



VICTORIA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
Higher 2

CHEMISTRY

9729/01

Paper 1 Multiple Choice

19 September 2018

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 Exam Number, name and CT group on the Multiple Choice Answer Sheet.

There are **thirty** questions. 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 choices in **soft pencil** on the separate Multiple Choice Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. No mark will 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.

- 1 The Avogadro constant is L . How many neutrons are present in 24 dm^3 of chlorine gas, measured at r.t.p?
- A 17L B 18.5L C 37L D 71L
- 2 A carbon sample contains a mixture of ^{12}C and ^{14}C isotopes. When 1.000 g of this sample is burned completely in $^{16}\text{O}_2$. The mass of CO_2 formed is 3.629 g.
- What is the percentage by mass of the ^{12}C isotope in this sample?
- A 85.0% B 88.6% C 90.0% D 91.4%
- 3 When phosphoryl chloride, POCl_3 , dissolves in water, it gives a mixture of phosphoric acid and hydrochloric acid. How many moles of sodium hydroxide would be needed to neutralise the solution formed by adding one mole of POCl_3 to excess water?
- A 3 B 4 C 5 D 6
- 4 Which of the following pairs have similar shapes and the first species has a smaller bond angle than the second species?
- 1 SiCl_4 , PF_4^+
 2 PH_3 , NH_3
 3 SO_3^{2-} , CO_3^{2-}
- A 1 only B 2 only
 C 1 and 2 only D 2 and 3 only
- 5 But-2-enedioic acid, $\text{HC}(\text{CO}_2\text{H})=\text{C}(\text{CO}_2\text{H})\text{H}$, exists as a pair of *cis-trans* isomers. The *cis* isomer has a lower melting point than the *trans* isomer.
- Which of the following statements is correct about but-2-enedioic acid?
- 1 In the solid state, both the *cis* and *trans* isomers have the same density.
 2 Intramolecular hydrogen bonding is present in the *cis* isomer.
 3 The *cis* isomer is less polar than the *trans* isomer.
- A 2 only B 1 and 2 only
 C 1 and 3 only D 2 and 3 only
- 6 Which of the following statements about prop-1,2-diene, $\text{H}_2\text{C}=\text{C}=\text{CH}_2$, is **not** correct?
- A The $\text{C}=\text{C}$ in prop-1,2-diene is stronger than the $\text{C}=\text{C}$ in ethene.
 B The two π -bonds in prop-1,2-diene are perpendicular to each other.
 C There are only two sp^2 hybridised carbon atoms in a prop-1,2-diene molecule.
 D Prop-1,2-diene is a planar molecule.

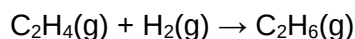
- 7 Which of the following statements is **not** correct?
- A Under very high pressure, HCl gas behaves more ideally than Cl₂ gas.
 - B Ideal gas molecules have zero size.
 - C Real gas molecules behave more ideally under low pressure and high temperature.
 - D There are no collisions between ideal gas molecules.

- 8 The lattice energies of the compounds, magnesium oxide, magnesium bromide, sodium oxide and sodium bromide are given below.

Which of the following values corresponds to the lattice energy of magnesium bromide?

- | | | | |
|---|----------------------------|---|----------------------------|
| A | −752 kJ mol ^{−1} | B | −2440 kJ mol ^{−1} |
| C | −2481 kJ mol ^{−1} | D | −3790 kJ mol ^{−1} |
- 9 The enthalpy changes of formation of gaseous ethene and ethane are +52 kJ mol^{−1} and −85 kJ mol^{−1} respectively at 298 K.

Consider the following reaction.



Which of the following statements is correct?

- A $\Delta S_{\text{reaction}}$ is positive.
 - B The enthalpy change of the reaction is −137 kJ mol^{−1}.
 - C If ethene is converted to ethane via four stages instead of one as shown above, the enthalpy change of the reaction will be less exothermic.
 - D The addition of a catalyst will cause the enthalpy change of reaction to be more exothermic.
- 10 Ammonium chloride readily dissolves in water at room temperature. During the process, the temperature of the solution decreases.

Which of the following statements is correct?

