



RIVER VALLEY HIGH SCHOOL

JC2 PRELIM EXAMINATION

CANDIDATE
NAME

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CLASS

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INDEX
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H2 CHEMISTRY

9729/01

Paper 1 Multiple Choice

26 September 2019

1 hour

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 index number on the Optical 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 Optical 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.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of **16** printed pages

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

- 1** A 50.00 cm³ of a solution of 0.300 mol dm⁻³ MoO_x²⁻ was reduced to Mo³⁺ using Zn powder. The filtrate required 45.00 cm³ of 0.200 mol dm⁻³ acidified KMnO₄ to revert back to its original form of MoO_x²⁻.

What is the value of x?

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

- 2** 10 cm³ of an unknown hydrocarbon was combusted in excess oxygen gas. The gaseous mixture contracted by 30 cm³. The gaseous mixture further contracted by 40 cm³ when it was passed through aqueous sodium hydroxide. All volumes of gases were measured at room temperature and pressure.

1	cyclopropane
2	butane
3	cyclobutane
4	but-2-ene

What is the hydrocarbon?

- A** 1 and 2 only
B 2 and 3 only
C 3 and 4 only
D 2, 3 and 4

- 3 The successive ionisation energies, in kJ mol^{-1} , of elements **X** and **Y** are given below.

X	575	1820	2740	11600	14800	18400	23400
Y	1320	3390	5320	7470	11000	13330	71330

- 1 The element preceding **X** in the Periodic Table has a higher first ionisation energy.
- 2 Element **Y** has a lower first ionisation energy than the element preceding it in the Periodic Table.
- 3 **X** and **Y** forms a compound with the formula X_3Y_2 .
- 4 Oxide of **X** dissolves in water to give an acidic solution.

Which statements about **X** and **Y** are true?

- A** 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 2 and 4 only

- 4 Use of Data Booklet is relevant to this question.

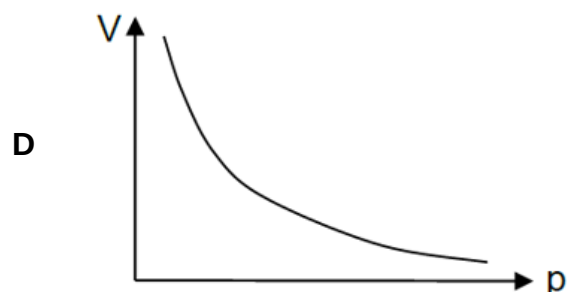
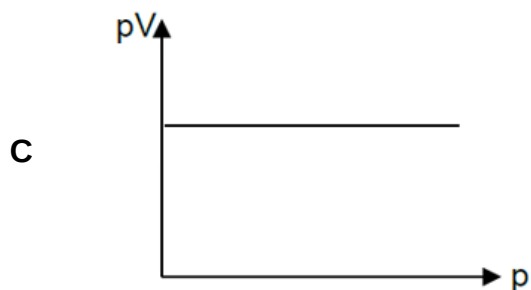
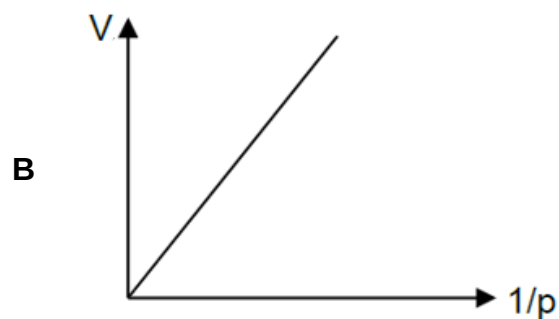
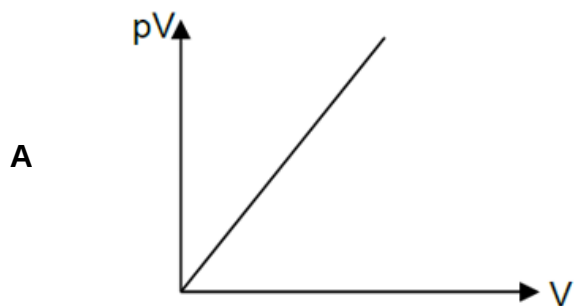
Some isotopes are unstable and undergo beta decay (β -decay).

