers on the OMR sheet; erase any mistakes cleanly. Multiple shaded answers to a question will not be accepted.

For shading of class register number on the ***OMR sheet***, please follow the given examples:
If your register number is **1**, then shade **01** in the index number column.
If your register number is **21**, then shade **21** in the index number column.

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Section A

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

1 A 10 cm^3 sample of ethanethiol, CH_3CH_2SH, was exploded with 80 cm^3 of oxygen according to the given equation:

$$CH_3CH_2SH + \frac{9}{2} O_2 \rightarrow 2\,CO_2 + SO_2 + 3\,H_2O$$

The resultant gas mixture was cooled to room temperature and passed through aqueous sodium hydroxide. What would be the final volume of gas(es) in the resultant mixture?

A 10 cm^3

B 35 cm^3

C 45 cm^3

D 75 cm^3

2 When hydrogen peroxide is added to acidified potassium dichromate(VI), the reaction that occurs is:

$$Cr_2O_7^{2-} + 3H_2O_2 + 8H^+ \rightarrow 2Cr^{3+} + 3O_2 + 7H_2O$$

Which of the following statements is **incorrect** for this reaction?

A The colour changes from orange to green.

B The hydrogen peroxide acts as a reducing agent.

C The oxidation number of oxygen does not change.

D There is bubbling observed as the reaction proceeds.

3 Which pair of species exhibit identical deflections in an electric field?

A $^{14}N^{+}$ and $^{14}N^{-}$

B $^{14}N^{+}$ and $^{28}Si^{2+}$

C $^{16}O^{2-}$ and $^{4}He^{2+}$

D $^{16}O^{2-}$ and $^{32}S^{2-}$

4 Which of the following pairs of substances have the same types of structure and bonding?

A AlF_3 and $AlCl_3$

B HF and HCl

C CO_2 and C

D SiO_2 and Si

5 Which of the following statements regarding the NH_2^- ion is correct?

A It has a linear shape around the N atom.

B It is the conjugate acid of NH_3.

C The bond angle of NH_2^- is smaller than that of NH_3.

D There is a dative bond in the ion.

6 In which of the following reactions will the enthalpy change correspond to an enthalpy change of formation?

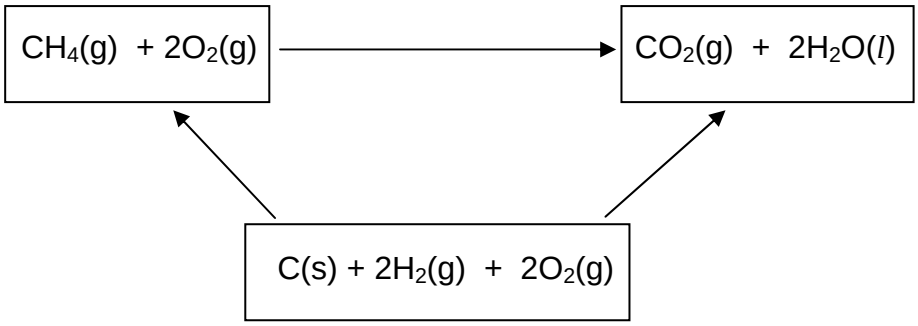
A $2H_2\ (g) + O_2\ (g) \rightarrow 2H_2O\ (g)$

B $Na\ (s) + Cl\ (g) \rightarrow NaCl\ (s)$

C $Mg^{2+}\ (g) + O^{2-}\ (g) \rightarrow MgO\ (s)$

D $K\ (s) + Mn\ (s) + 2O_2\ (g) \rightarrow KMnO_4\ (s)$

7 Look at the energy cycle below.



Given that the $\Delta H_f^{\ominus}(CH_4)$ = – 75 kJ mol^{-1}, $\Delta H_f^{\ominus}(CO_2)$ = – 393 kJ mol^{-1}, and $\Delta H_f^{\ominus}(H_2O)$ = – 286 kJ mol^{-1}, what is the standard enthalpy change of combustion of methane?

