



RIVER VALLEY HIGH SCHOOL

YEAR 6 PRELIMINARY EXAMINATION II

CANDIDATE
NAME

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CLASS

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INDEX
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H2 CHEMISTRY

9647/01

Paper 1 Multiple Choice

23 September 2016

1 hour

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class, centre number and index number on the Answer Sheet in the spaces provided.

There are **forty** 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 **17** printed pages and **3** blank pages.

Section A

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

- 1 For complete combustion of 20.0 g of heptane, what is the minimum volume of oxygen gas required at s.t.p.?
- A 0.2 dm³
 B 2.2 dm³
 C 49.3 dm³
 D 52.8 dm³
- 2 Element **X** exists as 3 different isotopes and has a relative atomic mass of 66.6. Which of the following compositions of isotopes is correct?
- A 25% ⁶⁵X, 50% ⁶⁶X and 25% ⁶⁷X
 B 30% ⁶⁵X, 60% ⁶⁶X and 10% ⁶⁷X
 C 50% ⁶⁵X, 20% ⁶⁶X and 30% ⁶⁷X
 D 10% ⁶⁵X, 20% ⁶⁶X and 70% ⁶⁷X
- 3 Which of the following does **not** contain a singly occupied orbital?
- A N²⁺ B S⁻ C Br⁺ D Sc³⁺
- 4 Dinitrogen tetroxide, N₂O₄, has a simple covalent structure. Which of the following correctly describes the bonding within the dinitrogen tetroxide molecule?

	σ bond	π bond	dative bond
A	3	2	2
B	5	0	4
C	5	2	2
D	5	4	0

- 5 The Valence Shell Electron Pair Repulsion (VSEPR) theory is used to predict the shapes of molecules.

Which shape is correctly predicted by VSEPR?

	number of bonded electron pairs around central atom	number of lone pairs around central atom	shape
A	2	4	non-linear
B	3	2	T-shaped
C	4	1	square planar
D	3	2	see-saw

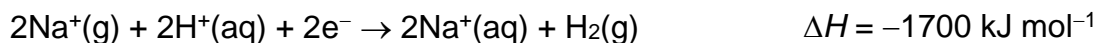
- 6 Equal masses of gaseous N_2 , NH_3 and N_2O are injected into an evacuated container to produce a total pressure of 3 atm.

How do the partial pressures of N_2 , NH_3 and N_2O compare?

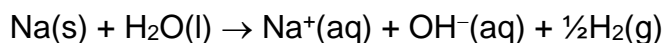
- A $p_{\text{N}_2} = p_{\text{NH}_3} = p_{\text{N}_2\text{O}}$ B $p_{\text{N}_2} < p_{\text{NH}_3} < p_{\text{N}_2\text{O}}$
 C $p_{\text{NH}_3} < p_{\text{N}_2} < p_{\text{N}_2\text{O}}$ D $p_{\text{N}_2\text{O}} < p_{\text{N}_2} < p_{\text{NH}_3}$

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

The enthalpy changes for three reactions are given below:

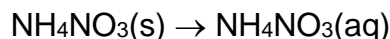


What is the enthalpy change for the following reaction?



- A -191 kJ mol^{-1}
 B -307 kJ mol^{-1}
 C -685 kJ mol^{-1}
 D $-1041 \text{ kJ mol}^{-1}$

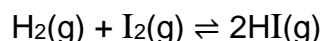
- 8 The dissolution of ammonium nitrate is a chemical reaction commonly used in cold packs that serve to relieve pain in sports injury. A thin plastic membrane separates powdered ammonium nitrate and water. When the cold pack is squeezed, the membrane breaks and the ammonium nitrate dissolves in water.



What are the signs of ΔH , ΔS , ΔG for the overall process?

	ΔH	ΔS	ΔG
A	–	–	+
B	–	+	–
C	+	+	–
D	+	+	+

- 9 Hydrogen reacts with iodine according to the equation:

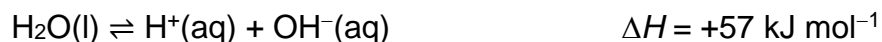


P atm of hydrogen is allowed to react with Q atm of iodine at constant temperature.

