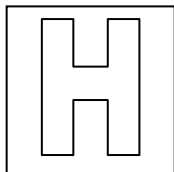


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PIONEER JUNIOR COLLEGE

2015 JC2 PRELIMINARY EXAMINATION
HIGHER 1



CHEMISTRY
Paper 1

8872/01

25 September 2015

Additional Materials: Data Booklet
 Multiple Choice Answer Sheet

50 minutes

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name and index number 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 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 has the greatest mass?

- A** 6×10^{23} molecules of hydrogen gas
- B** 3 moles of nitrogen molecules
- C** 1.2×10^{24} iron atoms
- D** 3×10^{23} copper(II) ions

2 A sample of 10 dm^3 of polluted air, measured at room temperature and pressure, is passed through limewater so that all the carbon dioxide present is precipitated as calcium carbonate. The mass of calcium carbonate formed is 0.05 g.

What is the percentage, by volume, of carbon dioxide in the air sample?

[A_r of C, 12.0; O, 16.0; Ca, 40.1]

- A** 0.03 % **B** 0.05 % **C** 0.12 % **D** 0.6 %

3 Gaseous particle **B** has a proton number n and a charge of +1.
Gaseous particle **C** has a proton number of $(n+1)$ and is isoelectronic with **B**.
B and **C** have the same number of neutrons.

Which of the following statements **incorrectly** describes **B** and **C**?

- A** The charge of **B** is half that of **C**.
- B** **B** has a larger ionic radius than **C**.
- C** **B** requires less energy than **C** when a further electron is removed from each particle.
- D** **B** has a higher charge density than **C**.

4 Which of the following molecules/ions has the smallest bond angle?

- A** AlH_4^- **B** SO_3^{2-} **C** XeF_2 **D** SF_2

- 5 Blu-Tack is a reusable adhesive that consists of a synthetic long chain hydrocarbon, and it is able to stick on to many surfaces, such as ceramic tiles and glass.

What is the likely attraction between Blu-Tack and glass surfaces?

- A van der Waal's forces
- B covalent bond
- C hydrogen bond
- D ionic bond

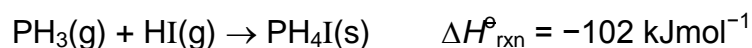
- 6 The table shows the enthalpy change of neutralisation, ΔH , for the various acids and bases.

acid	base	$\Delta H / \text{kJ mol}^{-1}$
sulfuric acid	sodium hydroxide	-57.0
P	sodium hydroxide	Less exothermic than -57.0
sulfuric acid	Q	Less exothermic than -57.0
R	potassium hydroxide	-57.0

What are the likely identities of **P**, **Q** and **R**?

	P	Q	R
A	hydrochloric acid	lithium hydroxide	nitric acid
B	phosphoric acid	ammonia	ethanoic acid
C	nitric acid	lithium hydroxide	hydrochloric acid
D	ethanoic acid	ammonia	nitric acid

- 7 Phosphine reacts with hydrogen iodide to form phosphonium iodide by the following reaction:



Given that ΔH°_f for $\text{PH}_3(\text{g}) = +5.4 \text{ kJ mol}^{-1}$ and ΔH°_f for $\text{HI}(\text{g}) = +26.5 \text{ kJ mol}^{-1}$, what is the enthalpy change of formation of phosphonium iodide?

- A $-56.5 \text{ kJ mol}^{-1}$
- B $-70.1 \text{ kJ mol}^{-1}$
- C $-123.1 \text{ kJ mol}^{-1}$
- D $-133.9 \text{ kJ mol}^{-1}$

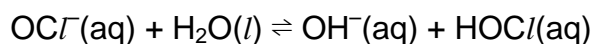
- 8 Two moles of compound **P** were placed in a vessel. The compound **P** was partly decomposed by heating. A dynamic equilibrium between **P**, **Q** and **R** was established.

At equilibrium, x mol of **R** were present and the total number of moles present was $(2 + x)$.

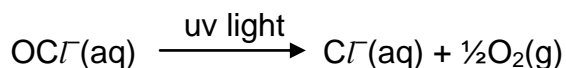
What is the equation for this equilibrium?

