NANYANG JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
Higher 1

CHEMISTRY 8872/01

Paper 1 Multiple Choice **21 September 2012**

50 minutes

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, class and tutor's name on the Answer Sheet in the spaces provided unless this has been done for you.

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 you 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.

This document consists of **15** printed pages and **1** blank page.

[Turn over

Section A

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

1 Carbon disulfide, CS_2, is a poisonous, volatile liquid used in the manufacture of viscose rayon and cellophane. It reacts with nitrogen monoxide, NO, to form a yellow solid and equal volumes of two gases.

What are the products of the reaction?

A S, CO, N_2

B S, CO, NO_2

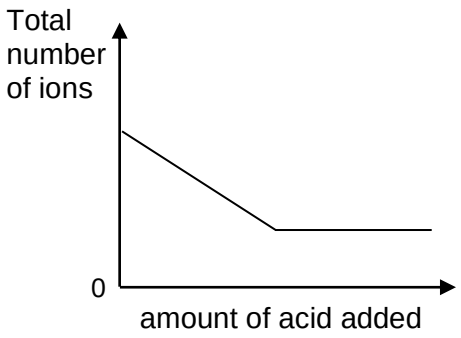
C S, CO_2, N_2

D S, CO_2, NO_2

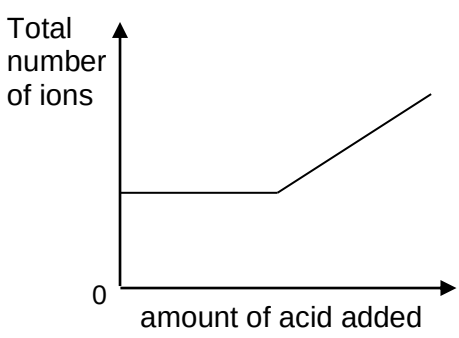
2 Dilute sulfuric acid was added to aqueous barium hydroxide until the acid was in excess.

Which graph shows the variation in the total number of aqueous ions in solution?

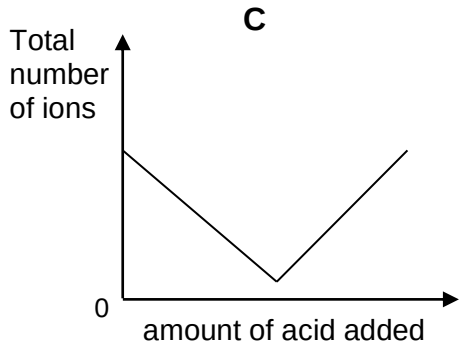
A



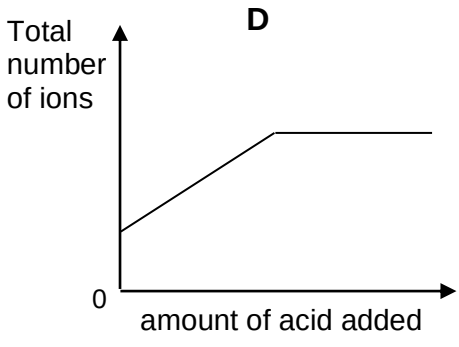
B



C



D



3 What is the electronic configuration of an element with a **second** ionisation energy that is lower than that of each of the elements either side of it in the Periodic Table?

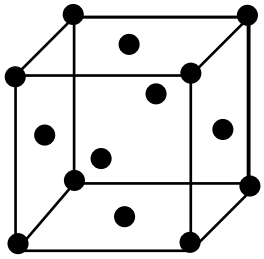
A $1s^2 2s^2 2p^3$

B $1s^2 2s^2 2p^4$

C $1s^2 2s^2 2p^5$

D $1s^2 2s^2 2p^6$

4 Copper and iodine are both shiny crystalline solids. The crystal structures of copper and iodine are both face-centred cubic. The diagram shows the arrangement of the particles in this type of crystal lattice.



What are the particles present in each lattice?

	copper	iodine
A	atoms	anions
B	atoms	atoms
C	cations	atoms
D	cations	molecules

5 What is a property of a solution of dry hydrogen chloride in dry methylbenzene?

A It has a pH less than 7.

B It is a non-conductor of electricity.

C It reacts with magnesium to give hydrogen.

D It reacts with anhydrous sodium carbonate to give carbon dioxide.