- 1 Dissolution of ammonium chloride is favoured due to the entropy change.
 - 2 Dissolution of ammonium chloride is not spontaneous at very low temperature.
 - 3 The sum of the hydration energies of ammonium ion and chloride ion is less exothermic than the lattice energy of ammonium chloride.
- | | | | |
|---|--------------|---|--------------|
| A | 1, 2 and 3 | B | 1 and 2 only |
| C | 2 and 3 only | D | 1 only |

- 11 Three experiments are conducted to determine the rate equation for a reaction between sulfuric acid and sodium thiosulfate. The volumes used and the time taken for the precipitate to form are shown below.

Experiment	Volume of H ₂ SO ₄ / cm ³	Volume of Na ₂ S ₂ O ₃ / cm ³	Volume of water / cm ³	Time / s
1	20	20	20	30
2	40	20	0	15
3	<i>x</i>	20	0	15

What could be a suitable value for *x*?

- A** 5 **B** 10 **C** 20 **D** 30
- 12 Lead is the final product formed by a series of changes in which the rate-determining stage is the radioactive decay of uranium-238. This radioactive decay is a first-order reaction with a half-life of 4.5×10^9 years.

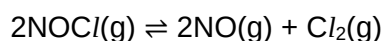
What would be the age of a rock sample, originally lead-free, in which the molar ratio of uranium to lead is now 1:7?

- A** 1.5×10^9 years **B** 2.25×10^9 years
C 9.0×10^9 years **D** 1.35×10^{10} years
- 13 A reversible reaction is catalysed.

Which of the following statements about this reaction are correct?

- The catalyst alters the mechanism of the reaction.
- The catalyst reduces the activation energy for both the forward and the backward reaction.
- The catalyst alters the composition of the equilibrium mixture.

- A** 1, 2 and 3 **B** 1 and 2 only
C 2 and 3 only **D** 1 only
- 14 Pure nitrosyl chloride gas, NOCl, was heated at 320 °C in a 2.0 dm³ vessel. At equilibrium, 30% of the NOCl gas has dissociated according to the equation below and the total pressure was *p* atm.



What is the numerical value of the equilibrium constant, K_p , at 320 °C?

- A** $\frac{17.9}{p}$ **B** $\frac{41.7}{p}$ **C** 0.0240*p* **D** 0.0276*p*
- 15 What is the pH of the resultant solution when 100 cm³ of 0.10 mol dm⁻³ aqueous NH₄Cl and 40 cm³ of 0.15 mol dm⁻³ aqueous NaOH are mixed at 25 °C? (pK_b of NH₃ = 4.75)
- A** 4.57 **B** 4.93 **C** 9.07 **D** 9.43

- 16 The value of the solubility product, K_{sp} , of silver chromate(VI), Ag_2CrO_4 , is 2.5×10^{-22} at 25°C .

Which statement about silver chromate(VI) is correct?

- A The units for K_{sp} of silver chromate(VI) are $\text{mol}^2 \text{dm}^{-6}$.
 B Addition of nitric acid will cause K_{sp} value of silver chromate(VI) to increase.
 C Addition of nitric acid will cause the solubility of silver chromate(VI) to increase.
 D The solubility of silver chromate(VI) in water is $1.58 \times 10^{-11} \text{ mol dm}^{-3}$.
- 17 Which of the following changes does not alter the reduction potential measured for a Cl_2/Cl^- half-cell?
- A Adding water into the half-cell.
 B Placing the half-cell in an ice-water bath.
 C Adding silver ions into the half-cell.
 D Introducing an additional 1 bar of inert gas into the half-cell.
- 18 When a large current was passed through an aqueous copper(II) sulfate solution with two inert electrodes, there was liberation of x mol of copper and $y \text{ dm}^3$ of oxygen, measured at r.t.p.

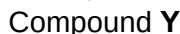
How many moles of electrons passed through the circuit?

- A $x + \frac{y}{12}$ B $x + \frac{y}{6}$ C $2x + \frac{y}{12}$ D $2x + \frac{y}{6}$
- 19 Which of the following statements concerning the chlorine-containing compounds of period 3 elements is correct?
- A PCl_3 and Cl_2O_7 are both acidic in nature due to their reactions with water.
 B NaCl dissolves easily in water due to the favourable ion-dipole interactions and the compounds with the highest electrical conductivity in molten state is AlCl_3 .
 C The low boiling points of PCl_3 and Cl_2O_7 are due to the weak $\text{P}-\text{Cl}$ and $\text{Cl}-\text{O}$ bond energies.
 D Both CCl_4 and SiCl_4 can dissolve in excess water completely to give an acidic solution.
- 20 When aqueous ammonia is added to a solution containing hexaaquairon(III) ions, $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$, a red-brown precipitate is formed which does not dissolve in excess ammonia.