β -decay is a process where a neutron transforms into a proton by the emission of an electron. The proton is retained in the nucleus.

Which of the following change describes a β -decay?

- A $^{40}\text{K} \rightarrow ^{40}\text{Ca}$
B $^{32}\text{P} \rightarrow ^{31}\text{P}$
C $^{11}\text{C} \rightarrow ^{12}\text{C}$
D $^{23}\text{Na} \rightarrow ^{22}\text{Ne}$

- 5 Which graph does **not** describe the behaviour of a fixed mass of ideal gas at constant temperature?



6 Which of the following statements are correct?

- 1 Covalent compounds can act as electrolytes in water.
- 2 Ionic bonds and covalent bonds can occur in the same compound.
- 3 An ionic compound will have the greatest degree of covalent character if both the cation and anion are large.
- 4 Ionic compounds can conduct electricity in both solid and liquid states.

- A 1 and 2 only
B 1 and 4 only
C 3 and 4 only
D 2 and 4 only

7 Which of the following shows a decrease in bond angle from left to right?

- | | | | |
|---|-----------------|----------------------|----------------|
| A | SiCl_4 | H_2O | NF_3 |
| B | AlCl_3 | NH_3 | PH_3 |
| C | PCl_3 | PF_3 | PBr_3 |
| D | CCl_4 | SF_6 | XeF_4 |

- 8 The table below gives the standard enthalpy change of hydrogenation of three compounds to form cyclohexane:

Compound	$\Delta H_{\text{hydrogenation}} / \text{kJ mol}^{-1}$
benzene	-206
1,3,5-cyclohexatriene	-360
cyclohexene	-120

Which of the following statements is correct?

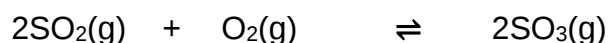
- A** 1,3,5-cyclohexatriene is more stable than benzene.
B Benzene has a lower energy content than 1,3,5-cyclohexatriene.
C The C=C bond energy in cyclohexene is weaker than that in 1,3,5-cyclohexatriene.
D The enthalpy change of atomisation of benzene is smaller than that of 1,3,5-cyclohexatriene.

- 9 Which of the following statements are correct for a system at dynamic equilibrium?

- 1 The rate of both forward and backward reaction is the same
- 2 The concentration of reactants is equal to the concentration of products
- 3 The rate constant of forward reaction is equal to the rate constant of the backward reaction

- A** 1 only **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

- 10 A pure sample of $\text{SO}_3(\text{l})$ is introduced into an evacuated vessel. The vessel, of constant volume, is heated to a constant temperature such that the equilibrium below is established.



The value of pressure is found to be 27% greater than if only $\text{SO}_3(\text{g})$ were present.

What is the mole fraction of oxygen in the equilibrium mixture?

- A** 0.119 **B** 0.213 **C** 0.425 **D** 0.787

- 11** Equal volumes of $1.35 \times 10^{-5} \text{ mol dm}^{-3} \text{ Bi(NO}_3)_3$ and $2.00 \times 10^{-5} \text{ mol dm}^{-3} \text{ NaOH}$ were added to a conical flask. Equilibrium was achieved within a few minutes and the following observations were made.

Given that solubility of Bi(OH)_3 is $2.87 \times 10^{-7} \text{ mol dm}^{-3}$, which option contains the correct descriptions?

	Precipitation of Bi(OH)_3	IP vs K_{sp} for the solution at equilibrium
A	Yes	$\text{IP} > K_{sp}$
B	Yes	$\text{IP} = K_{sp}$
C	No	$\text{IP} = K_{sp}$
D	No	$\text{IP} < K_{sp}$

- 12** Caesium-137 is a radioactive isotope with a half-life of 30.2 years. Following the Fukushima Daiichi nuclear disaster in 2011, it was reported that about 8.4 kg of Caesium-137 was released into the sea.