6 Which equation is used to define the first ionisation energy of bromine?

A $Br(g) \rightarrow Br^-(g) - e^-$

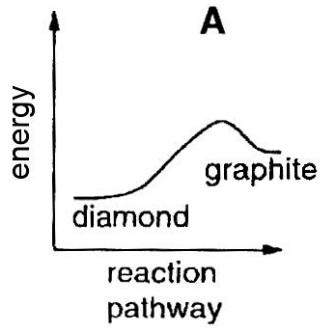
B $Br(g) \rightarrow Br^+(g) + e^-$

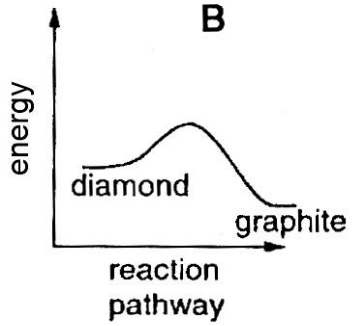
C $\frac{1}{2}Br_2(g) \rightarrow Br^-(g) - e^-$

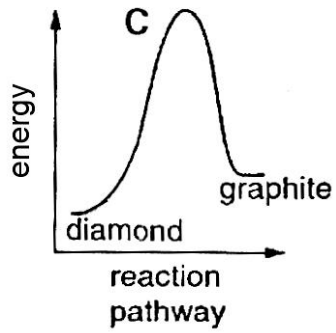
D $\frac{1}{2}Br_2(g) \rightarrow Br^+(g) + e^-$

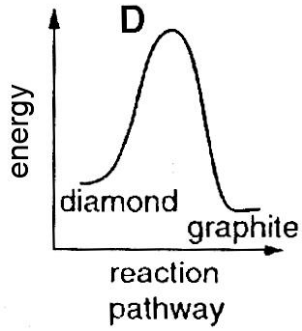
7 The conversion of diamond into graphite is exothermic by 2 kJ mol^{-1}. Diamond does not readily change into graphite.

Which reaction pathway correctly represents this conversion?



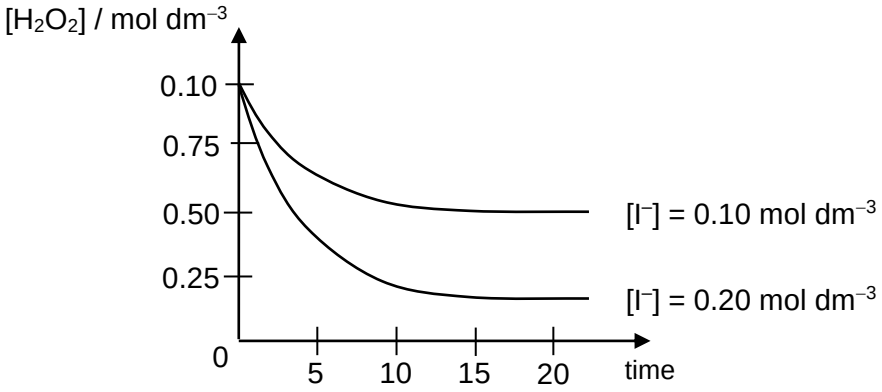






8 The iodide-catalysed decomposition of hydrogen peroxide proceeds by the two-stage process shown.

$$H_2O_2 + I^- \rightarrow IO^- + H_2O$$
$$H_2O_2 + IO^- \rightarrow I^- + H_2O + O_2$$



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

A The overall reaction equation is $2H_2O_2 \rightarrow 2H_2O + O_2$.

B The rate equation is rate = $k[H_2O_2][I^-]$.

C An increase in temperature will increase the total volume of oxygen gas produced.

D The rate constant, k, has a different value if iodide ions are absent.

9 For a gaseous reaction $2\mathbf{X}(g) + \mathbf{Y}(g) \rightarrow \mathbf{Z}(g)$, the rate equation is:

$$\text{rate} = k[\mathbf{X}]^2[\mathbf{Y}]^0$$

If the pressure in the reaction vessel is doubled, but the temperature remains constant, by what factor does the rate of reaction increase?

A 2

B 3

C 4

D 8

10 The equation for a reversible reaction used in industry to convert methane to hydrogen gas is shown below.

$$CH_4(g) + H_2O(l) \rightleftharpoons CO(g) + 3H_2(g) \qquad \Delta H^{\ominus} = -210 \text{ kJ mol}^{-1}$$

Which of the following statements is correct about this reaction when equilibrium has been reached?

A The concentrations of methane and carbon monoxide are equal.

B The rate of the forward reaction is greater than the rate of the reverse reaction.

C The amount of hydrogen is three times the amount of methane.

D The value of ΔH for the reverse reaction is + 210 kJ mol^{-1}.