- A** $\text{P} \rightleftharpoons 2\text{Q} + \text{R}$
B $2\text{P} \rightleftharpoons 2\text{Q} + \text{R}$
C $2\text{P} \rightleftharpoons \text{Q} + \text{R}$
D $2\text{P} \rightleftharpoons \text{Q} + 2\text{R}$

- 9 Swimming pool water can be kept free of harmful bacteria by adding aqueous sodium chlorate(I), NaOCl . This reacts with water to produce HOCl molecules which kill bacteria.



In bright sunshine, the OCl^- ion is broken down by ultra-violet light.



Which method would maintain the highest concentration of $\text{HOCl}(\text{aq})$?

- A** acidify the pool water
B add a solution of chloride ions
C add a solution of hydroxide ions
D bubble air through the water
- 10 What is the pH of the resulting solution when equal volumes of aqueous $\text{Ba}(\text{OH})_2$ at pH 10 and 12 are mixed ?

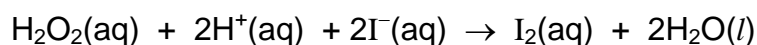
- A** 11.0 **B** 11.7 **C** 12.3 **D** 13.0

- 11 An enzyme, found in the stomach, operates at maximum efficiency when in an aqueous solution buffered at pH 5.

Which combination of substances, when dissolved in 10 dm³ of water, would give the necessary buffer solution?

- A 2 mol of CH₃CO₂H and 1 mol of NaOH
- B 2 mol of NaOH and 1 mol of CH₃CO₂H
- C 1 mol of HCl and 1 mol of CH₃CO₂Na
- D 2 mol of NH₃ and 1 mol of CH₃CO₂NH₄

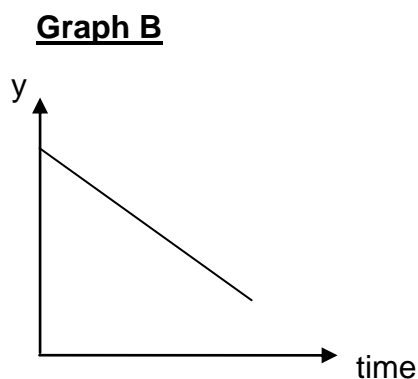
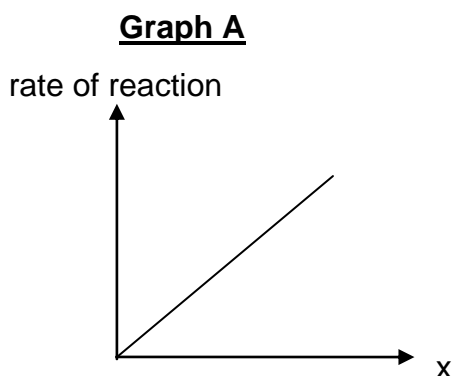
- 12 Hydrogen peroxide reacts with acidified iodide ions liberating iodine according to the equation below:



The kinetics of this reaction were investigated and it was found to have the following rate equation:

$$\text{rate} = k[\text{H}_2\text{O}_2][\text{I}^-]$$

Two series of experiments were conducted giving rise to **Graph A** and **Graph B**.



Which combination shows the correct labelling of the x-axis for **Graph A** and y-axis for **Graph B**?

- | | x-axis for Graph A | y-axis for Graph B |
|----------|---|---|
| A | $[\text{I}^-][\text{H}^+] / \text{mol}^2 \text{ dm}^{-6}$ | $[\text{H}_2\text{O}_2] / \text{mol dm}^{-3}$ |
| B | $[\text{H}_2\text{O}_2][\text{I}^-] / \text{mol}^2 \text{ dm}^{-6}$ | $[\text{H}^+] / \text{mol dm}^{-3}$ |
| C | $[\text{H}_2\text{O}_2] / \text{mol dm}^{-3}$ | $[\text{H}^+] / \text{mol dm}^{-3}$ |
| D | $[\text{I}^-] / \text{mol dm}^{-3}$ | $[\text{H}_2\text{O}_2] / \text{mol dm}^{-3}$ |

- 13 Consecutive elements **X**, **Y**, **Z** are in the third period of the Periodic Table. Element **Y** has the highest first ionisation energy and the lowest melting point.