What is the mass of Caesium-137 left in the sea after 100 years?

- A** 0.801 kg
- B** 0.846 kg
- C** 1.05 kg
- D** 6.73 kg

- 13** For the reaction: $A(g) + B(g) \rightarrow C(g) + D(g)$, the following experimental data was obtained.

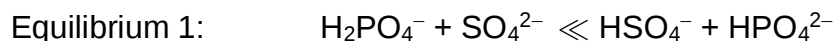
Expt No.	[A] /mol dm ⁻³	[B] /mol dm ⁻³	Initial rate of reaction /mol dm ⁻³ s ⁻¹
1	0.20	0.20	3.00×10^{-4}
2	0.60	0.20	9.00×10^{-4}
3	0.80	0.40	4.80×10^{-3}

Which of the following conclusions can be drawn for the reaction?

- 1 The unit for rate constant is mol⁻² dm⁶ s⁻¹.
- 2 The overall equation is the rate determining step.
- 3 The initial rate of reaction can be calculated from the initial rate of formation of C(g).

A 1 only **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

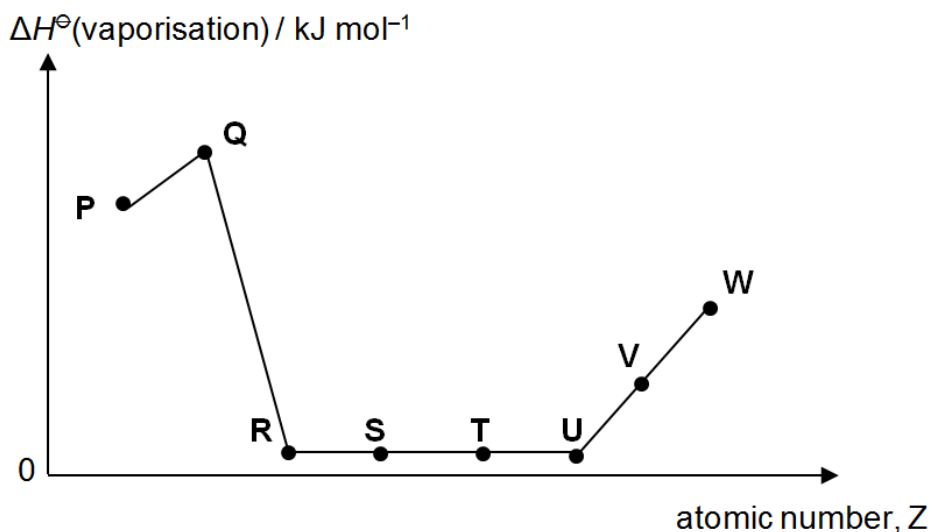
- 14** The following equilibrium are studied at a fixed temperature T °C.



Given that $K_2 > K_3$, which of the following statements is correct?

- A** HPO_4^{2-} is a stronger acid.
- B** $H_2PO_4^-$ is the conjugate base of HPO_4^{2-} .
- C** The position of Equilibrium 1 lies to the left.
- D** The rate of forward reaction for all three equilibrium decreases at (T+100) °C.

- 15 The graph below shows the variation in the standard enthalpy change of vaporisation, $\Delta H^\ominus(\text{vaporisation})$, for eight consecutive elements in the Periodic Table, all with atomic number, $Z \leq 20$.

