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TAMPINES JUNIOR COLLEGE

JC2 Preliminary Examination

CANDIDATE NAME							
CIVICS GROUP	1	2				TUTOR NAME	

CHEMISTRY 8872/01

Paper 1 Multiple Choice

Monday, 23 September 2013
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 and civics group on the Answer Sheet in the spaces 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 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 on this paper.

Section A

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

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

How many molecules are present in 1 cm^3 of oxygen gas under room conditions?

A $\frac{1 \times 24000}{6.02 \times 10^{23}}$

B $\frac{1 \times 6.02 \times 10^{23}}{24000}$

C $\frac{6.02 \times 10^{23} \times 24000}{1 \times 1000}$

D $1 \times 6.02 \times 10^{23} \times 32$

2 Which of the following ions would undergo the greatest deflection in an electric field?

A $^{16}O^{2+}$ **B** $^{16}O^{18}O^{+}$ **C** $^{16}O^{18}O^{2+}$ **D** $^{18}O^{2+}$

3 10 cm^3 of 0.2 mol dm^{-3} K_2XO_4 will just react with 40 cm^3 of 0.1 mol dm^{-3} iron(II) sulfate solution.

If Fe^{2+} is oxidized to Fe^{3+} by K_2XO_4, what is the final oxidation state of X?

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

4 The table gives the successive ionisation energies for an element X.

	1st	2nd	3rd	4th	5th	6th
Ionisation energy/ kJ mol^{-1}	950	1800	2700	4800	6000	12300

What could be the formula of the chloride of X?

A X*Cl* **B** XCl_2 **C** XCl_3 **D** XCl_4

5 Which of the following consists of species which are all planar?

A CO_3^{2-} , SO_3^{2-} and benzene

B Al_2Cl_6 , $SOCl_2$ and methanal

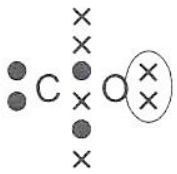
C NO_3^- , XeF_4 and ethanal

D BCl_3 , ICl_4^- and chlorobenzene

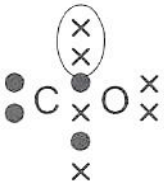
6 Dot-and-cross diagrams for carbon monoxide are shown.

Which circled pair of electrons represents a coordinate bond?

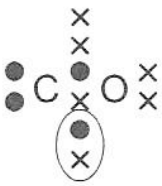
A



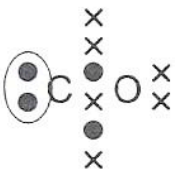
B



C



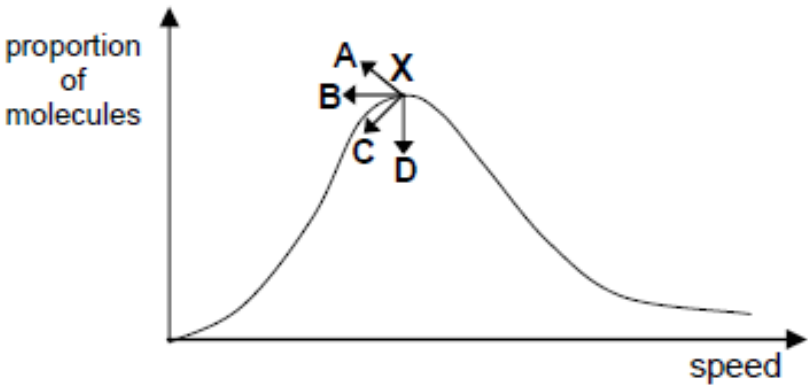
D



7 The diagram shows the Boltzmann distribution of the speeds of the molecules of a gas.

Point **X** represents the most probable speed.

If the gas is cooled, in which direction does **X** move?



8 Iodine-131 is a radioactive isotope with a half-life of 8 days. Given that radioactive decay is a first-order reaction, what fraction of the isotope would remain after 80 days?

A $\frac{1}{20}$ **B** $\frac{1}{160}$ **C** $\frac{1}{2^8}$ **D** $\frac{1}{2^{10}}$

9 The table shows the charge and radius of each of six ions.

ion	J^+	L^+	M^{2+}	X^-	Y^-	Z^{2-}
radius/ nm	0.14	0.18	0.15	0.14	0.18	0.15

The ionic solids JX, LY, and MZ have the same lattice type.

What is the order of their lattice energies starting from the most exothermic first?