11 The equation for a reaction used in the manufacture of nitric acid is

$$4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(l) \qquad \Delta H^{\ominus} = -900 \text{ kJ mol}^{-1}$$

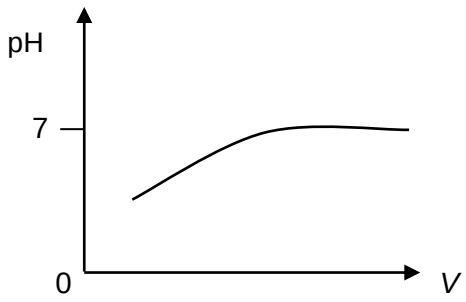
Which changes occur when the temperature of the reaction is increased?

	Position of equilibrium	**Value of K_c**
A	shifts to left	increases
B	shifts to left	decreases
C	shifts to right	increases
D	shifts to right	decreases

12 A 1 mol sample of ethanoic acid is diluted at constant temperature to a volume *V*.

Which diagram shows how the pH of the sample varies with *V*?

A



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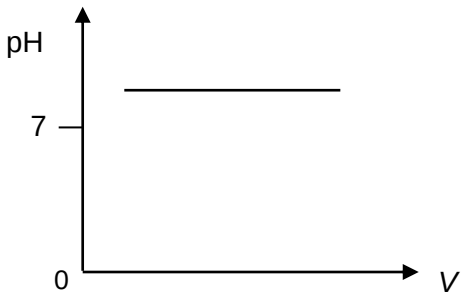

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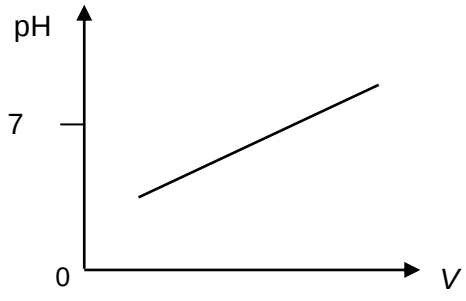
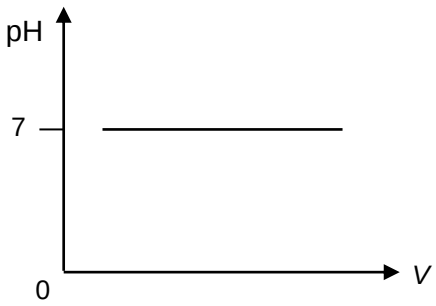


D



13 The table shows some data on two acid-base indicators.

Indicator	Approximate pH range	Colour change	
		acid	alkali
bromocresol green	3.8 – 5.5	yellow	blue
phenol red	6.8 – 8.5	yellow	red

What conclusion can be drawn about a solution in which bromocresol green is blue and phenol red is yellow?

A It is weakly acidic.

B It is neutral.

C It is weakly alkaline.

D It is strongly alkaline.

14 Fruit juices and fizzy drinks such as lemonade are often sold in aluminium cans. What is the most important reason why aluminium is a suitable metal?

A Aluminium can be recycled.

B Aluminium has a very low density.

C Aluminium is resistant to corrosion by acids.

D Aluminium is the most abundant metal in the Earth's crust.

15 A mixture of the oxides of two elements of the third period is dissolved in water. The solution is approximately neutral.

What could be the constituents of the mixture?

A Al_2O_3 and SO_2

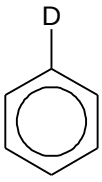
B Na_2O and MgO

C Na_2O and P_4O_{10}

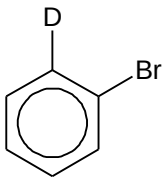
D SO_3 and P_4O_{10}

16 Deuterium, D, is a heavy isotope of hydrogen. Deuteriobenzene is reacted with bromine and iron filings under controlled conditions, so that only monobromination takes place.

Assuming that the carbon-deuterium bond is broken as easily as a carbon-hydrogen bond, which proportion of the brominated products will be 2-bromodeuteriobenzene?



deuteriobenzene



2-bromodeuteriobenzene

A 16%

B 20%

C 33%

D 45%

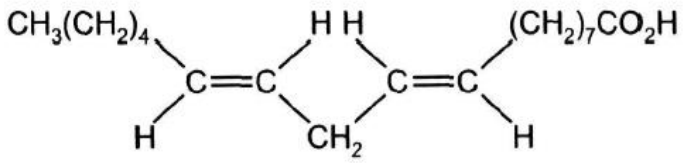
17 Low fat sunflower spreads which are high in polyunsaturates contain esters of linoleic acid.

