YISHUN INNOVA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
Higher 1

CANDIDATE NAME	
CG	INDEX NO

CHEMISTRY 8873/01

Paper 1 Multiple Choice **16 September 2021**

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/tape.
Write your name and class 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.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **10** printed pages and **2** blank pages.

1 10 cm^3 of a hydrocarbon C_xH_y was exploded with an excess of oxygen. There was a contraction of 30 cm^3. When the product was treated with a solution of potassium hydroxide, there was a further contraction of 40 cm^3. What is the molecular formula of the hydrocarbon?

[All gas volumes are measured at r.t.p.]

A C_4H_8

B C_4H_{10}

C C_3H_6

D C_3H_8

2 Three organic molecules each have

• three elements;
• the composition, by mass, C, 54.5 %; H, 9.1 %.

What could these molecules be?

1 $CH_3CH_2CH_2CO_2H$

2 $OHCCH_2CH_2CH_2OH$

3 $CH_3CH{=}CHCH_2SH$

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

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

In which series of elements do the atoms have the same number of neutrons as protons?

1 ^{4}He, ^{12}C, ^{24}Mg
2 ^{14}N , ^{20}Ne , ^{30}P
3 ^{28}Si, ^{34}S, ^{40}Ca,

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

4 Which of the species in their gaseous state shown below will be deflected by the largest angle in an electric field?

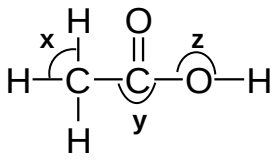
A $^{11}B^{3+}$

B $^{4}He^{2+}$

C $^{9}Be^{2+}$

D $^{1}H_2$

5 Which of the following shows the correct bond angles x, y and z for ethanoic acid as shown below?



	x	y	z
A	90°	120°	109°
B	109°	120°	105°
C	109°	180°	109°
D	90°	180°	105°

6 Consider the following four compounds.

What is the order of increasing boiling point of the compounds?

1 $CH_3CH_2CH_2F$

2 $CH_3CH_2CH_2OH$

3 $CH_3CH_2CH_2CH_3$

4 $(CH_3)_3CH$

A 1 → 2 → 4 → 3

B 3 → 4 → 1 → 2

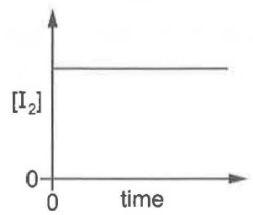
C 4 → 3 → 1 → 2

D 4 → 3 → 2 → 1

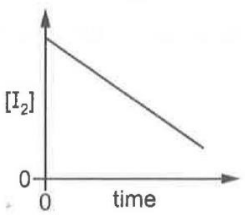
7 The reaction of iodine with propanone in the presence of aqueous acid is zero order with respect to iodine.

Which diagram represents the variation of $[I_2]$ with time?

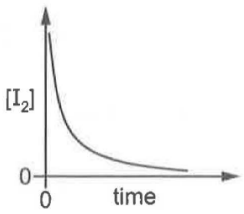
A



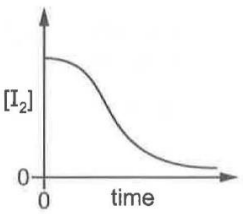
B



C



D



8 Lead is the final product formed by a series of changes in which the rate-determining step 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.

How long would it take for a rock sample, originally lead-free, to contain a molar proportion of uranium to lead of 1 : 3?

A 1.5×10^9 years

B 2.25×10^9 years

C 9.0×10^9 years

D 13.5×10^9 years

9 An equilibrium is represented by the following equation.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -92 \text{ kJ mol}^{-1}$$

What is the effect of introducing a catalyst on this reversible reaction?

A It increases the equilibrium yield of ammonia.

B It increases the equilibrium constant for the forward reaction.

C It increases the rate constant for both the forward and the reverse reaction.

D It increases the rate constant for the forward reaction but not the reverse reaction.

10 An aqueous solution was prepared containing 1.0 mol of $AgNO_3$ and 1.0 mol of $FeSO_4$ in 2.00 dm^3 of water. When equilibrium was established, there was 0.44 mol of $Ag^+(aq)$ in the mixture.

$$Ag^+(aq) + Fe^{2+}(aq) \rightleftharpoons Ag(s) + Fe^{3+}(aq)$$

What is the numerical value of K_c?