A JX, MZ, LY **B** LY, MZ, JX **C** MZ, JX, LY **D** MZ, LY, JX

10 Dinitrogen oxide, N=N=O, burns in ethyne, C_2H_2, in the gaseous phase to produce water vapour, carbon dioxide and nitrogen gases as the only products.

$$5N_2O(g) + C_2H_2(g) \rightarrow H_2O(g) + 2CO_2(g) + 5N_2(g) \qquad \Delta H = -1668 \text{ kJ mol}^{-1}$$

Assuming N=N bond energy in dinitrogen oxide is +418 kJ mol^{-1}, what is the nitrogen-oxygen bond energy in dinitrogen oxide in kJ mol^{-1}?

A 382 **B** 594 **C** 686 **D** 1350

11 Which is the correct statement about the following reaction?

$$P(g) + Q(g) \overset{M(s)}{\rightleftharpoons} R(g) \qquad \Delta H < 0$$

A The solid M will lower the activation energy of both forward and backward reactions.

B Both the rate constant and equilibrium constant will increase with increasing temperature.

C Increasing temperature will lower the activation energy resulting only in a greater fraction of R molecules with energy greater than activation energy.

D The activation energy of the forward reaction is equal to the activation energy of the backward reaction.

12 Phosphorus is an element in the third period, Na to Ar, of the Periodic Table.
What is true for phosphorus and none of the other elements in this period?

A Phosphorus has the highest melting point of the elements in this period.

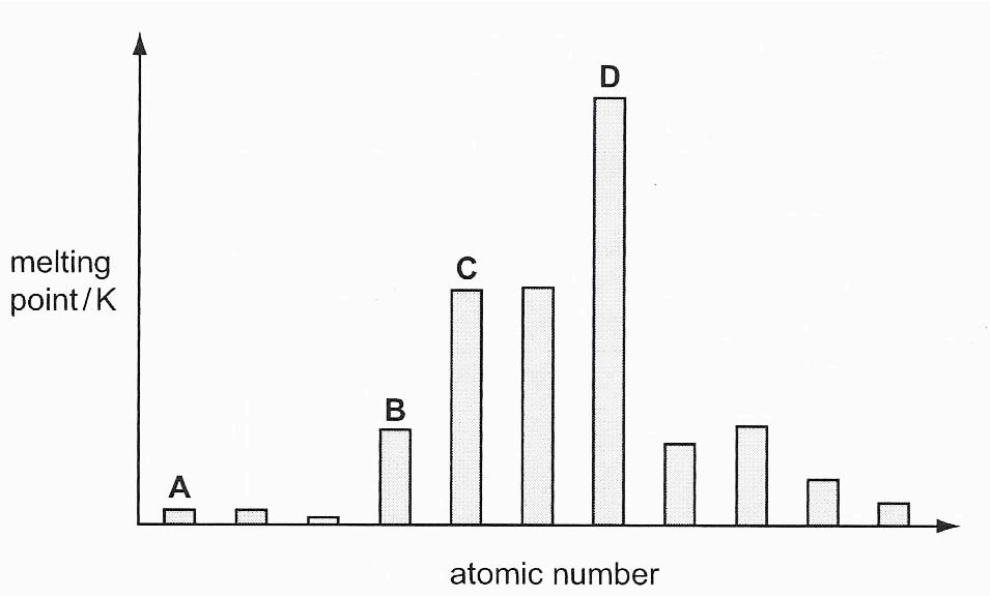
B Phosphorus is the only element in this period that forms two acidic oxides.

C Phosphorus is the only element in this period with exactly four atoms in its molecule.

D Phosphorus is the only element in this period whose chlorides react with water to form acidic solutions.

13 The bar chart shows the melting points of a series of consecutive elements arranged in order of increasing atomic number. The elements sodium to chlorine form part of this series.

Which bar represents sodium?



14 The chloride of element **Q** is hydrolysed by water to form an acidic solution and its oxide reacts with acid to form a salt.

What could be element **Q**?

