VICTORIA JUNIOR COLLEGE
JC 1 PROMOTIONAL EXAMINATION
Higher 2

CHEMISTRY

9729

Paper 2 Multiple Choice

50 min

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

There are **25** 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 Optical Mark Sheet.

This document consists of 8 printed pages.

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

1 Bones contain a complex mixture of calcium salts, protein and other materials. When a bone is strongly heated in a current of air, the only residue is calcium oxide.

From a sample of 50.0 g of bone, 14.0 g of calcium oxide were obtained.

What is the percentage by mass of calcium in the bone?

A 10.0% **B** 14.0% **C** 20.0% **D** 28.0%

2 0.0050 mol of a metal oxide, Y_2O_x, reacted exactly with 60 cm^3 of a 0.10 mol dm^{-3} of acidified potassium manganate(VII) solution. The half–equation for the reduction of MnO_4^- is shown below:

$$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$$

Given that the oxidation state of Y in the product is +6, what is the value of x?

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

3 A mixture of a gaseous hydrocarbon, C_6H_y, and oxygen in stoichoimetric ratio has a total volume of 1050 cm^3. After combustion, the total volume of carbon dioxide and water vapour produced is 1300 cm^3, all volumes being measured at the same temperature and pressure. What is the molecular formula of the hydrocarbon?

A C_6H_6 **B** C_6H_{10} **C** C_6H_{12} **D** C_6H_{14}

4 Ions of the two most common isotopes of the transition metal nickel are shown below:

$^{58}Ni^{2+}$ $^{60}Ni^{2+}$

Which one of the following statements is correct?

A The electron configuration of both $^{58}Ni^{2+}$ and $^{60}Ni^{2+}$ is $1s^22s^22p^63s^23p^63d^64s^2$.

B $^{60}Ni^{2+}$ has more protons than $^{58}Ni^{2+}$.

C In a magnetic field, $^{60}Ni^{2+}$ will be deflected more than $^{58}Ni^{2+}$.

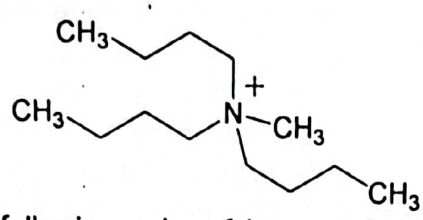
D Both $^{58}Ni^{2+}$ and $^{60}Ni^{2+}$ have the same number of electrons but different number of neutrons.

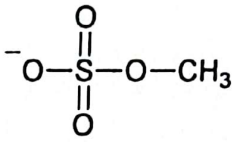
5 **X** and **Y** are cations. **X** contains n protons and has a charge of 2+. **Y** contains $(n–1)$ protons and has the same number of electrons as **X**.

What is the formula of the oxide formed by **Y**?

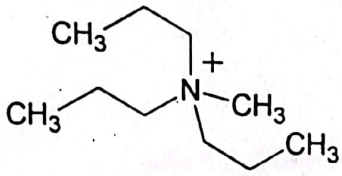
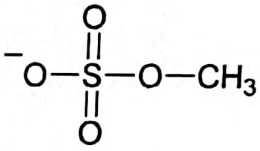
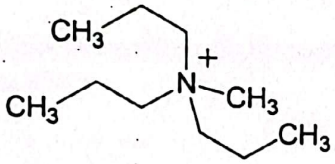
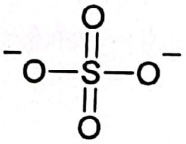
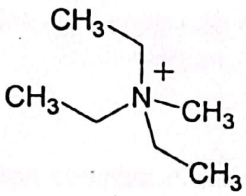
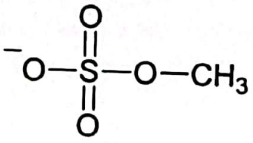
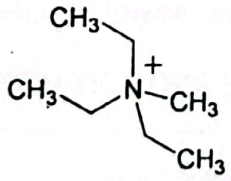
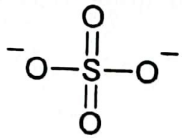
A YO **B** Y_2O **C** Y_2O_3 **D** YO_2

6 Researchers have designed ionic compounds with ionic bonding that are sufficiently weak for them to exist as liquids at temperatures below 100 °C. These compounds are known as *ionic liquids*. The structure of one such ionic liquid is shown below.





Which of the following pairs of ions would give an ionic compound with the lowest melting point?

