

INNOVA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION 2
in preparation for General Certificate of Education Advanced Level
Higher 1

CANDIDATE
NAME

CLASS

INDEX NUMBER

CHEMISTRY

8872/01

Paper 1 Multiple Choice

21 September 2015

50 minutes

Additional Materials: *Data Booklet*
Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name and class on all the work you hand in.
Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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.

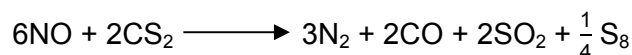
This document consists of **11 printed pages and 1 blank page.**



Section A

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

- 1 An exciting chemical demonstration is the 'barking dog'. An equation which describes the reaction is shown.



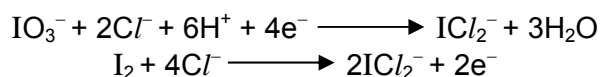
Carbon disulfide, CS_2 , is a liquid with a density of 1.26 g cm^{-3} .

Which mass of sulfur would be formed from 5.00 cm^3 of CS_2 if the reaction proceeded with 80% yield?

[M_r of $\text{CS}_2 = 76.2$; $\text{S}_8 = 256.8$]

- A** 1.67 g **B** 2.12 g **C** 2.65 g **D** 3.32 g

- 2 The following half-reactions occur when potassium iodate(V), KIO_3 , in hydrochloric acid solution oxidises iodine to ICl_2^- .



What is the ratio of IO_3^- to I_2 in the balanced chemical equation for the overall reaction?

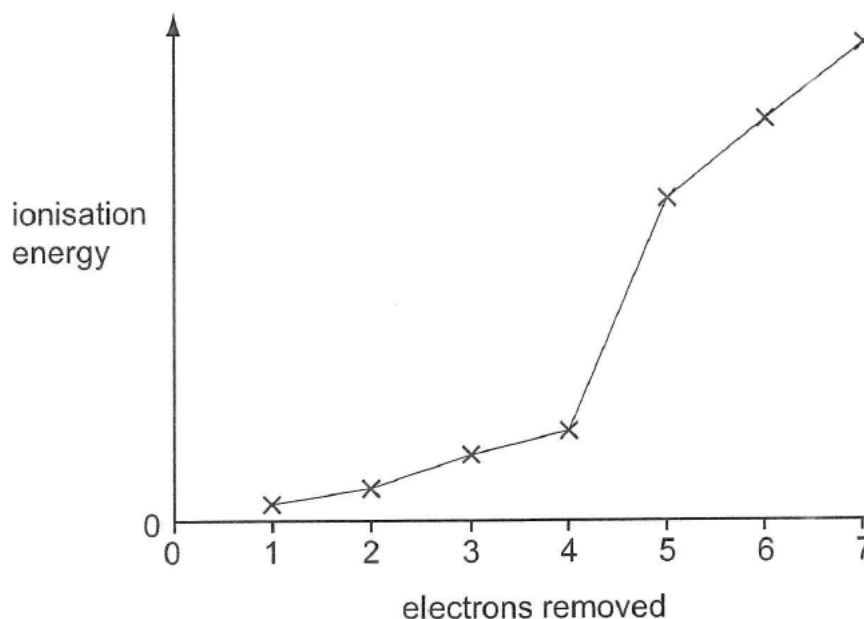
- A** 1:1 **B** 1:2 **C** 1:4 **D** 2:1

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

In which pairs do both species have different number of unpaired electrons?

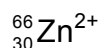
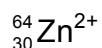
- A** O and Cl^+
B F^+ and Ga^-
C P and Ne^+
D Ga^+ and Ne

- 4 The first seven ionisation energies of an element **M** are shown in the sketch graph.



What could be the identity of element **M**?

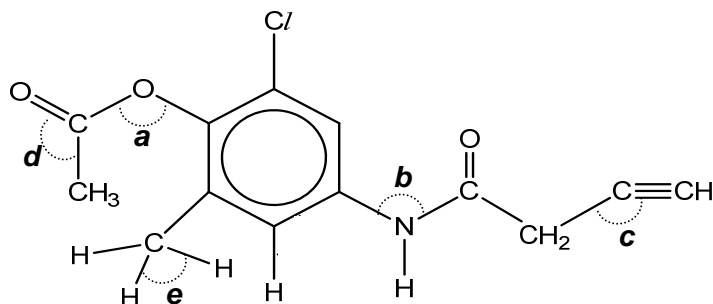
- A aluminium
 - B magnesium
 - C phosphorus
 - D silicon**
- 5 Ions of the two most common isotopes of zinc are shown below:



Which of the following statements is correct?

