PIONEER JUNIOR COLLEGE

JC2 PRELIMINARY EXAMINATION
HIGHER 1

CANDIDATE NAME									
CT GROUP	**1**	**5**				INDEX NUMBER			

CHEMISTRY 8872/01

Paper 1 Multiple Choice **23 September 2016**

50 minutes

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write your name, CT group and index number in the spaces provided.
Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **thirty** questions in 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.

Section A

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

1 Which of the following gases would occupy a volume of 3 dm^3 at 25 ^oC and 1 atmospheric pressure?

A 3.2 g of O_2 gas

B 5.6 g of N_2 gas

C 8.0 g of SO_2 gas

D 11.0 g of CO_2 gas

2 In an experiment, 60 cm^3 of a 0.1 mol dm^{-3} solution of metal(III) chloride salt reacted exactly with 30 cm^3 of 0.1 mol dm^{-3} aqueous sodium sulfite. The half-equation for oxidation of sulfite ion is shown below.

$$SO_3^{2-} + H_2O \rightarrow SO_4^{2-} + 2H^+ + 2e^-$$

What would be the change in oxidation number of the metal at the end of the reaction?

A −1 **B** −2 **C** −3 **D** −4

3 The electronic configurations of two atoms, **D** and **E**, are given below:

D: $1s^2\,2s^2\,2p^6\,3s^2\,3p^3$

E: $1s^2\,2s^2\,2p^6\,3s^2\,3p^4$

Which of the following is correct?

	1st I.E.	2nd I.E.
A	**D** < **E**	**D** > **E**
B	**D** < **E**	**D** < **E**
C	**D** > **E**	**D** > **E**
D	**D** > **E**	**D** < **E**

4 BH_3 reacts with NH_3 to give NH_3BH_3.

Which of the following about NH_3BH_3 is correct?

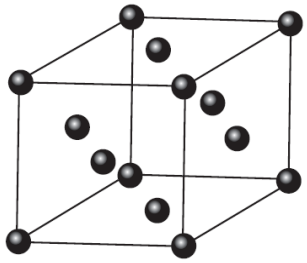
A It contains hydrogen bonding.

B The bonds around B atom are tetrahedrally arranged.

C The B atom is electron deficient.

D The B atom donates its lone pair of electrons to the N atom.

5 Aluminium and iodine are both solids with face-centred cubic crystal structures. The diagram shows the arrangement of the particles in this type of crystal lattice.



What are the particles present in each lattice?

	aluminium	**iodine**
A	atoms	atoms
B	atoms	molecules
C	cations	anions
D	cations	molecules

6 Which molecules is **not** planar?

A $AlCl_3$ **B** C_2H_4 **C** N_2H_4 **D** XeF_4

7 Which equation correctly defines the standard enthalpy change of formation of water?

A $2H(g) + O(g) \rightarrow H_2O(g)$

B $2H(g) + O(g) \rightarrow H_2O(l)$

C $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(g)$

D $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$

8 The explosive nitroglycerin, $C_3H_5N_3O_9$, decomposes rapidly upon ignition or sudden impact according to the following equation:

$$4C_3H_5N_3O_9(l) \rightarrow 12CO_2(g) + 10H_2O(g) + 6N_2(g) + O_2(g) \qquad \Delta H^{\ominus} = -5678 \text{ kJ mol}^{-1}$$

Given the following data:

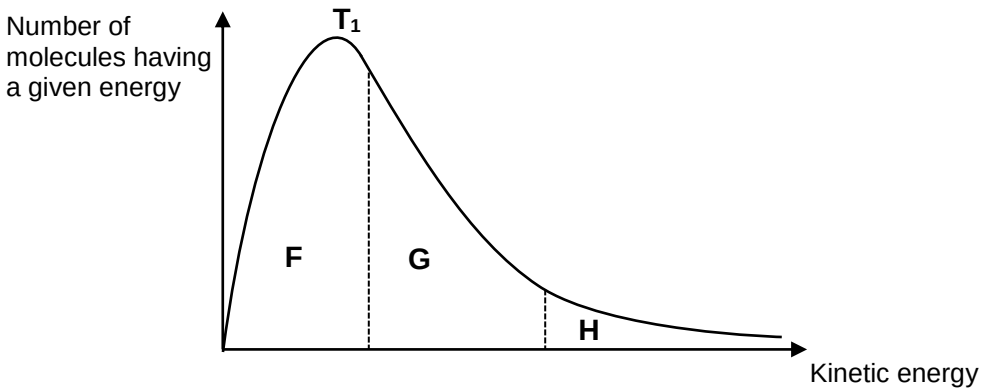
Standard enthalpy change of formation of $CO_2(g) = -394$ kJ mol^{-1}
Standard enthalpy change of formation of $H_2O(g) = -242$ kJ mol^{-1}

What is the standard enthalpy change of formation of nitroglycerin?