A sodium

B aluminium

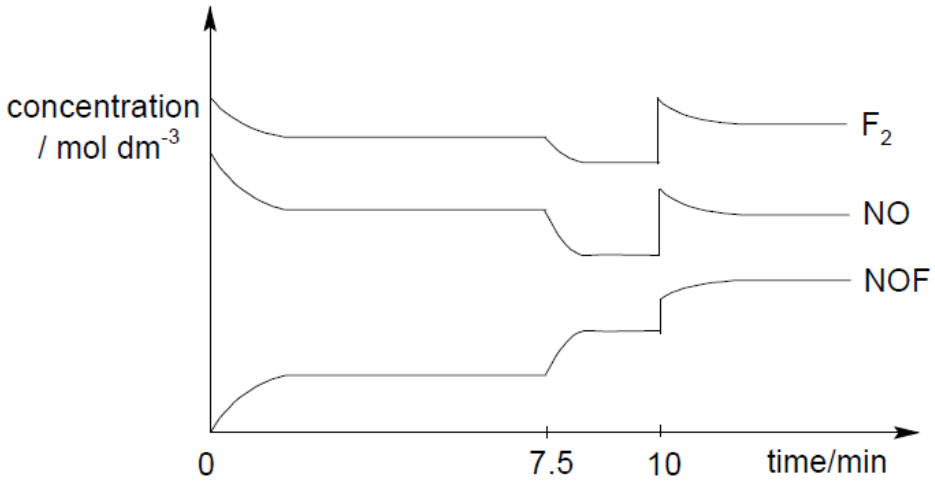
C silicon

D phosphorus

15 The reaction between NO and F_2 was studied by mixing the two gases:

$$2NO(g) + F_2(g) \rightleftharpoons 2NOF(g) \qquad \Delta H < 0$$

At different times during the experiment, various changes were made to the conditions inside the reaction vessel. The changes in concentrations of the three compounds in the equilibrium mixture with time are given by the graph below:



Which of the following statements is correct?

A There was a decrease in volume of the reaction vessel at 10.0 min.

B There was an increase in volume of the reaction vessel at 7.5 min.

C There was an increase in temperature at 10.0 min.

D A catalyst was added at 7.5 min.

16 A solution of pH 1.3 was produced when 0.10 mol of an acid, **U**, was dissolved in 2 dm^3 of water.

Given the above information, which of the following statements is true?

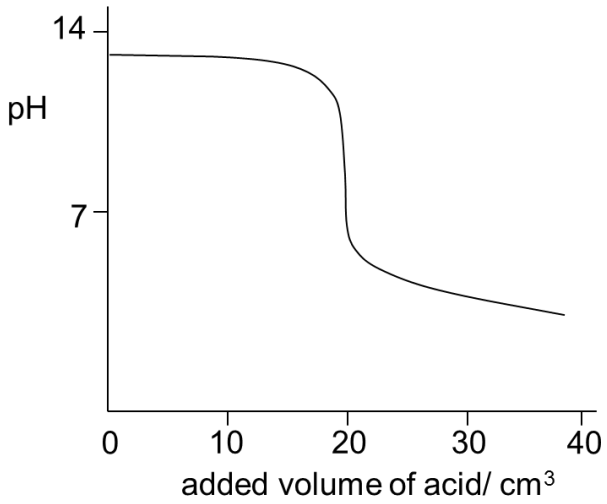
A The solution contains 0.050 mol of hydrogen ions.

B **U** is a weak acid with a large K_a value.

C **U** is a diprotic strong acid.

D **U** is a monoprotic strong acid.

17 The graph shows the change in pH when ethanoic acid is gradually added to 10 cm^3 of 0.10 mol dm^{-3} sodium hydroxide. An indicator is used to determine the end-point for the titration.



Which of the following contains the correct concentration of ethanoic acid and indicator used for the titration?

A 0.05 mol dm^{-3} ethanoic acid, phenolphthalein

B 0.05 mol dm^{-3} ethanoic acid, screened methyl orange

C 0.10 mol dm^{-3} ethanoic acid, phenolphthalein

D 0.10 mol dm^{-3} ethanoic acid, screened methyl orange

18 What is meant by the term *dynamic equilibrium?*

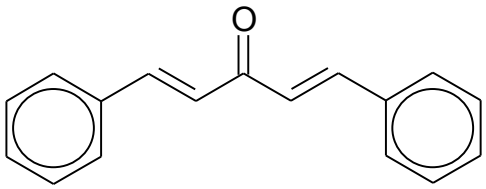
A An equilibrium that is constantly changing its position.

B An equilibrium where the forward and reverse reactions are taking place at different rates.

C An equilibrium where the forward and reverse reactions are taking place at the same rate.

D An equilibrium which has not yet settled to a constant state.

19 Dibenzalacetone is a bright yellow solid with the following structure.



dibenzalacetone

How many geometric isomers does dibenzalacetone have?

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

20 A food chemist wants to create the odour of green apples for a product. An ester with this odour has the formula $C_2H_5CO_2CH(CH_3)_2$.

In which of the following will the substances react together to produce this ester?