	Cation	Anion
A		
B		
C		
D		

7 In which of the following molecules would you expect to have a bond angle of 134°?

A OF_2 B BF_3 C CO_2 D NO_2

8 Given the following thermochemical data, calculate the standard enthalpy change of the reaction, $\Delta H_r^{\ominus}$.

$$CH_3C{\equiv}CCH_3(g) \xrightarrow{\Delta H_r^{\ominus}} CH_2{=}CHCH{=}CH_2(g)$$

Standard enthalpy change of combustion of $CH_3C{\equiv}CCH_3(g)$ = -2577 kJ mol^{-1}
Standard enthalpy change of combustion of carbon = -394 kJ mol^{-1}
Standard enthalpy change of combustion of hydrogen = -286 kJ mol^{-1}
Standard enthalpy change of formation of $CH_2{=}CHCH{=}CH_2(g)$ = $+110$ kJ mol^{-1}

A -253 kJ mol^{-1} B -33 kJ mol^{-1}
C $+33$ kJ mol^{-1} D $+253$ kJ mol^{-1}

9 Given only the standard enthalpy changes of combustion of carbon, hydrogen and methane, which of the following can be determined?

1 The enthalpy change for the hypothetical reaction:
$$2CO_2(g) + 4H_2O(l) \rightarrow 2CH_4(g) + 4O_2(g)$$

2 The enthalpy change of formation of water

3 The enthalpy change of formation of methane

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

10 The following reaction is thermodynamically feasible at low temperature.

$$CO(g) + 2H_2(g) \rightarrow CH_3OH(l)$$

What are the signs of ΔH and ΔS for the reaction?

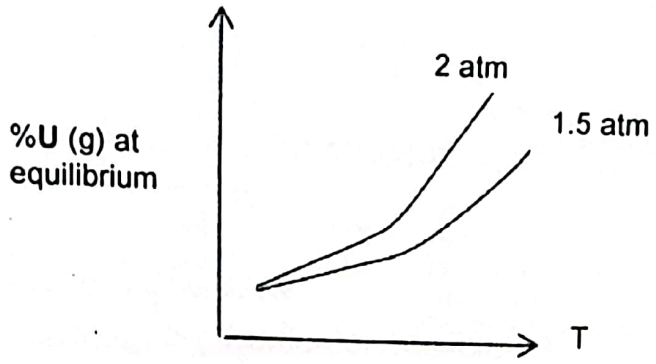
	ΔH	ΔS
A	+	−
B	−	−
C	−	+
D	+	+

11 Mixtures of argon and another gas are commonly used during welding. One such gaseous mixture has a density of 1.82 g dm^{-3} at s.t.p.

What could be the other gas in this mixture? [Density of argon = 1.78 g dm^{-3} at s.t.p.]

A carbon dioxide B fluorine
C neon D oxygen

12 The graph below shows how the percentage of reactant U(g) that remained in an equilibrium mixture varies with T at pressures of 1.5 atm and 2 atm.



Which of the following statements can be deduced from this information?

1 The forward reaction is exothermic.

2 The equation for the above reaction could be U(g) ⇌ V(g) + W(g).

3 The equilibrium constant, K_p, increases as pressure increases in the system.

A 1, 2 and 3 B 1 and 2 only

C 2 and 3 only D 1 only

13 What is the pH of an aqueous solution containing 0.100 mol dm^{-3} benzoic acid, a weak monobasic acid?
[K_a(benzoic acid) = 6 × 10^{-5} mol dm^{-3}]

A 2.61 B 5.39 C 8.61 D 9.78

14 Which of the following statements is **not** correct about buffer solutions?

A When a small amount of acid is added into the buffer solutions, the pH of the solution will remain the same.

B When a small amount of water is added into the buffer solutions, the pH of the solution will remain the same.

C It can be prepared by mixing a weak acid and its salt.

D The pH of the blood is maintained by a buffer solution containing H_2CO_3 and HCO_3^-.

15 What is a satisfactory indicator for the titration of 0.100 mol dm^{-3} ethanoic acid and 0.100 mol dm^{-3} aqueous ammonia?

A methyl red (pH range 4.2 – 6.0)

B bromothymol blue (pH range 6.0 – 7.6)

C phenolphthalein (pH range 8.2 – 10.0)

D there is no satisfactory indicator

16 Which one of the following could increase the solubility of calcium ethanoate, $Ca(CH_3CO_2)_2$ in water.

A the addition of water

B the addition of dilute nitric acid

C the addition of aqueous sodium ethanoate

D the addition of calcium chloride

17 Public swimming pools are often chlorinated to kill bacteria. As an alternative to chlorination, silver ions can be used in a concentration of not more than 10^{-6} mol dm^{-3} and not less than 10^{-7} mol dm^{-3} of silver ions.