A – 604 kJ mol^{-1}

B – 754 kJ mol^{-1}

C – 890 kJ mol^{-1}

D – 1040 kJ mol^{-1}

8 An equilibrium can be represented by the following equation.

$$2\mathbf{L}\ (s) + \mathbf{M}\ (g) \rightleftharpoons \mathbf{N}\ (g) + 2\mathbf{P}\ (g)$$

When 2 mol of **L** and 1 mol of **M** were placed in an empty 1 dm^3 container and heated, the equilibrium mixture contained 0.48 mol of **L**.

What is the numerical value of the equilibrium constant, K_c, at the temperature of the experiment?

A 4.8

B 7.3

C 9.8

D 32

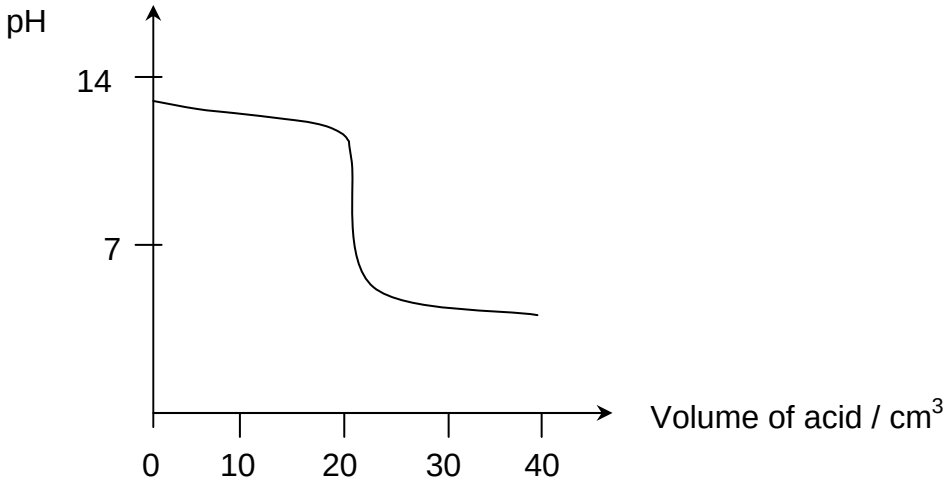
9 Bromocresol green is an acid-base indicator with a pH range of 3.8 to 5.4. The acidic colour of the indicator is yellow and the alkaline colour is blue.

Two drops of the indicator are added to each of the four aqueous solutions listed below. Which solution has its colour **not** correctly stated?

	Solution	Colour
A	Aqueous H_2SO_4 of concentration 1.0×10^{-4} mol dm^{-3}	yellow
B	Aqueous Na_2SO_4 of concentration 2.0×10^{-5} mol dm^{-3}	blue
C	Aqueous HC*l* of concentration 3.0×10^{-5} mol dm^{-3}	yellow
D	Aqueous NaC*l* of concentration 5.0×10^{-6} mol dm^{-3}	blue

10 In an acid-base titration, a 0.10 mol dm^{-3} solution of an acid is added to 10 cm^3 of a 0.10 mol dm^{-3} solution of an alkali.

The pH value of the solution is plotted against the volume, V, of acid added as shown in the diagram.



This diagram could represent a titration between

A $CH_3CO_2H(aq)$ and $Ba(OH)_2(aq)$

B $CH_3CO_2H(aq)$ and $KOH(aq)$

C $H_2SO_4(aq)$ and $KOH(aq)$

D $H_2SO_4(aq)$ and $Ba(OH)_2(aq)$

11 Bromine is formed by the reaction between bromate(V) ions and bromide ions and acid:

$$BrO_3^-(aq) + 5Br^-(aq) + 6H^+(aq) \rightarrow 3Br_2(aq) + 3H_2O(l)$$

The results of some experiments on the reaction are shown below.

Experiment	Concentration / mol dm^{-3}			Initial rate / mol dm^{-3} s^{-1}
	BrO_3^-	Br^-	H^+	
1	0.10	0.10	0.10	1.2×10^{-3}
2	0.10	0.30	0.10	3.6×10^{-3}
3	0.20	0.10	0.10	2.4×10^{-3}
4	0.20	0.10	0.20	9.6×10^{-3}

Which statement is true based on the above data?