A 1.35

B 1.62

C 2.89

D 5.79

11 Which of the following equations illustrates the lattice energy of MgO?

A $Mg(s) + \frac{1}{2} O_2(g) \rightarrow MgO(s)$

B $Mg^{2+}(aq) + O^{2-}(aq) \rightarrow MgO(s)$

C $Mg^{2+}(g) + O^{2-}(g) \rightarrow MgO(s)$

D $Mg(g) + O(g) \rightarrow MgO(s)$

12 The standard enthalpy change of formation of NO is +90 kJ mol^{-1}.

What is the enthalpy change of the reaction shown below?

$$2NO(g) \rightarrow N_2(g) + O_2(g)$$

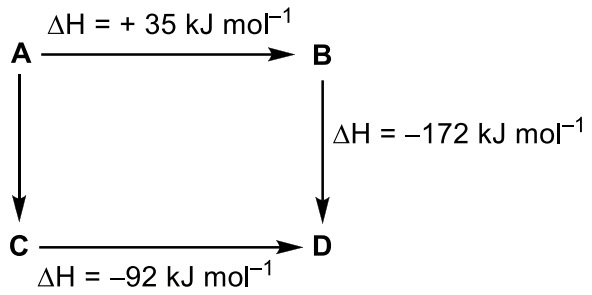
A –180 kJ mol^{-1}

B –90 kJ mol^{-1}

C +90 kJ mol^{-1}

D +180 kJ mol^{-1}

13 The diagram below illustrates the energy changes for a set of reactions.



Which of the following statements is correct?

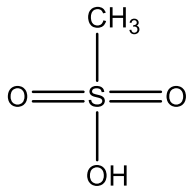
A **D** has a higher energy content than **B**.

B The transformation **A** → **D** is endothermic.

C The transformation **C** → **B** is exothermic.

D The enthalpy change for the transformation **A** → **C** is –45 kJ mol^{-1}.

14 Methanesulfonic acid is a monoprotic strong acid which is used to remove calcium carbonate from kettles.



methanesulfonic acid

Which statement about methanesulfonic acid is **incorrect**?

A The K_a value of methanesulfonic acid is very small.

B 0.1 mol dm^{-3} methanesulfonic acid has a pH value of 1.

C The Brønsted-Lowry conjugate base of methanesulfonic acid is the $CH_3SO_3^-$ ion.

D The gas evolved when methanesulfonic acid reacts with magnesium is H_2.

15 At 25°C, K_w= 1.00 x 10^{-14} mol^2dm^{-6}.

At 50°C, K_w= 5.48 x 10^{-14} mol^2dm^{-6}.

Which row is correct?

	the ionisation of water is	at 50°C, water with a pH of 7.0 is
A	endothermic	alkaline
B	endothermic	neutral
C	exothermic	alkaline
D	exothermic	neutral

16 Which pair of solutions will produce an acidic buffer solution upon mixing equal volumes of each solution?

A 1.50 mol dm^{-3} of HC*l* and 1.00 mol dm^{-3} of NaOH

B 1.00 mol dm^{-3} of NH_3 and 2.00 mol dm^{-3} of HC*l*

C 0.50 mol dm^{-3} of H_2SO_4 and 2.00 mol dm^{-3} of NH_3

D 1.00 mol dm^{-3} of $C_6H_5CO_2H$ and 0.50 mol dm^{-3} of KOH

17 A non-cyclic organic compound has the molecular formula $C_4H_9O_2N$.

Which pair of functional groups could **not** be present in the molecule?

A one carboxylic acid group and one amine group

B one alcohol group and one amide group

C one ester group and one amine group

D one alkene group and one carboxylic acid group

18 Which pairs of molecules are constitutional (structural) isomers?

1 $CH_3CH_2CH(CH_3)_2$ and $(CH_3)_4C$

2 Butanone and 2-methylpropanal

3 

A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

19 P and Q are two straight-chain unsaturated hydrocarbons with the molecular formula C_4H_8. Each react separately with bromine gas. The products of the two reactions are different isomers.

Which pair of names could identify the two organic **products** made?

A 1, 1-dibromobutane and 1,2-dibromobutane

B 1,2-dibromobutane and 2,3-dibromobutane

C 1,3-dibromobutane and 2,4-dibromobutane

D 2,3-dibromobutane and 3,3-dibromobutane

20 Which compound cannot undergo a reaction when treated with hot ethanolic potassium hydroxide?

A CH_2Br_2

B $CHBr_2CBr_3$

C $(CH_3)_2CHCHBr_2$

D $CH_3CBr_2CH_3$

21 Pentaerythritol is used as an intermediate in the manufacture of paint. It has the molecular formula $C_5H_{12}O_4$ and contains four primary alcohol groups.

After prolonged heating under reflux with an excess of $Cr_2O_7^{2-}$ / H^+, it forms compound X which also has five carbon atoms.

What is the molecular formula of compound X?