- A Both Zn^{2+} ions have the same number of electrons but different number of protons.
- B Both Zn^{2+} ions have the same electron configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$.
- C The ${}_{30}^{64}\text{Zn}^{2+}$ ion has fewer neutrons in its nucleus than the ${}_{30}^{66}\text{Zn}^{2+}$ ion.**
- D The ${}_{30}^{66}\text{Zn}^{2+}$ ion will be deflected more than the ${}_{30}^{64}\text{Zn}^{2+}$ ion in an electric field of the same strength.

6 Refer to the molecule below.



Which one of the following shows the correct information with regard to the various labelled bond angles?

	smallest bond angle	→	largest bond angle
A	<i>c</i>	<i>d</i>	<i>e</i>
B	<i>d</i>	<i>a</i>	<i>c</i>
C	<i>e</i>	<i>b</i>	<i>a</i>
D	<i>b</i>	<i>e</i>	<i>d</i>

7 Three substances, **X**, **Y** and **Z**, have the physical properties shown in the table.

substance	melting point / °C	boiling point / °C	density / g cm ⁻³	conductivity (solid)	conductivity (liquid)
X	114	184	4.93	poor	poor
Y	993	1695	2.56	poor	good
Z	650	1755	1.74	good	good

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

	X	Y	Z
A	I ₂	SiO ₂	Ca
B	I ₂	NaF	Mg
C	Si	Mg	NaF
D	Ca	KCl	SiO ₂

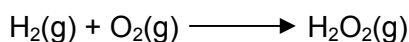
8 Consider the following four compounds.

- | | |
|---|--|
| 1 | $(\text{CH}_3)_3\text{CH}$ |
| 2 | $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$ |
| 3 | $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ |
| 4 | $\text{CH}_3\text{CH}_2\text{Cl}$ |

What is the order of **decreasing** boiling point of the compounds?

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

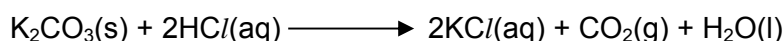
9 What does the following equation represents?



- A standard enthalpy change of combustion of H_2
 B standard enthalpy change of formation of H_2O_2
C sum of standard enthalpy change of formation of H_2O_2 and the enthalpy change of vaporisation of H_2O_2 .
 D sum of standard enthalpy change of combustion of H_2 and the enthalpy change of vaporisation of H_2O_2 .

10 In an experiment, 1.00 g of solid K_2CO_3 was added to a polystyrene cup containing 25.0 cm^3 of 1.0 mol dm^{-3} aqueous HCl . It was found that the temperature of the solution rose by 2.1°C .

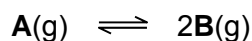
The equation for the reaction is as follows.



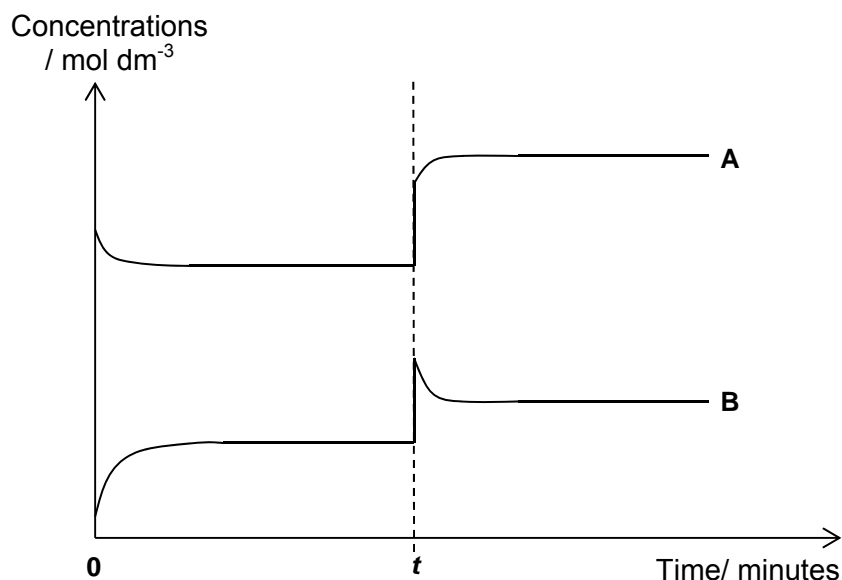
What is the correct value for the enthalpy change of reaction above?
 (Assume that the heat capacity of the solution is $4.2 \text{ J K}^{-1} \text{ cm}^{-3}$)