At equilibrium, it is found that

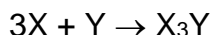
- A** the partial pressure of hydrogen is greater than P .
 - B** the total pressure of the system is $(P + Q)$ atm.
 - C** the total pressure of the system is greater than $(P + Q)$ atm.
 - D** the total pressure of the system is less than $(P + Q)$ atm.
- 10 When 10 cm^3 of 0.02 mol dm^{-3} aqueous $\text{Ba}(\text{OH})_2$ is added to separate solutions of 10 cm^3 of 0.1 mol dm^{-3} MgCl_2 and 10 cm^3 of 0.1 mol dm^{-3} CaCl_2 , what would be observed?
- (K_{sp} of $\text{Mg}(\text{OH})_2 = 3.2 \times 10^{-11} \text{ mol}^3 \text{ dm}^{-9}$; K_{sp} of $\text{Ca}(\text{OH})_2 = 1.35 \times 10^{-5} \text{ mol}^3 \text{ dm}^{-9}$)
- A** Only $\text{Ca}(\text{OH})_2$ would be precipitated.
 - B** Only $\text{Mg}(\text{OH})_2$ would be precipitated.
 - C** Both $\text{Mg}(\text{OH})_2$ and $\text{Ca}(\text{OH})_2$ would be precipitated.
 - D** Neither $\text{Mg}(\text{OH})_2$ nor $\text{Ca}(\text{OH})_2$ would be precipitated.

- 11 The auto-ionisation of water is represented by the following equation:



Given that the value of the equilibrium constant, K_w , is $1.0 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ at 298 K, which of the following statements is true?

- A Water is not a neutral liquid at a temperature lower than 298 K.
 - B When water is heated, the concentration of OH^- increases.
 - C The pH of water at temperatures higher than 298 K is greater than 7.
 - D The association of water molecules by hydrogen bonding increases as temperature rises.
- 12 Consider the following reaction:

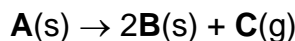


The mechanism involves the following steps:



Based on the information, what is the rate equation for this reaction?

- A Rate = $k[\text{X}]^2$
 - B Rate = $k[\text{X}_2][\text{Y}]$
 - C Rate = $k[\text{X}]^2[\text{Y}]$
 - D Rate = $[\text{X}]^3[\text{Y}]$
- 13 The decomposition of compound **A** is a first order reaction which proceeds according to the equation:



A sample of **A** gave 80 cm^3 of **C** on complete decomposition and it took 40 min for 40 cm^3 of **C** to be evolved.

For another identical sample of **A**, how long would it take for 70 cm^3 of **C** to be evolved?

- A 40 min
- B 70 min
- C 80 min
- D 120 min

- 14** The Daniell Cell comprises two half-cells – a copper electrode dipped in copper(II) sulfate solution and a zinc electrode dipped in zinc sulfate solution – linked by a salt bridge.

Which of the following will increase the cell e.m.f. of the Daniell Cell?

- A** Adding solid copper(II) sulfate to the copper half-cell.
- B** Increasing the mass of copper electrode.
- C** Increasing the concentration of the zinc sulfate solution.
- D** Allow the system to reach equilibrium before measuring cell e.m.f.

- 15** Two separate electrolyses were performed as follows, under the same conditions of temperature and pressure.

1. When aqueous hydrochloric acid was electrolysed for five minutes, 100 cm^3 of hydrogen were collected from the cathode.
2. When aqueous sulfuric acid was electrolysed for five minutes, 200 cm^3 of oxygen were collected from the anode.

If the current used in electrolysis 1 was I , what was the current used in electrolysis 2?

- A** $4I$ **B** $2I$ **C** I **D** $0.5I$

- 16** Which of the following is a trend across Period 3 of the Periodic Table?

- A** The radii of ions decrease.
- B** The first ionisation energy decreases.
- C** The melting points of elements decrease.
- D** The compounds of elements become increasingly covalent.

- A** $\text{Ca}(\text{NO}_3)_2 \rightarrow \text{CaO} + \text{N}_2\text{O}_5$
- B** $\text{Ca}(\text{NO}_3)_2 \rightarrow \text{Ca}(\text{NO}_2)_2 + \text{O}_2$
- C** $2\text{Ca}(\text{NO}_3)_2 \rightarrow 2\text{CaO} + 4\text{NO}_2 + \text{O}_2$
- D** $3\text{Ca}(\text{NO}_3)_2 \rightarrow \text{Ca}_3\text{N}_2 + 4\text{NO}_2 + 5\text{O}_2$

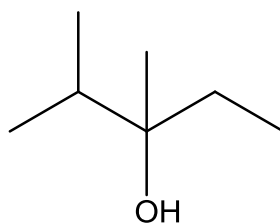
- Which of the following solutions of halide will **not** change the colour of acidified potassium dichromate(VI) ?

- A** chloride **B** bromide **C** iodide **D** astatide

- A** Transition elements exhibit more than one oxidation state in their compounds.
- B** Transition elements or their compounds are widely used as catalysts.
- C** Transition elements form many coloured compounds.
- D** Transition elements have partially filled d orbitals.