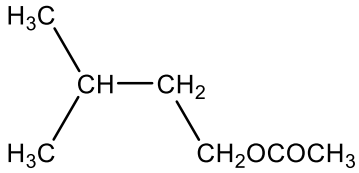
A $C_5H_4O_8$

B $C_5H_4O_4$

C $C_5H_8O_4$

D $C_5H_8O_8$

22 The following ester, commonly known as banana oil, is used to confer banana flavour in foods.



banana oil

Which of the following substances react together to produce banana oil?

A $CH_3OH + CH(CH_3)_2CH_2CH_2CO_2H$

B $CH_3CO_2Na + CH(CH_3)_2CH_2CH_2Cl$

C $CH_3CO_2H + CH(CH_3)_2CH_2CH_2OH$

D $CH_3CO_2H + CH(CH_3)_2CH_2CH_2Cl$

23 Which of the following statement regarding the properties of high density polyethene (HDPE) and low density polyethene (LDPE) is least likely to be correct?

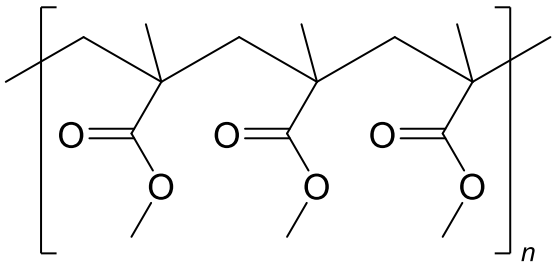
A HDPE has less branching than LDPE.

B HDPE is a harder material than LDPE.

C HDPE has a higher melting point than LDPE.

D HDPE is more suitable to be used to make plastic bags than LDPE.

24 Poly(methyl methacrylate) is used in modern dentistry in the manufacture of artificial teeth. Part of its polymer chain is shown.



Which statement about poly(methyl methacrylate) is incorrect?

A It can undergo alkaline hydrolysis.

B The relative molecular mass of the monomer is 100.0.

C Permanent dipole-permanent dipole interactions exist between polymer chains.

D A small molecule of water is lost when polymerisation took place.

25 Poly(propene) is an example of addition polymer.

Which statements are correct?

1 On combustion, poly(propene) can produce carbon monoxide and carbon dioxide.
2 When poly(propene) is buried in a landfill site, it will not significantly biodegrade.
3 The empirical formula of poly(propene) is the same as its monomer.

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

26 Which solid has more than one type of chemical bond?

A aluminium
B ammonium chloride
C calcium sulfide
D diamond

27 Which of the following properties steadily decrease from hydrogen chloride to hydrogen bromide and to hydrogen iodide?

1 thermal stability
2 polarity of the H–X bond
3 boiling point

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

28 Pure germanium is an important element in the electronics industry and is used in transistors. To manufacture pure germanium, the metal is separated from other metals by the formation of germanium tetrachloride, $GeCl_4$, followed by fractional distillation.

$GeCl_4$ is a liquid at room temperature and has similar properties to $SiCl_4$.

Which statement about germanium tetrachloride is correct?

A germanium tetrachloride is an ionic compound.
B germanium tetrachloride is hydrolysed by water.
C germanium tetrachloride will conduct electricity.
D the bond angle in germanium tetrachloride is 120°.

29 What is formed when solid sodium chloride is added to water?

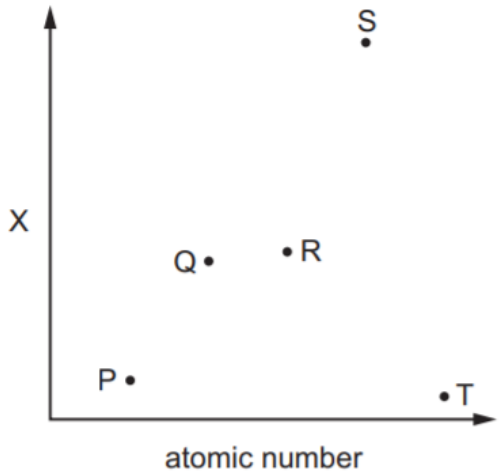
A sodium chloride molecules in solution

B sodium hydroxide solution and hydrochloric acid solution

C sodium hydroxide solution and hydrogen chloride gas

D sodium ions in solution and chloride ions in solution

30 The magnitude of property X of five elements from the third period of the Periodic Table, P, Q, R, S and T is shown. P, Q, R, S and T have consecutive atomic numbers. The letters do not represent the symbols of the elements.



Which row correctly identifies property X and element R?

	property X	element R
A	electrical conductivity	A*l*
B	electronegativity	Si
C	melting point	A*l*
D	melting point	Si

BLANK PAGE

BLANK PAGE