$CH_3(CH_2)_4CH{=}CHCH_2CH{=}CH(CH_2)_7CO_2H$
linoleic acid

On the lid of a brand of spread it is claimed that the spread contains virtually no *trans* fatty acids.

Which isomer does **not** contain a *trans* linkage and could be present in the spread?

A



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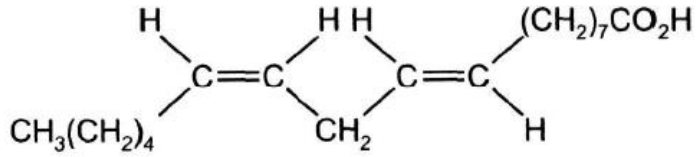

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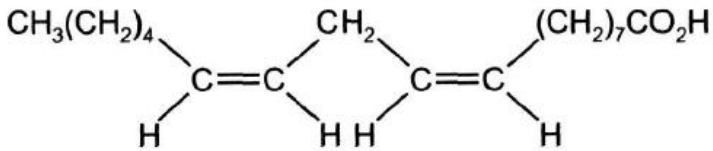
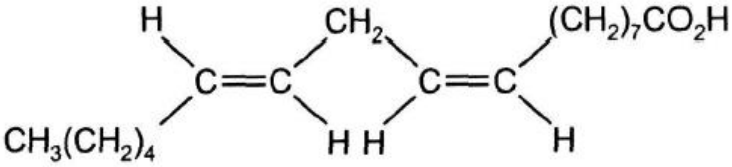


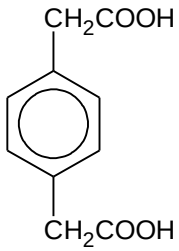
D



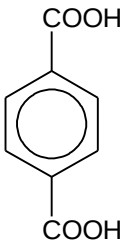
18 A sample of 1,4-diethylbenzene was treated with hot, concentrated alkaline $KMnO_4$.

What compound could be formed?

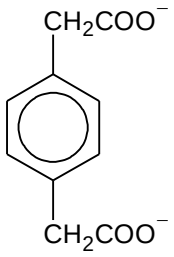
A



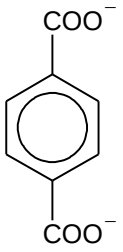
C



B



D



19 Aqueous silver nitrate was added at the same time to separate solutions of chloroethane and iodoethane. The first signs of a reaction were in the sample containing iodoethane.

Why was the reaction with iodoethane noticed first?

A The chloroethane also reacted with the aqueous silver nitrate but gave a soluble product.

B The chloroethane reacted more slowly because the carbon-chlorine bond is less polar than carbon-iodine bond.

C The chloroethane reacted more slowly because the carbon-chlorine bond is longer than carbon-iodine bond.

D The iodoethane reacted more quickly because the carbon-iodine bond is weaker than carbon-chlorine bond.

20 What will be the final organic products in this sequence of reactions?

$$(CH_3)_2C(OH)CH_2CH_2Cl \xrightarrow[\text{heat}]{\text{NaOH(alc)}} \mathbf{P} \xrightarrow[\text{heat}]{KMnO_4/H^+} \textbf{products}$$

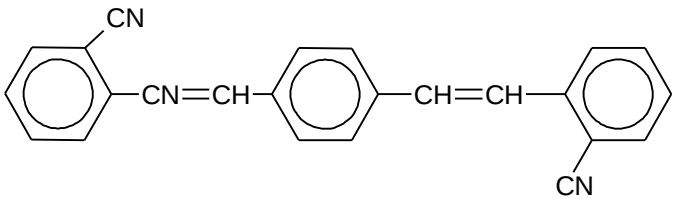
A $(CH_3)_2C(OH)CO_2H$ only

B $(CH_3)_2C(OH)CH_2CO_2H$ only

C $(CH_3)_2CO$ and CH_2ClCHO

D $(CH_3)_2CO$ and CH_2ClCO_2H

21 A compound used as an optical brightener in detergents has the following formula.



Which of the following is likely to be a property of this compound?

A It is readily soluble in water.

B It only reacts with 2 moles of hydrogen.

C It is hydrolysed by hot dilute sulfuric acid to give an acid.

D It gives a yellow precipitate on warming with alkaline aqueous iodine.

22 Halogenoalkanes have a wide variety of commercial uses.

For which group of compounds is the breaking of the carbon-halogen bond a cause of major environmental problem?