- A $-8.82 \text{ kJ mol}^{-1}$
 B $+8.82 \text{ kJ mol}^{-1}$
C $-30.5 \text{ kJ mol}^{-1}$
 D $+30.5 \text{ kJ mol}^{-1}$

- 11 The decomposition of compound **A** to form compound **B** can be represented by the following equation:

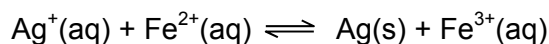


An enclosed system initially containing some quantities of **A** and **B** are allowed to reach equilibrium. At t minutes, a change has been introduced to the system. The graphs of the concentrations of **A** and **B** against time is plotted.



Which of the following could result in the change in concentrations of **A** and **B** as represented by the graph at t minutes?

- A increase in concentration of **A**
 - B decrease in concentration of **A**
 - C** decrease in volume of the system
 - D decrease in pressure of the system
- 12 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 $\text{Ag}^+(\text{aq})$ in the mixture.



What is the numerical value of K_c ?

- A 1.35
- B 1.62
- C 2.89
- D** 5.79

13 What is the pH of a solution containing $0.0100 \text{ mol dm}^{-3}$ of $\text{Ba}(\text{OH})_2$ at 298K?

- A 2.0
- B 1.70
- C 12.0
- D 12.3**

14 Bromine and methanoic acid react as follows:



The rate of reaction is found to be first order with respect to both bromine and to methanoic acid.

Which of the following statements about the above reaction is **incorrect**?

- A The units of the rate constant is $\text{mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$.
 - B** The half-life of the reaction can be found using $t_{1/2} = \frac{\ln 2}{k}$.
 - C The rate of formation of $\text{H}^+(\text{aq})$ is twice the rate of disappearance of $\text{Br}_2(\text{aq})$.
 - D Doubling the concentration of methanoic acid doubles the rate of evolution of gas.
- 15 Which of the following elements forms an oxide with a giant structure and a chloride which is readily hydrolysed?
- A aluminium
 - B carbon
 - C phosphorus
 - D** silicon

Answer: D

Aluminium: Al_2O_3 has giant covalent structure and AlCl_3 undergoes partial hydrolysis

Carbon: Both oxide and chloride are simple molecular structure.

Phosphorus: Both oxide and chloride are simple molecular structure.

Silicon: SiO_2 has giant covalent structure and SiCl_4 gets completely hydrolysed to form SiO_2 easily.

- 16 For the elements in the third period of the Periodic Table, which property decreases consistently from sodium to chloride?

- A electrical conductivity
- B ionisation energy
- C melting point
- D** radius of the atom

Answer: D

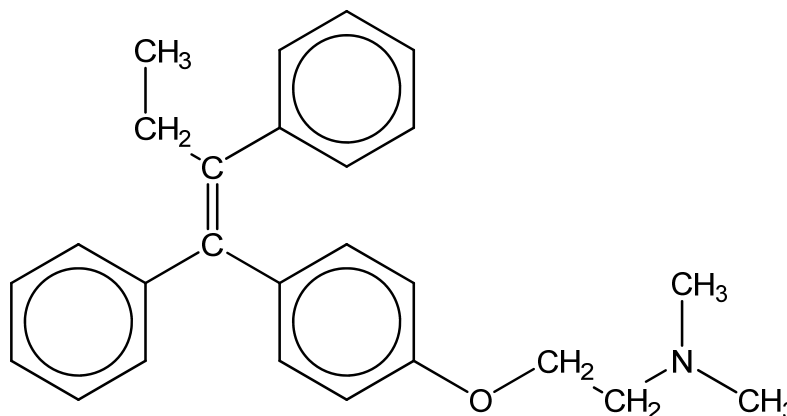
Electrical conductivity increases from sodium to aluminium, drops to Si, and drops to P, S and Cl

Ionisation energy generally increases from sodium to chlorine, with anomalies at Al and S

Melting point increases from sodium to silicon, and drops to P, S and Cl

Radius decreases continuously from sodium to chlorine due to increase in ENC

- 17 Tamoxifen is widely used in the treatment of breast cancer.