A -368 kJ mol^{-1} **B** -1470 kJ mol^{-1}

C -3207 kJ mol^{-1} **D** $+5042$ kJ mol^{-1}

9 The Boltzman distribution curve shows the number of molecules have a particular kinetic energy at constant temperature, $\mathbf{T_1}$.



How would the size of the areas labelled **F**, **G** and **H** change if a lower temperature, $\mathbf{T_2}$ was used?

	F	**G**	**H**
A	increase	increase	decrease
B	increase	decrease	decrease
C	decrease	increase	increase
D	decrease	decrease	increase

10 At 300 ^{o}C, the equilibrium constant for the reaction 2**J**(g) $\rightleftharpoons$ 2**K**(g) + **L**(g) is x.

What is the equilibrium constant for the following reaction at the same temperature?

$$\mathbf{K}(g) + \tfrac{1}{2}\mathbf{L}(g) \rightleftharpoons \mathbf{J}(g)$$

A $\dfrac{1}{\sqrt{x}}$ **B** $\sqrt{x}$

C x **D** x^2

11 The dissociation of dinitrogen tetroxide into nitrogen dioxide is represented by the equation below.

$$N_2O_4(g) \rightleftharpoons 2NO_2(g) \qquad \Delta H = +52.7 \text{ kJ mol}^{-1}$$

If the temperature of an equilibrium mixture of these gases is increased at constant volume, how would the equilibrium position and pressure be affected?

	equilibrium position	**pressure**
A	shifts to the right	increase
B	shifts to the right	decrease
C	shifts to the left	increase
D	shifts to the left	Decrease

12 Which is a suitable indicator for the titration between 0.5 mol dm^{-3} propanoic acid and 1.0 mol dm^{-3} sodium hydroxide?

A No suitable indicator

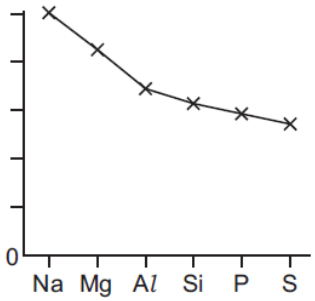
B Methyl red (pH range 4.2 – 6.3)

C Bromothymol blue (pH range 6.0 – 7.6)

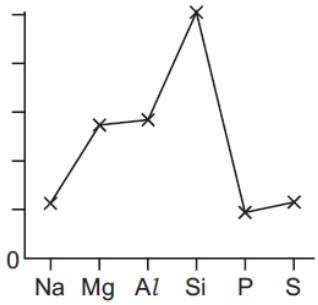
D Phenolphthalein (pH range 8.2 – 10)

13 The graphs below show the variation in two properties of the elements Na to S.

Graph 1



Graph 2



Which properties are illustrated in Graphs 1 and 2?

	Graph 1	**Graph 2**
A	atomic radius	first ionisation energy
B	atomic radius	melting point
C	electrical conductivity	first ionisation energy
D	electrical conductivity	melting point

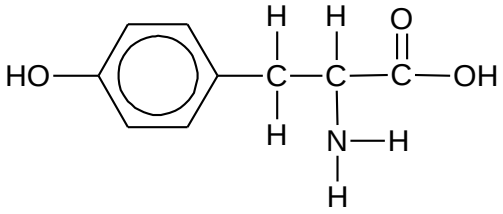
14 Which set contains a basic, an acidic and an amphoteric oxide?