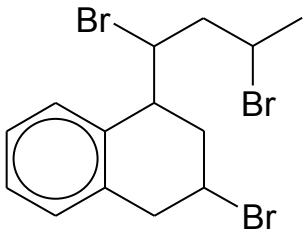
A C_2H_5OH and $(CH_3)_2CHCOOH$

B CH_3COOH and $CH_3CH(OH)CH_2CH_3$

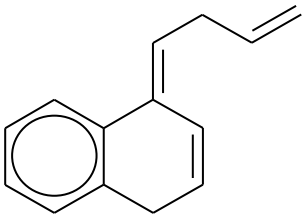
C C_2H_5COOH and $C_2H_5CH_2OH$

D C_2H_5COOH and $(CH_3)_2CHOH$

21 Which is **not** a possible product formed when the following compound is heated with excess ethanolic KOH?



A



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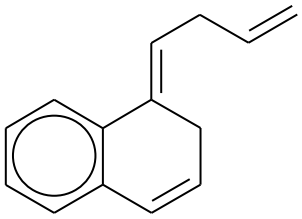

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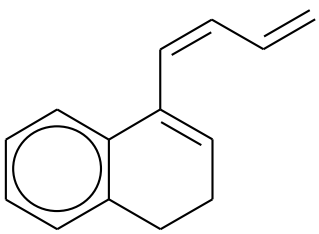
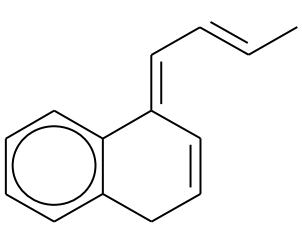
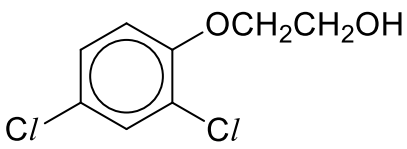


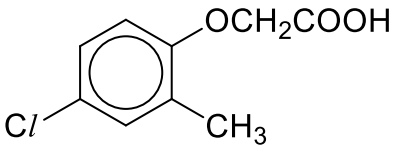
D



22 *2,4–D* and *MCPA* are two common selective weed killers.



2,4-D



MCPA

Which one of the following reagents can be used to distinguish between them?

A sodium metal

B phosphorus pentachloride

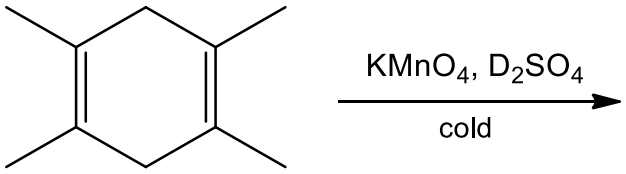
C 2,4-dinitrophenylhydrazine

D hot acidified potassium dichromate(VI)

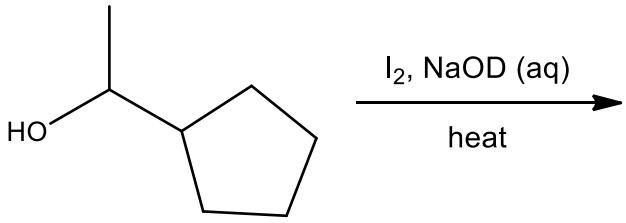
23 Deuterium, D, is an isotope of hydrogen, $^{2}_{1}H$.

Which of the following reactions yields a stable organic compound containing deuterium?

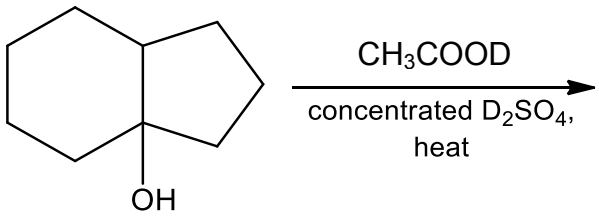
A



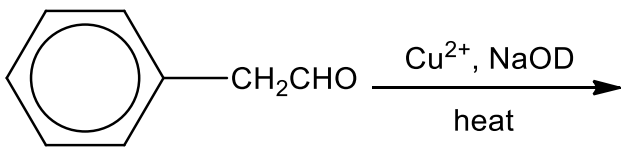
B



C



D



24 An organic compound **K** has the following properties:

- 1 mole of **K** reacts with excess Na(s) to produce one mole of $H_2(g)$.
- 1 mole of **K** reacts with warm alkaline aqueous iodine to produce one mole of $CHI_3(s)$.

Which compound could **K** be?