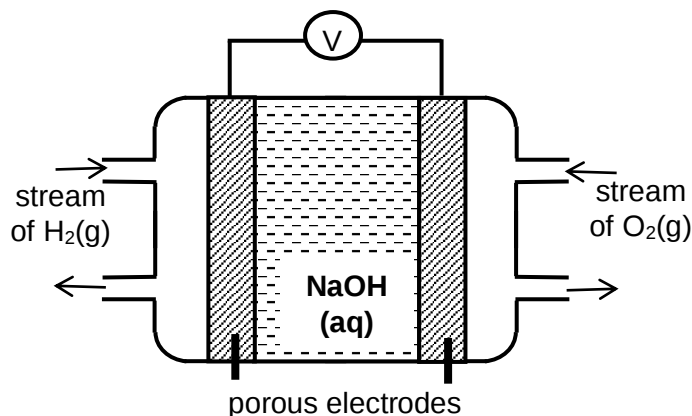


Which of the following statement is correct?

- A Element **Q** forms an oxide which is amphoteric.
 - B Element **R** forms an oxide which is basic in aqueous solution.
 - C Element **V** forms a chloride which is neutral in aqueous solution.
 - D Element **W** forms a chloride which is basic in aqueous solution.
- 16 Element **E** is in the third period of the Periodic Table. The chloride of **E** has a simple molecular structure while the oxide of **E** has a giant ionic structure. Which of the following statements is **incorrect**?
- A The atomic radius of **E** is larger than that of chlorine.
 - B The melting point of **E** is lower than its preceding element.
 - C The chloride of **E** dissolves in water to give an acidic solution.
 - D The oxide of **E** reacts with excess aqueous sodium hydroxide to form a colourless complex.

17 Use of the Data Booklet is relevant in this question.

A hydrogen-oxygen fuel cell is constructed using 1.00 mol dm^{-3} sodium hydroxide as the electrolyte. What is the change in pH of the solution around each electrode when the current is flowing?



	Cathode	Anode
A	increase	decrease
B	increase	increase
C	decrease	increase
D	decrease	decrease

18 Use of the Data Booklet is relevant to this question.

An antique car bumper is to be chrome plated. The bumper is dipped into a Cr^{3+} solution where it serves as an electrode of an electrolytic cell. Oxygen is formed on the other electrode.

Which of the following statements is correct?

- A The bumper is the anode of the electrolytic cell.
- B Reduction of water occurs at the cathode.
- C For every 52 g of chromium plated, 3 mole of oxygen is evolved.
- D It takes about 8 hours to plate 52 g of chromium, if the current used is 10 A.

- 19** When a dilute sulfate solution of a metal **J** is electrolysed, metal **J** and a diatomic gas **K** are produced at the cathode and the anode respectively in the molar ratio 2:1. In another experiment, the same quantity of electricity is used to electrolyse a saturated sodium chloride solution and a gas **L** is evolved at the anode.

What is the molar ratio of **J : K : L**?

- A** 2:1:1 **B** 2:1:2
C 4:2:1 **D** 4:2:3

- 20** Covalent bonds are formed when orbitals overlap. The shape of many organic molecules can be explained by the hybridisation of orbitals.

Which bond is **not** present in the molecule, $\text{HC}\equiv\text{CCH}=\text{CH}_2$?

- A** A σ bond formed by 1s-2sp overlap
- B** A σ bond formed by 2sp-2sp² overlap
- C** A σ bond formed by 2sp-2sp³ overlap
- D** A π bond formed by 2p-2p overlap

- 21** In the 1960s, a certain class of organic compounds was widely used in aerosol sprays, refrigerants and making foamed plastics. However, they were found to destroy the ozone layer in the upper atmosphere and viable replacements were sought to minimise ozone depletion.

Which of the following compounds can be used safely as a replacement?

- A** CHBr_3
- B** CF_3CBr_3
- C** $\text{CHCl}_3/\text{FCCl}_2/\text{F}_2$
- D** $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$

22 For which property of the alkanes does the numerical value decrease down the homologous series?

- A** Density
- B** Enthalpy change of vapourisation
- C** Number of isomers
- D** Vapour pressure

23 Hydrogen bromide reacts with but-1-ene to form bromobutane.

Which statements are possible descriptions of the organic intermediate in this reaction?