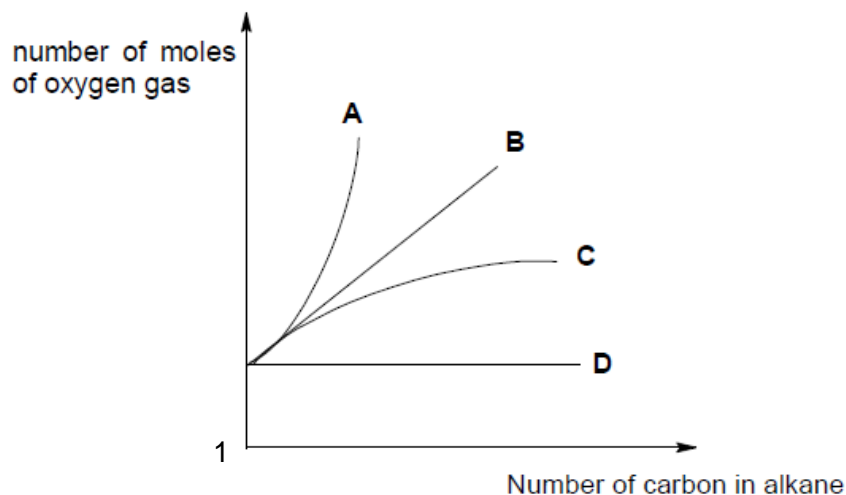
What could be the identities of **X**, **Y** and **Z**?

	X	Y	Z
A	magnesium	aluminium	silicon
B	aluminium	silicon	phosphorus
C	sodium	magnesium	aluminium
D	silicon	phosphorus	sulfur

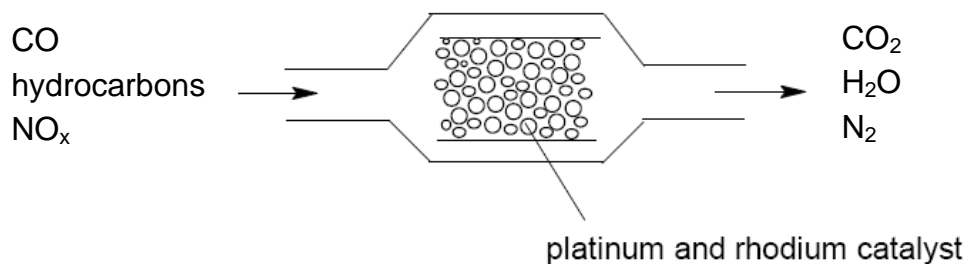
- 14 An element **H** forms an oxide of high melting point which is insoluble in water. The chloride of **H** is solid at room temperature, has a low melting point and boiling point and dissolves in water forming an acidic solution.

What element is **H**?

- A** magnesium
B aluminium
C silicon
D phosphorus
- 15 How many isomers, including cyclic compounds, are there with the molecular formula C_4H_8 ?
- A** 4 **B** 5 **C** 6 **D** 7
- 16 Which line on the graph shows the relationship between the number of carbon atoms in an alkane and the number of moles of oxygen gas needed for complete combustion of the alkane?



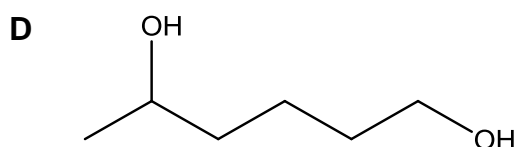
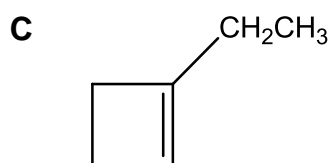
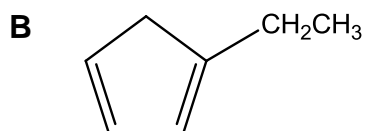
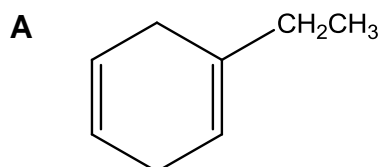
- 17 The diagram represents a section of a catalytic converter on the exhaust system for a car. Harmful gases are converted into carbon dioxide, nitrogen and water vapour.