A The overall order of reaction is three.

B The rate of reaction is independent of $[BrO_3^-]$.

C The units of the rate constant is $mol^{-3}\ dm^9\ s^{-1}$.

D The time taken for the concentration of Br^- to decrease to half its initial value is the same for Experiment 1 to 4.

12 Which of the following statements about the properties of a catalyst is correct?

A A catalyst increases the average kinetic energy of the reacting particles.

B A catalyst decreases the rate of the reverse reaction.

C A catalyst has no effect on the enthalpy change of the reaction.

D A catalyst does not react and hence remains chemically unchanged at the end of the reaction.

13 **Q**, **R**, **S**, and **T** are elements in Period 3 of the Periodic Table.

Amongst all the elements in Period 3, **Q** has the largest ionic radius, **R** has the highest electrical conductivity, **S** has the highest melting point and **T** has highest first ionisation energy.

Which of the following sequences shows correctly the elements in increasing proton number?

A **T**, **Q**, **R**, **S**

B **T**, **R**, **S**, **Q**

C **R**, **S**, **Q**, **T**

D **Q**, **R**, **S**, **T**

14 Sodium and aluminium are elements in Period 3 of the Periodic Table.

Which statement concerning the compounds of sodium and aluminium is correct?

A Both their chlorides give acidic solutions when added to water.

B Both their chlorides have similarly high boiling points.

C Both their oxides give neutral solutions when added to water.

D Both their oxides react with hydrochloric acid.

15 The hexa-aquairon(III) ion, $[Fe(H_2O)_6]^{3+}$, hydrolyses as shown.

$$[Fe(H_2O)_6]^{3+}(aq) \rightleftharpoons [Fe(H_2O)_5(OH)]^{2+}(aq) + H^+(aq)$$

Which of the following statements is correct?

A The hydrolysis is favoured by low pH values.

B The iron undergoes a change in oxidation state.

C The hexa-aquairon(II) ion, $[Fe(H_2O)_6]^{2+}$, is less likely to undergo hydrolysis.

D The O–H bonds in H_2O are weaker than in $[Fe(H_2O)_6]^{3+}$.

16 How many dichlorinated structural isomers can be formed by the chlorination of pentane in the presence of sunlight?

A 8

B 9

C 10

D 11

17 Fly paper is used as a non-toxic method of trapping houseflies. To increase its effectiveness and attractiveness, *Muscalure*, which is a fly sex pheromone, is added to the paper during its manufacture. *Muscalure* has the structure

$$CH_3(CH_2)_7CH{=}CH(CH_2)_{12}CH_3$$

Which of the following statements about *Muscalure* is **incorrect**?

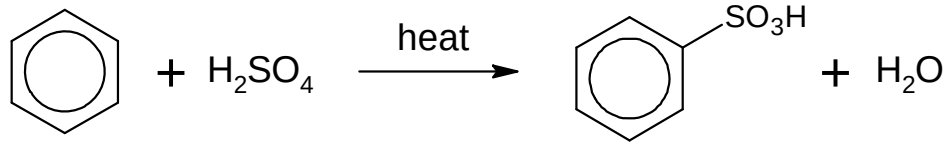
A It exists as a pair of geometrical isomers.

B It gives a diol with cold, dilute potassium dichromate(VI).

C It undergoes addition with aqueous bromine to give three organic compounds.

D It can be extracted from the fly paper by soaking the paper in a solution of benzene.

18 When benzene and concentrated sulfuric acid are heated together under reflux for several hours, benzenesulfonic acid is formed.



What type of reaction has benzene undergone?

A addition

B neutralisation

C oxidation

D substitution

19 Ozone depletion potential (ODP) is a measure of the effectiveness of chlorofluoroalkanes in destroying stratospheric ozone.

In which sequence are compounds listed in increasing order of their ODPs?