Which compound would, in saturated solution, provide the necessary concentration of silver ions?

	compound	solubility product
A	AgBr	5×10^{-13} mol^2 dm^{-6}
B	AgCl	2×10^{-10} mol^2 dm^{-6}
C	$AgIO_3$	2×10^{-8} mol^2 dm^{-6}
D	Ag_2CO_3	5×10^{-12} mol^3 dm^{-9}

18 An ether was produced in the following reaction.

What is the reaction mechanism involved?

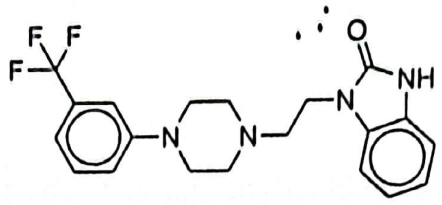
A electrophilic addition

B electrophilic substitution

C nucleophilic addition

D nucleophilic substitution

19 In 2015, Flibanserin made the news by becoming the first drug to be approved for the treatment of female hypoactive sexual desire disorder. The structure of Flibanserin is shown below.



Flibanserin

Which of the following statements about Flibanserin is correct?

A There are 2 chiral carbon centres.

B It is a planar molecule.

C It contains carbonyl functional group.

D There are 13 carbon atoms that use sp^2 hybridised orbitals for bonding.

20 How many isomers, both structural and stereoisomers, of mono–substituted product could be formed when 2,2–dimethylbutane is reacted with chlorine in direct sunlight?

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

21 The use of the Data Booklet is relevant to this question.

Which of the following would be the easiest initiating step in a free radical process?

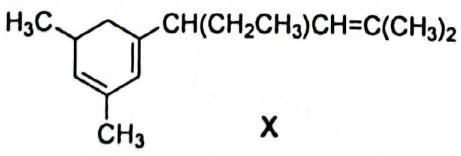
A $CH_4 \rightarrow CH_3\bullet + H\bullet$

B $Cl_2 \rightarrow 2Cl\bullet$

C $HBr \rightarrow H\bullet + Br\bullet$

D $H_2 \rightarrow 2H\bullet$

22 A hydrocarbon, **X**, has the following structure.



X

Heating **X** with an excess of hot concentrated acidified $KMnO_4$ solution produces several products.

Which of the following is **not** one of the products?

A CH_3COCH_3

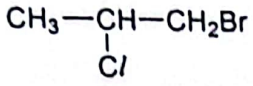
B CH_3COCO_2H

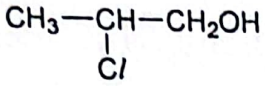
C $HO_2CCH_2COCH_3$

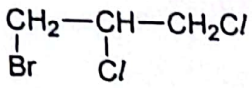
D $HO_2CCH(CH_2CH_3)COCH_2CH(CH_3)CO_2H$

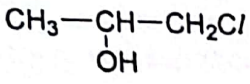
23 A mixture of propene, bromine water and aqueous sodium chloride was left to react in the dark.

Which of the following compounds can be detected in the mixture after 24 hours?

A 

B 

C 

D 

24 1,2–dibromo–3–chloropropane (DBCP) has been used widely in the control of earthworms in agricultural land.

Which one of the following could be used to synthesise this compound with high yield?

1 $CH_2CHCH_2Cl + Br_2 \rightarrow$ DBCP

2 $CH_2BrCHBrCH_3 + HCl \rightarrow$ DBCP + H_2

3 $CH_2CHCH_2Cl + 2Br_2 \rightarrow$ DBCP + HBr

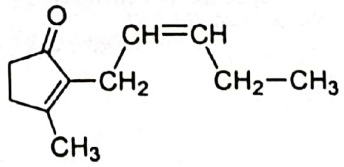
A 1, 2 and 3

B 1 and 2 only

C 2 and 3 only

D 1 only

25 The sweet smell of jasmine flower comes from the compound jasmone. It has the structure shown below.



Jasmone

Which of the following statements are correct?

1 Jasmone can exist as two cis–trans isomers.

2 Addition of steam to jasmone in the presence of catalyst yields a product with two –OH group.

3 16 stereoisomers will be formed when jasmone reacts with cold, dilute $KMnO_4$.

A 1, 2 and 3

B 1 and 2 only

C 2 and 3 only

D 1 only