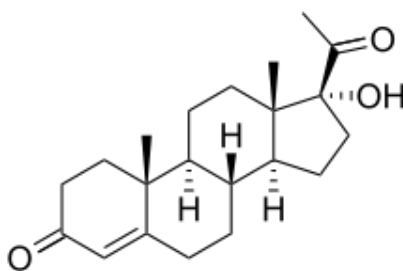
Which of the following statements is **incorrect**?

- A Platinum and rhodium catalyse redox reactions.
 - B Carbon monoxide and nitrogen oxide react to form carbon dioxide and nitrogen.
 - C Carbon monoxide reacts with hydrocarbons to give carbon dioxide and water.
 - D Oxides of nitrogen react with hydrocarbons to give carbon dioxide, water and nitrogen.
- 18 An organic compound, on heating with an excess of hot concentrated acidified $\text{KMnO}_4(\text{aq})$, produces $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_2\text{CO}_2\text{H}$ as one of the products.

Which of the following shows the structure of the organic compound?



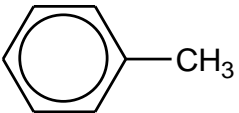
- 19** Steroidogenesis is the biological pathway by which cholesterol is transformed into other biological steroids. One of the intermediates produced during steroidogenesis in human body is 17 α -hydroxyprogesterone.



17 α -hydroxyprogesterone.

Which of the following statements for one mole of 17 α -hydroxyprogesterone is correct?

- A** It turns aqueous potassium dichromate(VI) green.
- B** It produces one mole of hydrogen gas on reaction with sodium.
- C** It gives yellow precipitate with alkaline aqueous iodine.
- D** It produces an organic product with six more hydrogen atoms when it reacts with lithium aluminium hydride.
- 20** What will be observed when the following compounds are added to hot acidified potassium manganate(VII)?

		$\text{CH}_3\text{CH}=\text{CH}_2$	$\text{CH}_3\text{OCOCH}_2\text{CH}_3$
A	Solution decolourises. Effervescence occurs.	Solution decolourises. Effervescence occurs.	Solution decolourises. Effervescence occurs.
B	Solution decolourises. No effervescence.	Solution decolourises. Effervescence occurs.	Solution decolourises. Effervescence occurs
C	Solution decolourises. Effervescence occurs.	Solution decolourises. Effervescence occurs.	Solution decolourises. No effervescence.
D	Solution remains purple. No effervescence.	Solution remains purple. No effervescence.	Solution remains purple. No effervescence

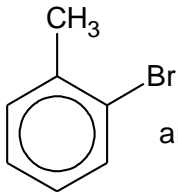
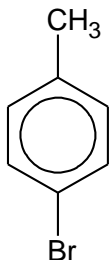
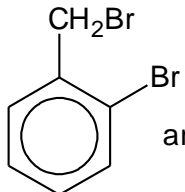
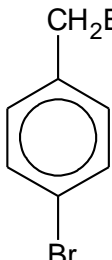
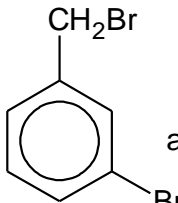
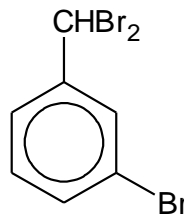
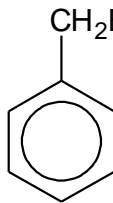
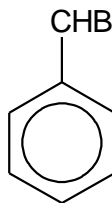
21 Which compound would give negative test results with all the following reagents?

- acidified potassium dichromate(VI)
- alkaline aqueous iodine
- aqueous bromine

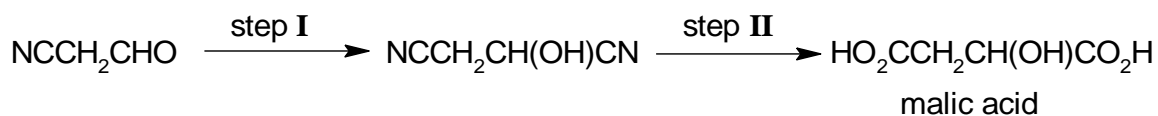
- A** cyclohexene
B propan-2-ol
C 2-methylpropan-2-ol
D ethanal

22 When a solution containing a mixture of methylbenzene and bromine is exposed to sunlight, a reaction occurs until no further change takes place.