A anaesthetics

B CFCs

C flame retardants

D plastics

23 A compound **R**, $C_5H_{10}O$, gives the following experimental observations.

- Potassium dichromate, on warming with **R**, retains its orange colour.
- **R** does not form any precipitate with 2,4-dinitrophenylhydrazine.
- **R** produces white fumes on addition of phosphorus pentachloride.

What could be the structural formula of **R**?

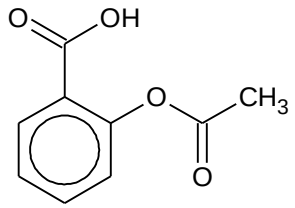
A $CH_3COCH_2CH_2CH_3$

B $CH_3CH_2CH_2CH_2CHO$

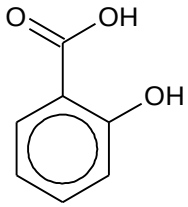
C $(CH_3)_2C(OH)CH=CH_2$

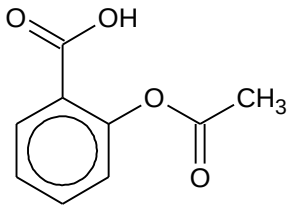
D $CH_3CH(OH)CH_2CH=CH_2$

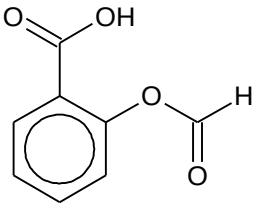
24 Aspirin has the following structure.

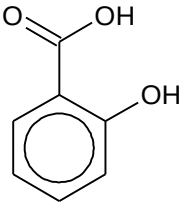


When aspirin is hydrolysed by acid present in the stomach, what products are formed?

A  + CH_3CO_2H

B  + HCO_2H

C  + CH_3OH

D  + CO_2 + CH_3OH

25 Consider the following four compounds.

1 bromoethanoic acid
2 chloroethanoic acid
3 propan-1-ol
4 propanoic acid

What is the relative order of **decreasing** acidity of these compounds?

A	1	2	4	3
B	2	1	3	4
C	2	1	4	3
D	3	2	1	4

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.

26 Carbon monoxide burns readily in oxygen to form carbon dioxide.

What can be deduced from this information?

1 The +4 oxidation state of carbon is more stable than the +2 state.

2 The standard enthalpy change of formation of carbon dioxide is more exothermic than that of carbon monoxide.

3 The value of the equilibrium constant for the following reaction is likely to be high.

$$2CO(g) + O_2(g) \rightleftharpoons 2CO_2(g)$$

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.

27 Carbon forms double bonds with each of the Group IV elements oxygen, sulfur and selenium. In each case, the double bond is polar.

In the molecules carbon dioxide (CO_2), carbonyl sulfide (COS) and carbonyl selenide (COSe), the polarities of these double bonds do not necessarily cancel.

	Overall polarity of molecule
CO_2	0
COS	0.71
COSe	0.73

Which factors could account for these observations?

1 The C=S bond is more polar than the C=Se bond.

2 The C=O bond is more polar than the C=S bond.

3 The C=Se bond is more polar than the C=O bond.

28 A reversible reaction is catalysed. Which of the following statements about this system are correct?

1 The catalyst does not change the enthalpy change of the reaction.

2 The catalyst reduces the activation energy for both the forward and the backward reaction.

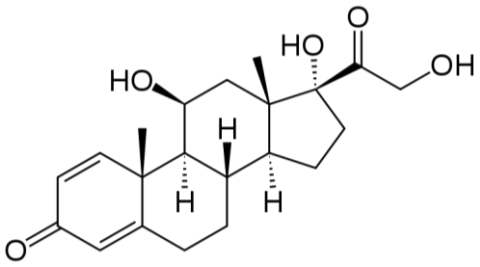
3 The catalyst alters the composition of the equilibrium mixture.

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



prednisolone

Which reagents could react with prednisolone?

1 2,4-dinitrophenylhydrazine

2 aqueous bromine

3 aqueous sodium carbonate

30 When bottles containing still (i.e. non-fizzy) wines are opened, the wine soon becomes 'vinegary' even when the cork is replaced. Such wines may be kept by pumping in a mixture of carbon dioxide and nitrogen before resealing the bottle.

How does this mixture prevent the 'vinegary' taste developing?

1 Oxidation of ethanol to ethanoic acid is prevented.

2 The amount of carbon dioxide dissolved in the wine is increased.

3 The acidity of the wine is decreased.