- 1 It contains carbon, hydrogen and bromine.
- 2 It has a positive charge.
- 3 It reacts with a nucleophile.
- 4 It has a plane of symmetry.

- A** 1 and 3 only
- B** 2 and 3 only
- C** 2 and 4 only
- D** 3 and 4 only

24 Which salt will be the most acidic in aqueous solution?

- A** $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_3\text{Cl}$
- B** $\text{C}_6\text{H}_5\text{NH}_3\text{Cl}$
- C** MgCl_2
- D** NH_4Cl

25 When propene is bubbled through iodine monochloride, ICl , dissolved in water, which products could be formed?

- 1 $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{Cl}$
- 2 $\text{CH}_3\text{CHICH}_2\text{OH}$
- 3 $\text{CH}_3\text{CHC}/\text{CH}_2\text{I}$
- 4 $\text{CH}_3\text{CHICH}_2\text{Cl}$

- A** 1 and 2 only
B 2 and 3 only
C 3 and 4 only
D 2, 3 and 4

26 Tetrapeptide, **P**, is formed by an unknown amino acid. **P** has a relative molecular mass of M .

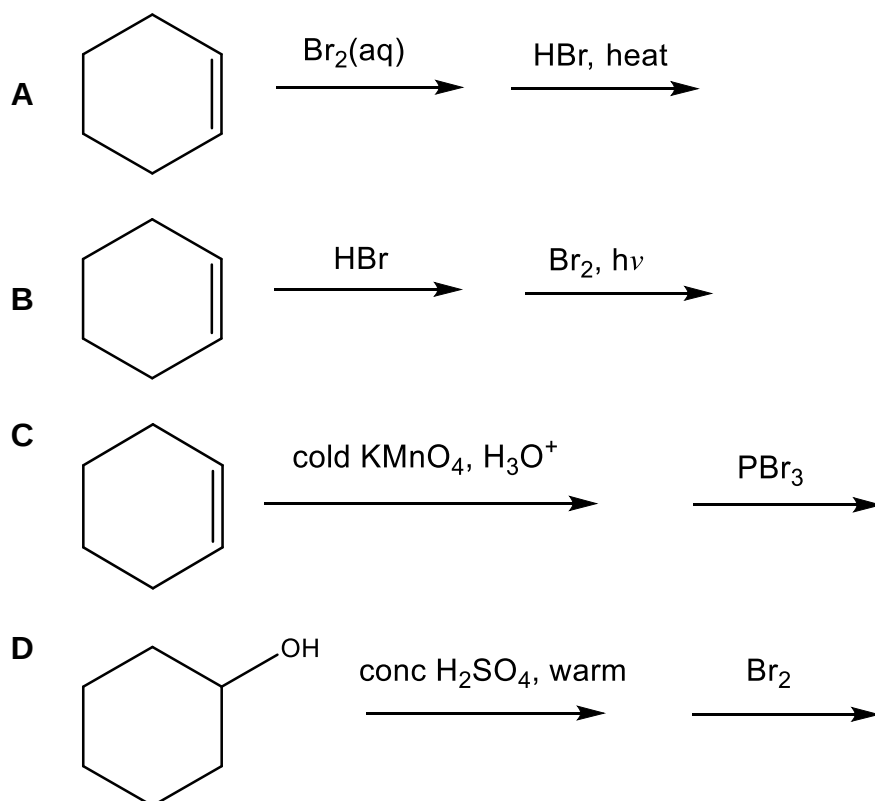
What is the relative molecular mass of the amino acid?