What are likely to be the main products?

- A**  and 
- B**  and 
- C**  and 
- D**  and 

- 23** Malic acid is present in apples. It can be synthesised in the following two-step process.



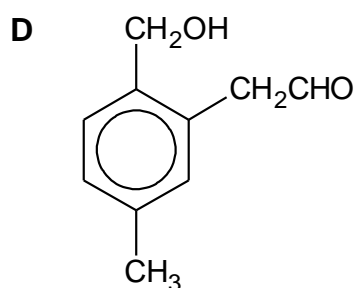
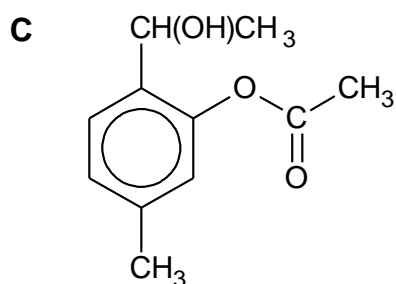
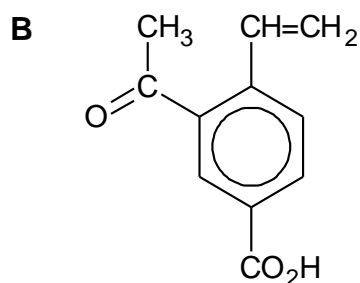
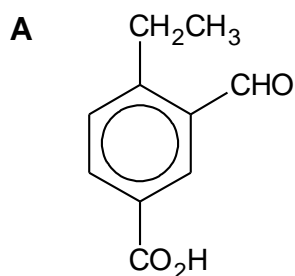
Which of the following best describes steps I and II?

	step I	step II
A	addition	oxidation
B	addition	hydrolysis
C	substitution	oxidation
D	substitution	hydrolysis

- 24** Compound **Y** has the following properties.

- It does not react with Fehling's solution but gives an orange precipitate with 2,4-dinitrophenylhydrazine.
- It reacts with Na_2CO_3 to give rapid effervescence.
- It turns orange acidified potassium dichromate(VI) green.

Which of the following could be **Y**?



25 Consider the following four compounds.

- | | |
|---|---------------------|
| 1 | bromoethanoic acid |
| 2 | chloroethanoic acid |
| 3 | ethanoic acid |
| 4 | ethanol |

What is the 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 that you consider to be correct).

The response **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.

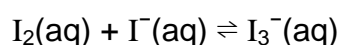
No other combination of statements is used as a correct response.

- 26** Oxygen dissolved in the sea is critical for the survival of ocean life. It was found in a study that the solubility of oxygen is higher in water of lower salinity than in water of higher salinity. Oxygen is also more soluble in the colder, deeper parts of the ocean.

Which are possible explanations for the above observations?

- 1 The dissolving of oxygen in water is an exothermic process.
- 2 Oxygen is soluble in water due to intermolecular hydrogen bonding.
- 3 Oxygen is less soluble in water of higher salinity due to interference from ion-dipole interactions.

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



Hexane and water are immiscible. Molecular iodine, I_2 , is much more soluble in hexane than it is in water.

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

- 1 hexane
- 2 aqueous silver nitrate
- 3 aqueous potassium iodide

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

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

What can be deduced from this information?

- 1 The ionic dissociation of water is an endothermic process.
- 2 The pH of water at 50 °C is 6.63.
- 3 Water is not a neutral liquid at 50 °C.

29 A halogenoalkane has the formula $\text{C}_3\text{H}_5\text{Cl}_3$.
Which one of the following is the correct name of the isomers of this compound?

- 1 1,1,1-trichloropropane
- 2 1,2,2-trichloropropane
- 3 2,2,3-trichloropropane

30 Which substances consist of planar molecules?

- 1 cyclohexene
- 2 benzene
- 3 ethene

Answers

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