A	Na_2O	MgO	Al_2O_3
B	MgO	Al_2O_3	P_4O_{10}
C	Al_2O_3	SiO_2	P_4O_{10}
D	MgO	P_4O_{10}	SO_3

15 How many alcohols can have the molecular formula $C_4H_{10}O$?

A 2 **B** 3 **C** 4 **D** 5

16 Which bond angle is **not** found in the following molecule?



A 105 ° **B** 107 ° **C** 120 ° **D** 180 °

17 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 $CHCIF_2$ < CH_3CCI_2F < CCI_2FCCIF_2

B $CHCIF_2$ < CCI_2FCCIF_2 < CH_3CCI_2F

C CCI_2FCCIF_2 < $CHCIF_2$ < CH_3CCI_2F

D CH_3CCI_2F < CCI_2FCCIF_2 < $CHCIF_2$

18 Alkane **M**, C_6H_{14}, was reacted with chlorine in the presence of ultraviolet light. Only two mono-chlorinated products of formula $C_6H_{13}CI$ were obtained.

What is a possible structure of **M**?

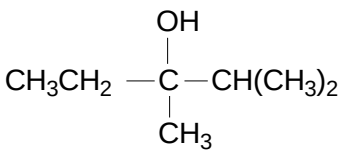
A $CH_3CH_2CH_2CH_2CH_2CH_3$

B $(CH_3)_2CHCH_2CH_2CH_3$

C $(CH_3)_2CHCH(CH_3)_2$

D $(CH_3)_3CCH_2CH_3$

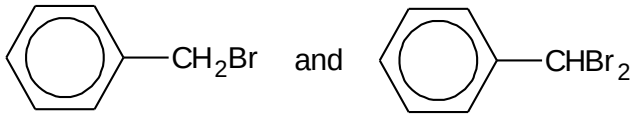
19 How many possible products (including geometric isomers) can be formed when the following compound is treated with excess concentrated sulfuric acid at 170 °C?

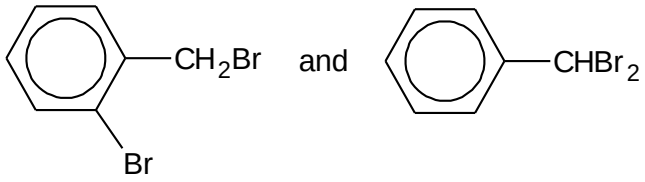


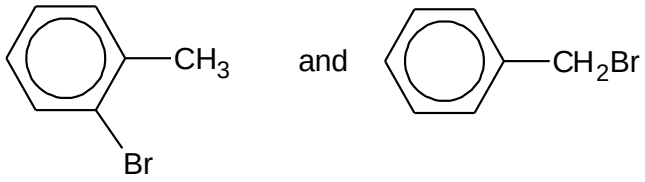
A 3 **B** 4 **C** 5 **D** 6

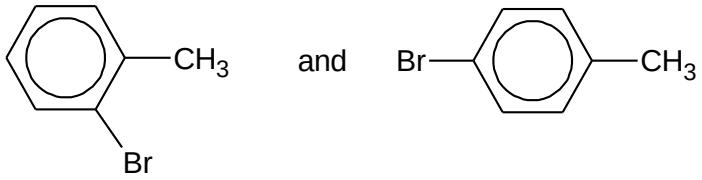
20 Methylbenzene reacts with bromine in the presence of anhydrous iron(III) bromide in the dark.

What are the main products obtained when an equimolar quantity of methylbenzene and bromine are mixed?

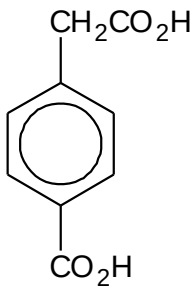
A 

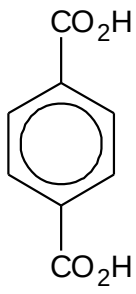
B 

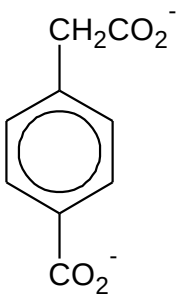
C 

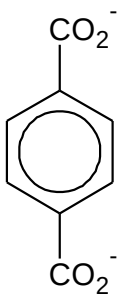
D 

21 What is the product formed when 1-ethyl-4-methylbenzene reacts with hot alkaline potassium manganate(VII)?

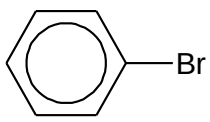
A 

B 

C 

D 

22 In which compound is the carbon-halogen bond hydrolysed most readily by aqueous sodium hydroxide?

A 

B CH_2=CH*Cl*

C CH_3CH_2Br

D CH_3CH_2Cl

23 The Russian composer Borodin was also a research chemist who discovered a reaction in which two ethanal molecules combine to form a compound as shown in reaction **I**. The product forms another compound on heating in reaction **II**.