A $CHCl F_2$ < CH_3CCl_2F < $CCl_2FCCl F_2$

B $CHCl F_2$ < $CCl_2FCCl F_2$ < CH_3CCl_2F

C $CCl_2FCCl F_2$ < $CHCl F_2$ < CH_3CCl_2F

D CH_3CCl_2F < $CCl_2FCCl F_2$ < $CHCl F_2$

20 Chloroethane, bromoethane and iodoethane were heated with aqueous $AgNO_3$. The time taken for the silver halide precipitate to form is given below.

Chloroethane: 10 minutes

Bromoethane: 2 minutes

Iodoethane: Instantaneous

Which statement best explains the rate of reaction?

A The electronegativity of the halogens decreases down the group.

B The atomic radius of the halogens increases down the group.

C The C–C*l* bond is the most polar and the C–I bond is the least polar.

D The C–C*l* bond is the strongest and the C–I bond is the weakest.

21 2-bromopropane, $(CH_3)_2CHBr$, may be used as the starting point for making $(CH_3)_2CHCO_2H$.

Which of the following sequences would be most suitable?

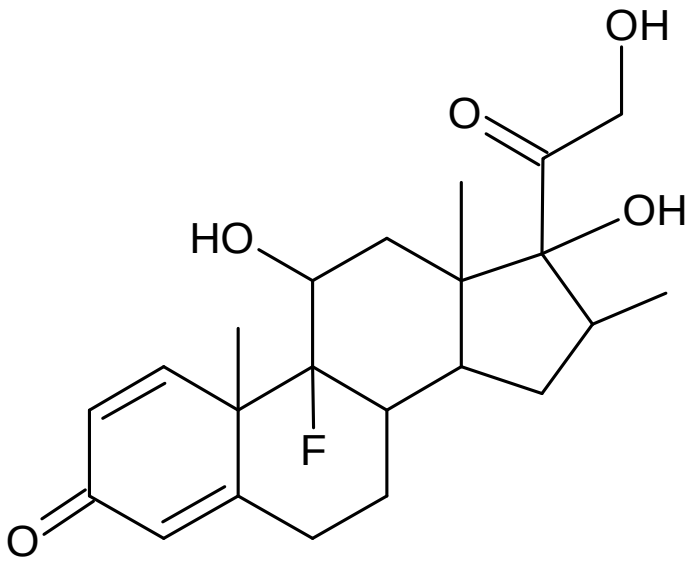
A $(CH_3)_2CHBr \rightarrow (CH_3)_2CHOH \rightarrow (CH_3)_2CHCO_2H$

B $(CH_3)_2CHBr \rightarrow (CH_3)_2CHCN \rightarrow (CH_3)_2CHCO_2H$

C $(CH_3)_2CHBr \rightarrow (CH_3)_2CHOH \rightarrow (CH_3)_2CHCN \rightarrow (CH_3)_2CHCO_2H$

D $(CH_3)_2CHBr \rightarrow (CH_3)_2CHCN \rightarrow (CH_3)_2CHOH \rightarrow (CH_3)_2CHCO_2H$

22 Recently in Singapore, it was found that some traditional Chinese medicine health products that were being sold illegally contained the compound dexamethasone.



dexamethasone

Dexamethasone is first treated with hydrogen in the presence of a platinum catalyst, and the product is then oxidised by warming with acidified $KMnO_4$.

Given that no carbon-carbon σ-bond is broken in this process, how many double bonds will there be in the structure of the final product?

A 3

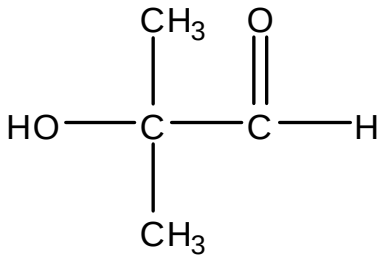
B 4

C 5

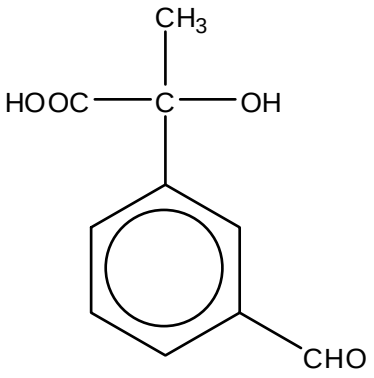
D 6

[Turn Over

23 Which of the following reagents may be used to distinguish between the compounds **U** and **V** under suitable conditions?