A $CH_3COCH(OH)CH(OH)CH_3$

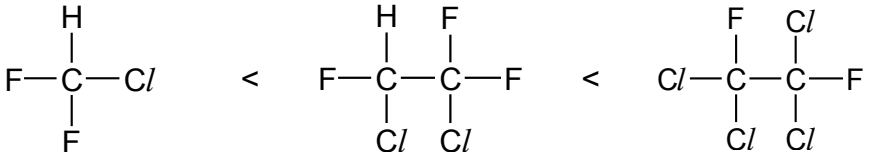
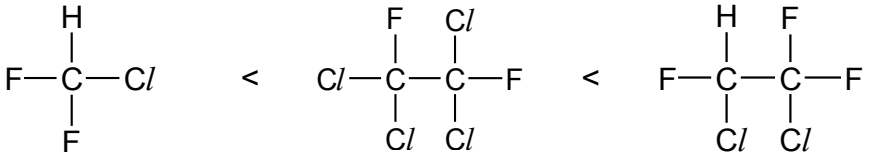
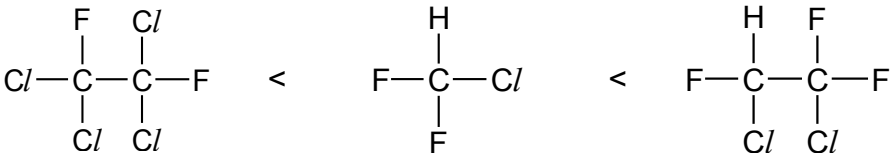
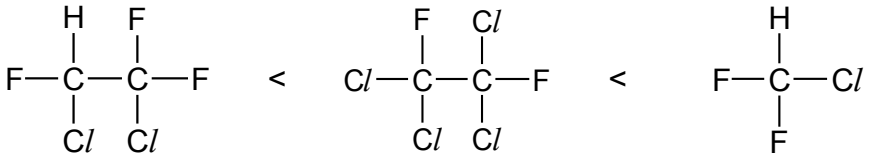
B $HOCH_2CH(OH)CH_2COOH$

C $CH_3CO_2CH(OH)CH_2OH$

D $CH_3CH(OH)CH_2COOH$

25 Chlorofluorocarbons (CFCs) are commonly used as aerosols, propellants and refrigerants. However in the stratosphere, CFCs can damage the ozone layer through a radical chain reaction.

In which sequence are the following compounds listed in **increasing** order of their ability to destroy ozone?

A  **B**  **C**  **D** 

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 physical properties are due to hydrogen bonding between molecules?

1 Water has a higher boiling point than H_2S.

2 Ice floats on water.

3 The H–O–H bond angle in water is approximately 104°.

27 In an experiment, 2 moles of SO_2 and 3 moles of O_2 were allowed to react and reach equilibrium in a 1 dm^3 vessel at two different temperatures.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The following results were obtained:

temperature/ °C	equilibrium yield of SO_3/ mol
200	1.2
300	0.8

What can you deduce about the reaction from the results?

1 It is an exothermic reaction.

2 The equilibrium constant at 200 °C is 0.94 mol^{-1} dm^3.

3 The backward reaction is favoured at higher temperature.

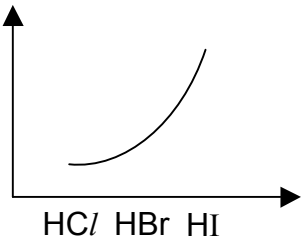
The responses **A** to **D** should be selected on the basis of

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

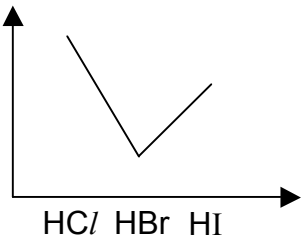
No other combination of statements is used as a correct response.

28 Which graph shows the correct trend for the physical property stated?

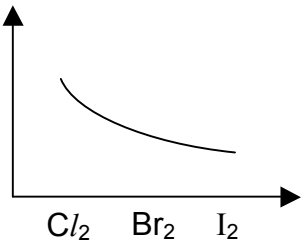
1 Bond length in HX



2 Boiling point of HX



3 Boiling point of X_2



29 Which of the following compounds form a single organic product when they are reacted with hot acidified potassium manganate(VII)?

1 $CH_3CH=CH_2$

2 $(CH_3)_2C=C(CH_3)_2$

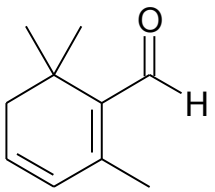
3 $HOCH_2CHO$

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 Safranal is a component of the spice saffron.



safranal

Which of the following descriptions about safranal are correct?

1 It reacts with KCN in H_2SO_4(aq) at 10 to 20 °C.

2 It reacts with Fehling's solution.

3 It has all atoms lying in the same plane.

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