- A** $\frac{M}{4}$ **B** $\frac{M}{4} + 18$ **C** $\frac{M + 54}{4}$ **D** $\frac{M}{4} + 54$

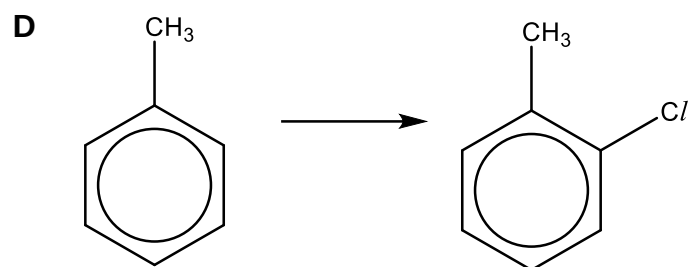
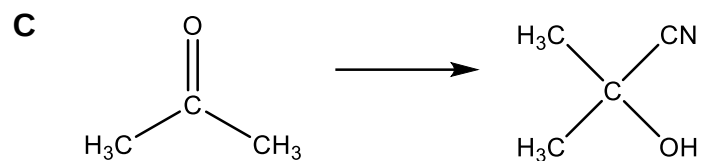
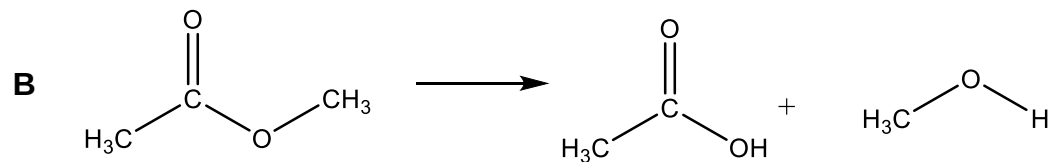
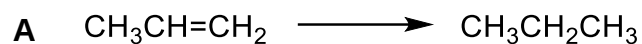
27 Which reaction yields a carbon compound incorporating deuterium, D? [D = ^2H]

	Reactant	Reagents and conditions
A	$\text{CH}_3\text{CH}_2\text{CN}$	NaOD , D_2O , heat
B	$(\text{CH}_3)_3\text{COH}$	conc H_2SO_4 , heat
C	CH_3COCl	NaOD , D_2O , warm
D	$\text{CD}_2(\text{OH})\text{CO}_2\text{H}$	acidified KMnO_4 , heat

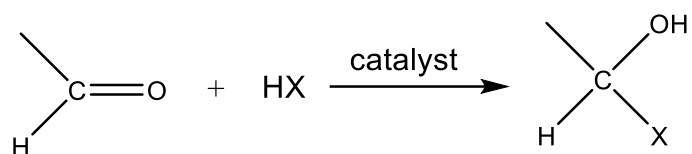
28 Which two-step synthesis process will not give a good yield of 1,2-dibromocyclohexane?



29 Which reaction will **not** take place in the presence of a suitable homogeneous catalyst?

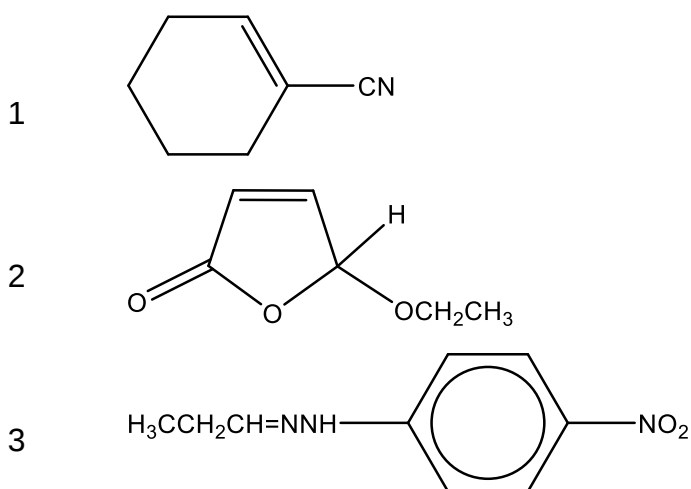


30 There is a range of reactions of the aldehyde group which have the pattern



of which the formation of a cyanohydrin (where X = CN) is one.

Which compounds could be obtained by such an addition to an aldehyde group, followed by a dehydration?



- A** 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3 only

END OF PAPER