Tamoxifen

What is the number of sp^2 and sp^3 hybridised carbon atoms respectively after subjecting Tamoxifen to hydrogen gas under heat and in the presence of nickel.

	sp^2	sp^3
A	6	20
B	8	18
C	18	8
D	20	6

18 Which formula could represent a compound which has *cis-trans* isomers?

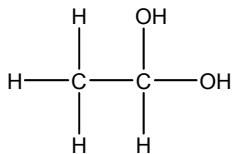
A $C_2H_6O_2$

B $C_2H_2O_4$

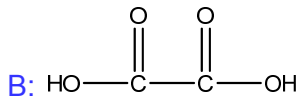
C C_2H_3Cl

D $C_2H_2Cl_2$

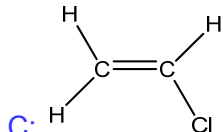
Answer: D



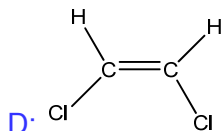
A: All the bonds are saturated so no *cis-trans* isomerism can occur.



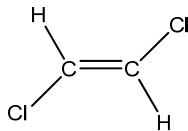
B: C – C bond is saturated so no *cis-trans* isomerism can occur.



C: There is no two different groups on each carbon of the C=C double bond.



D: Cis

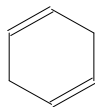


Trans

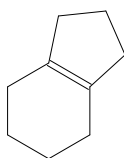
19 Which of the following compound forms two organic products when it is heated with acidified potassium manganate(VII) solution?

A $CH_2=CHCH_2CH=CH_2$

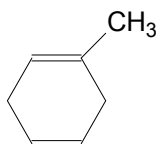
B



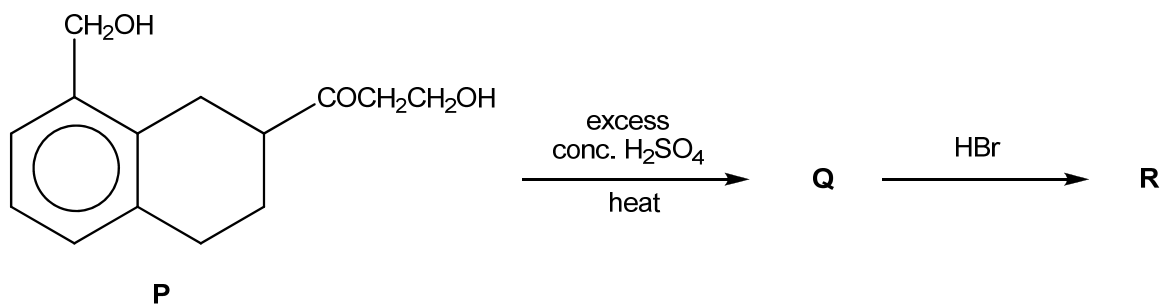
C



D



20 Compound **P** is used in the following synthesis.



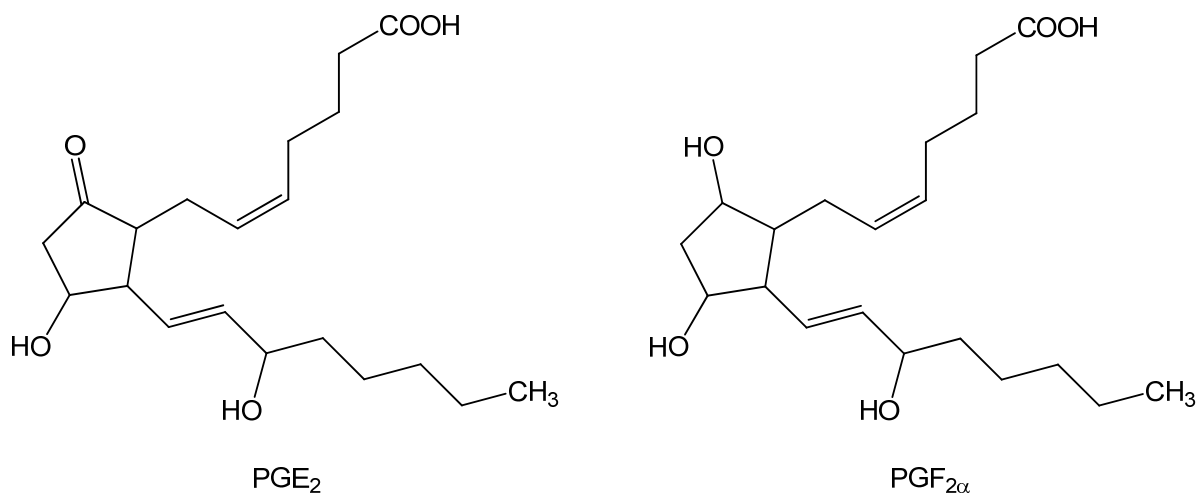
What is the likely structure of the final product **R**?