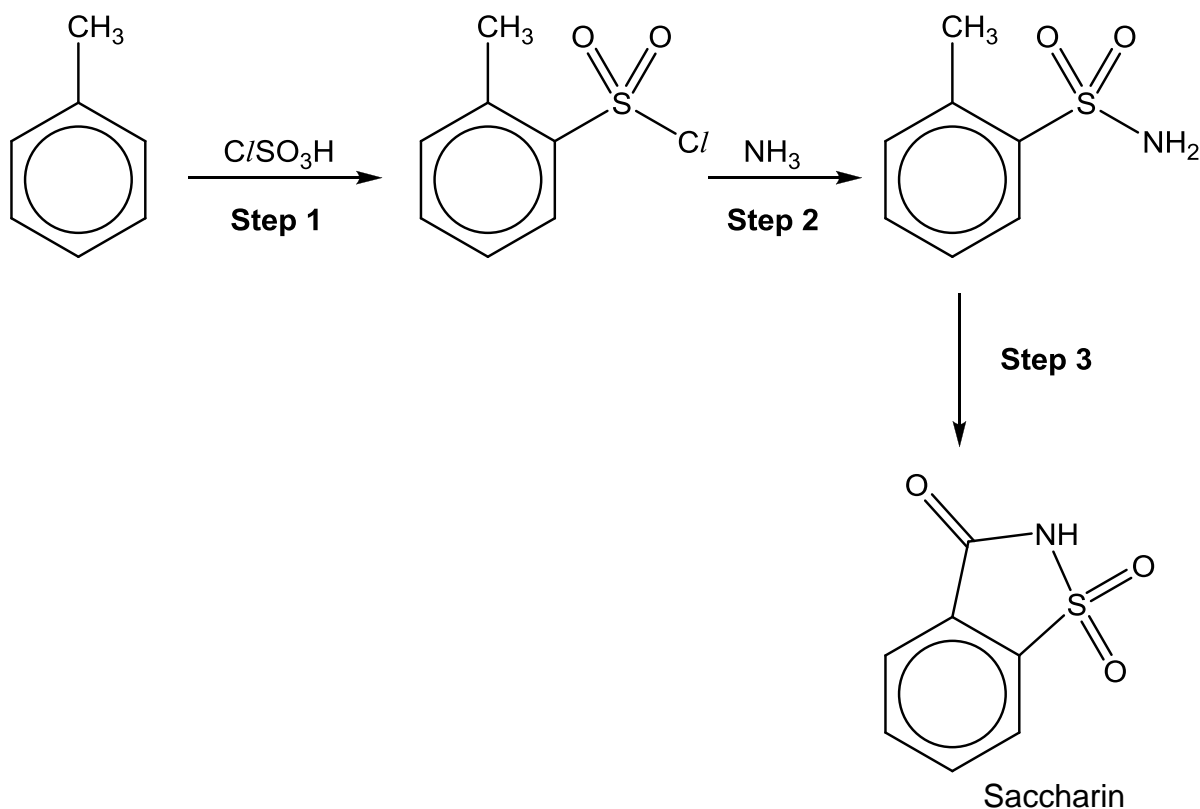
- A** CO_2
- B** $\text{CH}_3\text{CH}_2\text{CH}_3$
- C** $\text{CH}_3\text{CH}_2\text{CH}_2\text{CN}$
- D** $\text{CH}_2(\text{OH})\text{CH}(\text{OH})\text{CH}_3$

- 21 How many alkenes (including stereoisomers) can be formed when the following alcohol is heated with concentrated sulfuric acid?



- A 0 B 2 C 3 D 4

- 22 Saccharin, an artificial sweetening agent, can be synthesized from methylbenzene using the following reaction scheme:



What type of reactions do steps 1 and 2 illustrate?

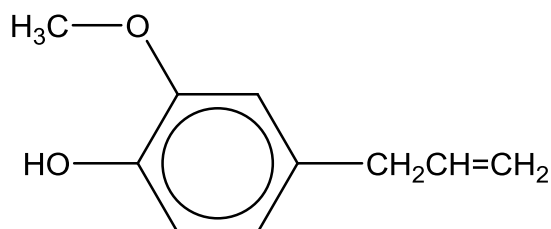
	Step 1	Step 2
A	Electrophilic substitution	Condensation
B	Electrophilic substitution	Nucleophilic Addition
C	Nucleophilic substitution	Condensation
D	Nucleophilic substitution	Nucleophilic Addition

23 Fluothane, CF_3CHBrCl , is a volatile liquid widely used as an anaesthetic.

Which of the following statements about fluothane is **not** correct?