What is the role of the ammonia molecule in this reaction?

- A Bronsted-Lowry base
 B Lewis acid
 C Ligand
 D Reducing agent

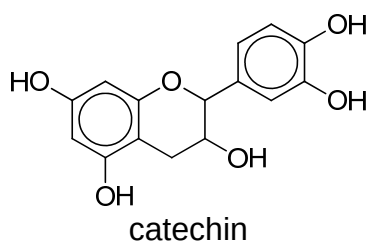
- What could **X** be?



- 25 Starting with $\text{C}_6\text{H}_5\text{COCH}_3$, which two-stage process does **not** involve a condensation reaction?

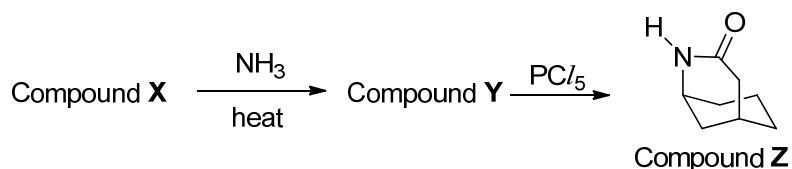
stage 1	stage 2
A HCN with trace NaCN	NaOH
B NH_2NH_2	NaOH
C I_2 with NaOH	$\text{C}_2\text{H}_5\text{OH}$ with conc. H_2SO_4
D NaBH_4	CH_3COCl

- 26 Catechin is an antioxidant found in tea leaves, chocolates and red wine. It is often studied for its function as an inhibitor to the growth of cancer cells, amongst other health benefits.



Which of the following statements about catechin is correct?

- A 1 mol of catechin reacts with 5 mol of NaOH.
 B It can undergo electrophilic substitution with 2.5 mol of $\text{Br}_2(\text{aq})$.
 C It can undergo oxidation with hot alkaline $\text{KMnO}_4(\text{aq})$.
 D 1 mol of catechin reacts with 2 mol of Na_2CO_3 .
- 27 The diagram below shows a reaction scheme for the formation of compound **Z**.



Which combination could be **X** and **Y**?

	X	Y
A		
B		
C		
D		

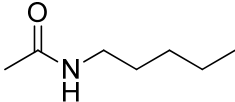
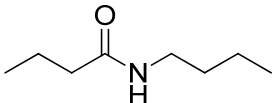
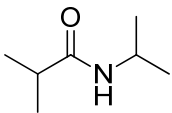
- 28** Equal amounts of two organic compounds, **P** and **Q**, were separately added to 100 cm³ of water and the pH values of both solutions were determined. It was found that the pH of the aqueous solution of **P** is higher.

Which pairs of compounds could be **P** and **Q**?

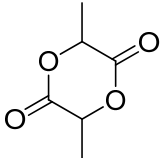
- | | P | Q |
|---|---|--|
| 1 | CH ₃ CH ₂ OH | CH ₃ CO ₂ H |
| 2 | CH ₃ CH ₂ NH ₂ | C ₆ H ₅ NH ₂ |
| 3 | C ₆ H ₅ ONa | C ₆ H ₅ CO ₂ Na |
- A** 1, 2 and 3 **B** 1 and 2 only
C 2 and 3 only **D** 1 only

- 29** An amide, **M**, has the empirical formula C₇H₁₅ON. When **M** is hydrolysed by heating under reflux with dilute hydrochloric acid, a carboxylic acid with empirical formula C₂H₄O is obtained as one of the products.

What could be the skeletal formula of **M**?

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

- 30** Which ester might be formed when lactic acid, CH₃CH(OH)CO₂H, is heated?

- 1 CH₃CH(OH)CO₂CH(CH₃)CO₂H
- 2 
- 3 CH₃CH(OH)CO₂CH(OH)CH₃
- A** 1, 2 and 3 **B** 1 and 2 only
C 2 and 3 only **D** 1 only

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