I $2CH_3CHO \rightarrow CH_3CH(OH)CH_2CHO$

II $CH_3CH(OH)CH_2CHO \rightarrow CH_3CH=CHCHO + H_2O$

Which best describes reactions **I** and **II**?

	reactions **I**	reactions **II**
A	addition	condensation
B	addition	elimination
C	substitution	condensation
D	substitution	elimination

24 Aldehydes and ketones are produced industrially by the catalytic oxidation of alkenes, e.g. ethanal is manufactured from ethene as shown below.

$$H_2C=CH_2 + \tfrac{1}{2}O_2 \xrightarrow{\text{catalyst}} CH_3CHO$$

What is produced when pent-2-ene undergoes the same reaction?

A $CH_3CH_2CH_2COCH_3$

B $CH_3CH_2CH_2CH_2CHO$

C $CH_3CH_2COCH_3$

D $CH_3CH_2CH_2CHO$

25 Which compound is likely to have the lowest pK_a value?

A $CH_3CH_2CO_2H$

B $CH_2ClCH_2CO_2H$

C $CH_2FCH_2CO_2H$

D $CH_2(OH)CH_2CO_2H$

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 Iodine and iodide ions undergo the following reaction in aqueous solution.

$$I_2(aq) + I^-(aq) \rightleftharpoons I_3^-(aq)$$

Molecular iodine, I_2, is much more soluble in hexane than in water.

Which of the following would cause a shift in equilibrium position to the **left** when added to the above equilibrium mixture?

1 Adding hexane to the equilibrium mixture.

2 Adding aqueous silver nitrate to the reaction mixture.

3 Adding aqueous potassium iodide to the reaction mixture.

27 The value of the ionic product of water, K_w, varies with temperature.

Temperature/ °C	K_w/ mol^2 dm^{-6}
50	5.5×10^{-14}
25	1.0×10^{-14}

What can be deduced from this information?

1 Water is an acidic liquid at 50 °C.

2 The pH of water at 50 °C is 6.63.

3 The ionic dissociation of water is an endothermic process.

28 Which set of solutions of equal volume, when mixed, will **not** give an acidic buffer?

1 0.10 mol dm^{-3} CH_3CO_2H and 0.10 mol dm^{-3} NaOH

2 0.10 mol dm^{-3} CH_3CO_2H and 0.05 mol dm^{-3} $Ca(OH)_2$

3 0.05 mol dm^{-3} HC*l* and 0.05 mol dm^{-3} CH_3CO_2Na

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 Compound **P** and **Q** have the following formulae:

$HOCH_2CH(OH)CHO$ $HOCH_2COCH_2OH$

P **Q**

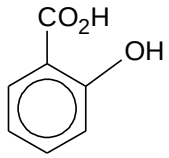
Which statements about these compounds are correct?

1 Both **P** and **Q** can be reduced to $HOCH_2CH(OH)CH_2OH$.

2 Both **P** and **Q** produce a brick-red precipitate with Fehling's reagent.

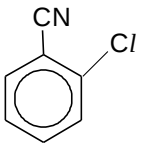
3 **P** can be directly oxidised to **Q**.

30 The diagram below shows the structure of salicyclic acid.



salicyclic acid

Which compounds give salicyclic acid on acid hydrolysis?

1


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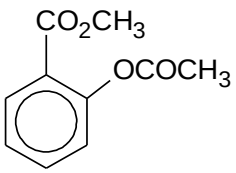

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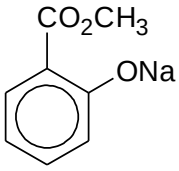

End of Paper

2016 Preliminary Examination
JC2 H1 Chemistry (8872)
Answers

1	C	**11**	A	**21**	D
2	A	**12**	D	**22**	C
3	D	**13**	B	**23**	B
4	B	**14**	B	**24**	A
5	D	**15**	C	**25**	C
6	C	**16**	D	**26**	B
7	D	**17**	A	**27**	C
8	A	**18**	C	**28**	A
9	B	**19**	B	**29**	D
10	A	**20**	D	**30**	C