- A** Fluothane may cause the depletion of the ozone layer.
- B** Weak van der Waals' forces hold molecules of fluothane together.
- C** Fluothane undergoes elimination when treated with hot ethanolic NaOH .
- D** When a sample of fluothane is heated with aqueous silver nitrate, a mixture of white and cream precipitate is formed.

24 Eugenol is a common component of perfumes and essential oils. It is also used as an antiseptic.



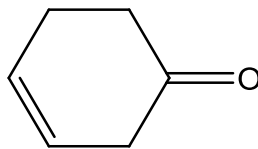
eugenol

(You may treat the $-\text{OCH}_3$ group attached to the benzene ring as inert.)

Which of the following statements about eugenol is correct?

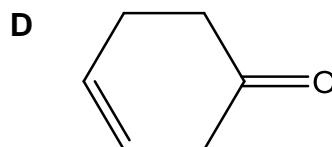
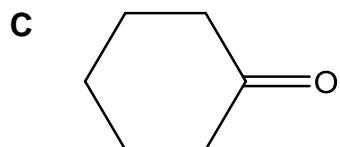
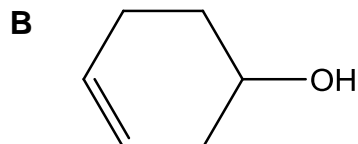
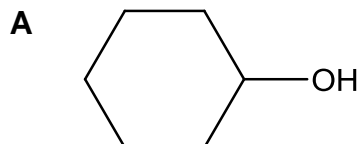
- A** It reacts with 2,4-DNPH to give an orange precipitate.
- B** It gives white fumes when reacted with thionyl chloride.
- C** It decolourises hot acidified potassium manganate(VII).
- D** It reacts with 2 moles of Br_2 in a suitable solvent to form a product with 4 bromine atoms incorporated.

25 Cyclohex-3-en-1-one has the following structure:



cyclohex-3-en-1-one

Which of the following compounds is formed when cyclohex-3-en-1-one is reacted with NaBH_4 dissolved in an organic solvent?



26 Compound **J** gives the following observations with Tollens' Reagent and $\text{Na}_2\text{CO}_3(\text{aq})$.

Reagent	Observation
Tollens' Reagent	Silver mirror observed
$\text{Na}_2\text{CO}_3(\text{aq})$	No effervescence observed

From the above observations, what could be a possible structure for **J**?

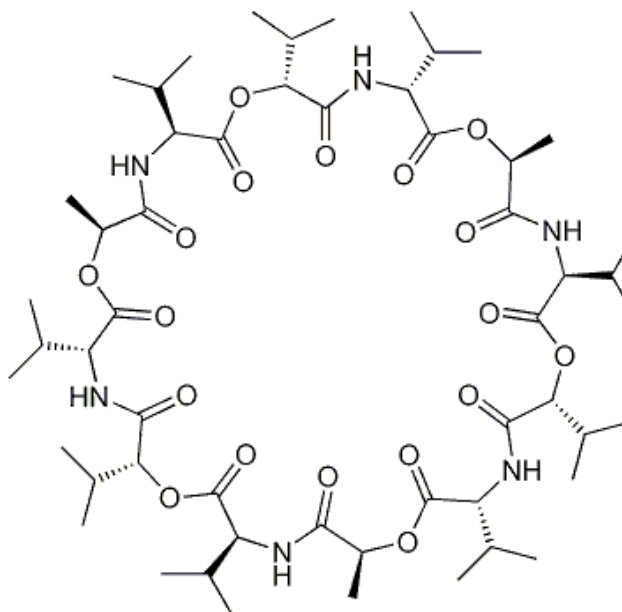
- A** $(\text{COOH})_2$
B CH_3COCHO
C CH_3COCOOH
D $\text{CH}_3\text{COCOCH}_3$

- 27** In the study of organic reaction mechanisms, radioactive oxygen-18, ^{18}O , is often used to tag organic molecules. The radioactivity of the products can then be detected to deduce which products contain ^{18}O .

When ^{18}O -tagged propan-1-ol is heated with ethanoic acid in the presence of a small amount of concentrated sulfuric acid, which of the following set of products will be obtained?