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

21 Which of the following gives the compounds in order of decreasing K_a ?

- A** $\text{CH}_3\text{CH}_2\text{OH} > \text{CH}_3\text{CO}_2\text{H} > \text{CH}_2\text{FCO}_2\text{H}$
- B** $\text{BrCH}_2\text{CO}_2\text{H} > \text{ClCH}_2\text{CO}_2\text{H} > \text{CH}_3\text{CO}_2\text{H}$
- C** $\text{CH}_3\text{CH}_2\text{CO}_2\text{H} > \text{CH}_3\text{CO}_2\text{H} > \text{HCOOH}$
- D** $\text{CH}_3\text{CCl}_2\text{CO}_2\text{H} > \text{ClCH}_2\text{CHClCO}_2\text{H} > \text{Cl}_2\text{CHCH}_2\text{CO}_2\text{H}$

- 22** PGE₂ and PGF_{2α} are two prostaglandins, both with pharmacological activity.



Which reagent will convert PGE₂ into PGF_{2α} efficiently?

- | | | | |
|----------|---------------------------------|----------|------------------|
| A | H_2/Ni | B | LiAlH_4 |
| C | $\text{H}_2\text{O}/\text{H}^+$ | D | NaBH_4 |

Answer: D

H_2/Ni will reduce both $\text{C}=\text{C}$ bond in alkenes and $\text{C}=\text{O}$ bond in carbonyl compounds.
 LiAlH_4 will reduce both COOH bond in acids and $\text{C}=\text{O}$ bond in carbonyl compounds.
 $\text{H}_2\text{O} / \text{H}^+$ is the reagent and condition for hydration.
 NaBH_4 is a specific reducing agent for reduction of carbonyl group.

- 23** Which pair of compounds can be produced when ester **G**, $\text{C}_3\text{H}_7\text{OCOC}_3\text{H}_7$ is refluxed with dilute sulfuric acid?

- A** $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ and $(\text{CH}_3)_2\text{CO}$
B $(\text{CH}_3)_2\text{CHCOOH}$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
C $\text{CH}_3\text{CH}_2\text{COOH}$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
D $\text{CH}_3\text{CH}_2\text{COOH}$ and $(\text{CH}_3)_2\text{CHOH}$

Answer: B

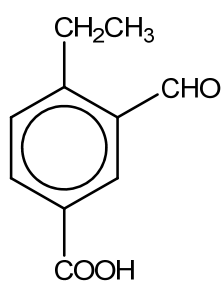
Hydrolysis of $\text{C}_3\text{H}_7\text{OCOC}_3\text{H}_7$ will give $\text{C}_3\text{H}_7\text{COOH}$ with a total of 4 carbons and $\text{C}_3\text{H}_7\text{OH}$ which should be an alcohol with 3 carbons.

- 24 Treatment of 2,4-dibromoheptane with hot alcoholic NaOH produces a mixture of dienes with the molecular formula C_7H_{12} .

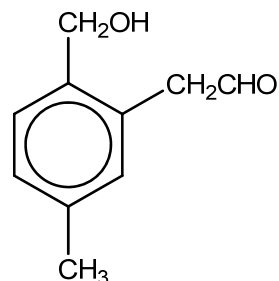


Which diene would **not** be produced in this reaction?