Compound U



Compound V

A Alkaline aqueous iodine

B Fehling's solution

C Hot acidified potassium manganate (VII)

D Sodium metal

24 Which reactions will **not** yield an organic compound incorporating deuterium, D? [D = $^{2}_{1}H$]

A CH_3COOH heated with CD_3OD and concentrated D_2SO_4

B CH_3CHO with $LiAlD_4$ in dry ether at room temperature

C CH_3CH_2Br heated with ethanolic NaOD

D $CH_2{=}CH_2$ with DCl in CCl_4 at room temperature

25 Which of the following compounds is insoluble in water but soluble in dilute aqueous sodium hydroxide?

A benzoic acid

B cyclohexanol

C ethanoic acid

D propan-1-ol

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 The values of two lattice energies are given below.

$NaF, -915\ kJ\ mol^{-1}$

$MgO, -3933\ kJ\ mol^{-1}$

Which of the following correct statements help to explain the difference between these two values?

1 The two ions in each compound are isoelectronic.

2 The attraction between doubly charged ions is about four times that between singly charged ions.

3 The interionic distance in NaF is 0.102 nm and that in MgO is 0.074 nm.

27 A metal hydroxide dissolves partially in water as shown:

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

Which of the following are true as temperature increases?

1 The pH of the solution would increase.

2 The system would reach equilibrium in a shorter time.

3 The value of the equilibrium constant would increase.

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 At 35^{o}C, the value of K_c is 1.6 x 10^{-5} for the following reaction:

$$\mathbf{W}(s) + \mathbf{X}(g) \rightleftharpoons \mathbf{Y}(g)$$

Which of the following statements are correct?

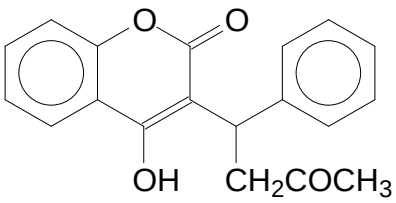
1 When equilibrium is reached, the concentration of **Y** is less than that of **X**.

2 When the volume of the vessel is reduced, the equilibrium position will remain unchanged.

3 When a catalyst is added to the system, the concentration of **Y** at equilibrium will increase.

29 Warfarin is an anticoagulant medication that helps to prevent blood from clotting.

It has the structure shown below:



Which of the following statements about Warfarin are **false**?

1 It can exhibit cis-trans isomerism.

2 It is resistant to hydrolysis in acidic medium.

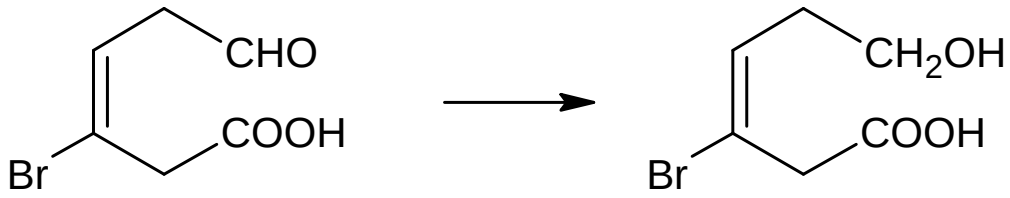
3 It gives an orange precipitate when heated with 2,4-DNPH.

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.

30 The following conversion needs to be carried out in a laboratory.



Which of the following reagents can be used for the above conversion?

1 $NaBH_4$ in ethanol

2 $LiAlH_4$ in dry ether

3 $H_2(g)$ with platinum catalyst

[Turn Over

Answers for 2011 JC2 H1 Chemistry Prelim Paper 1

Q No.	1	2	3	4	5	6	7	8	9	10
Ans	B	C	B	D	C	D	C	B	C	A

Q No.	11	12	13	14	15	16	17	18	19	20
Ans	C	C	C	D	C	B	B	D	A	D

Q No.	21	22	23	24	25	26	27	28	29	30
Ans	B	B	B	C	A	C	A	B	B	D