- A** $CH_3-CH=CH-CH_2-CH=CH-CH_3$
B $CH_3-CH=C=CH-CH_2-CH_2-CH_3$
C $CH_3-CH=CH-CH=CH-CH_2-CH_3$
D $CH_2=CH-CH_2-CH=CH-CH_2-CH_3$
- 25 Which of the following reagents can be used to distinguish between compounds **S** and **T** shown below?



compound **S**



compound **T**

- A** 2,4-dinitrophenylhydrazine
B hot acidified $KMnO_4$
C Na_2CO_3
D Tollens' reagent

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 responses **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

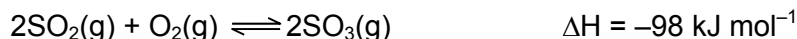
No other combination of statements is used as a correct response.

26 The three statements that follow are all true.

Which of these can be explained, at least in part, by reference to hydrogen bonding?

- 1** Ice floats on water.
- 2** Propan-2-ol is less volatile than propanone.
- 3** The relative molecular mass of ethanoic acid in benzene is higher than expected.

27 The following equilibrium exists between sulfur dioxide and sulfur trioxide:



Which of the following are correct?

	changes made	K_c
1	add catalyst	no change
2	add more SO_2	no change
3	reduce temperature	increase

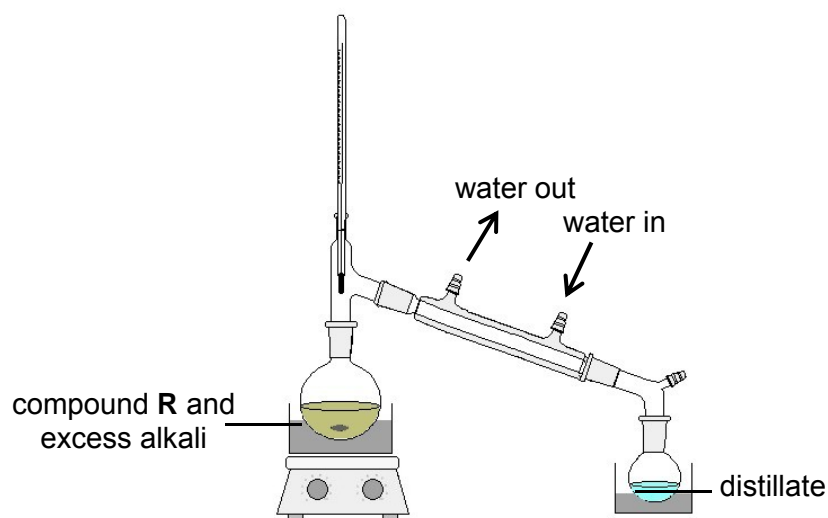
28 Which of the following statements are correct for the sequence of compounds below considered from left to right?



- 1** The electronegativity difference between the elements in each compound increases.
- 2** The formula units of these compounds are isoelectronic.
- 3** The bonding becomes increasingly covalent.

29

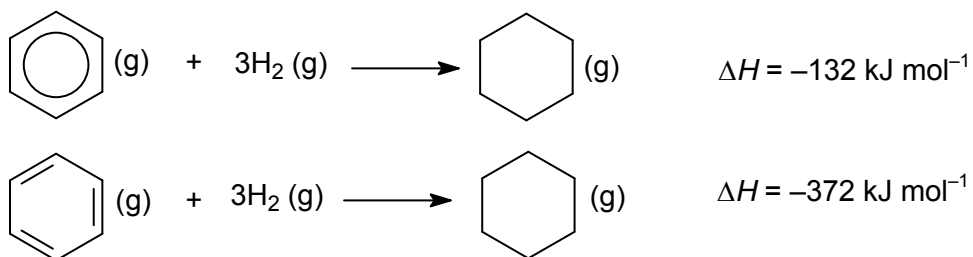
Compound **R** is heated under reflux in the presence of excess alkali. The distillate forms a yellow precipitate with hot aqueous alkaline iodine.



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

- 1 ethylbenzoate
- 2 2-iodobutane
- 3 butanoic acid

- 30 Under high pressure and in the presence of a catalyst, benzene and a hypothetical compound cyclo-1,3,5-hexatriene undergo hydrogenation to form cyclohexane in the reactions shown.



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

- 1 Benzene is more stable than cyclo-1,3,5-hexatriene.
- 2 Benzene undergoes substitution reaction to form cyclohexane.
- 3 The enthalpy change of combustion of benzene is more exothermic than that of cyclo-1,3,5-hexatriene.