- A** $\text{CH}_3\text{CH}_2\text{CH}_2^{18}\text{OCOCH}_3$ and H_2O
 - B** $\text{CH}_3\text{CH}_2\text{CH}_2\text{OCOCH}_3$ and H_2^{18}O
 - C** $\text{CH}_3\text{CH}_2\text{CH}_2^{18}\text{OCOCH}_3$ and H_2^{18}O
 - D** $\text{CH}_3\text{CH}_2\text{CH}_2\text{OCOCH}_3$ and H_2O
- 28** Which of the following correctly shows the compounds arranged in decreasing $\text{p}K_{\text{a}}$ values?
- A** $\text{CH}_2\text{FCOOH} > \text{CH}_2\text{ClCOOH} > \text{CH}_2\text{BrCOOH}$
 - B** $\text{CH}_3\text{COOH} > \text{C}_6\text{H}_5\text{COOH} > \text{C}_6\text{H}_5\text{OH}$
 - C** $\text{CCl}_3\text{COOH} > \text{CHCl}_2\text{COOH} > \text{CH}_2\text{ClCOOH}$
 - D** $\text{C}_2\text{H}_5\text{OH} > \text{C}_6\text{H}_5\text{OH} > \text{C}_6\text{H}_5\text{COOH}$

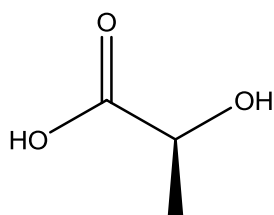
- 29 Valinomycin is a peptide-like molecule that disrupts plasma membrane formation in bacteria.



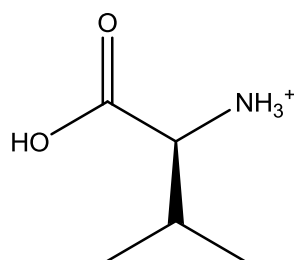
valinomycin

Which of the following will **not** be produced when valinomycin is heated with dilute $\text{H}_2\text{SO}_4(\text{aq})$ for a period of time?

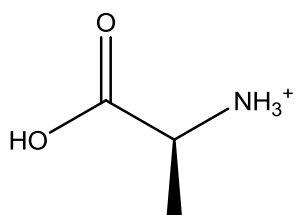
A



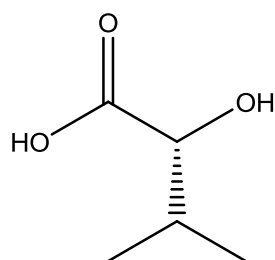
B



C



D



- 30** Denaturation of proteins occurs due to the destruction of the tertiary structure where various R group interactions are disrupted by external factors.

Which of the following correctly shows the R group interactions that will be affected by the corresponding external factor?

	R group interactions	External factor
A	disulfide bridges	extreme pH changes
B	ionic interactions	addition of alcohol
C	van der Waals' forces	addition of heavy metal ions
D	hydrogen bonding	extreme pH changes

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.

31 Which statements about aluminium are correct?

- 1** It forms amphoteric oxides.
- 2** It forms an ionic compound with oxygen.
- 3** It forms an ionic compound with chlorine.

32 Between ethanol molecules, there exists

- 1** hydrogen bonds.
- 2** instantaneous dipole-induced dipole interactions.
- 3** covalent bonds.

33 For a first order reaction, which of the following graphs will be a straight line passing through the origin?

- 1** Initial rate vs concentration of reactant
- 2** Initial rate vs time taken for complete reaction
- 3** Concentration of reactant vs time taken for complete reaction

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

34 Which statements correctly describe an electrolytic cell?

- 1 It is driven by an external battery.
- 2 The polarities of the cathode and anode are negative and positive respectively.
- 3 It is used to extract unreactive metals from the ores.

35 Which of the following statements are true for astatine, the element below iodine in Group VII of the Periodic Table?

- 1 Silver astatide is insoluble in concentrated aqueous ammonia.
- 2 Astatine oxidises potassium chloride to chlorine.
- 3 Hydrogen astatide is more stable to heat than hydrogen iodide.

36 When placed in a strong magnetic field, paramagnetic objects are attracted to the field. Paramagnetism arises when an element has unpaired electrons.

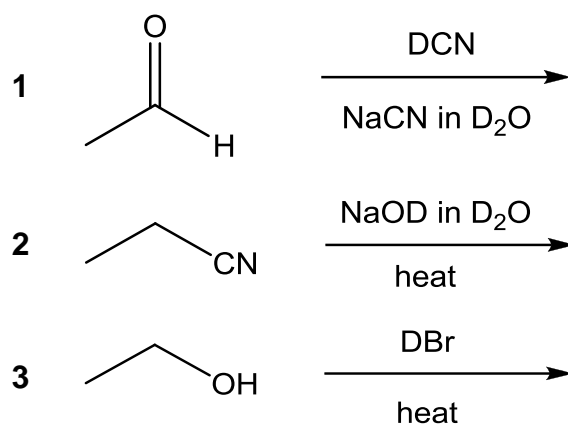
Which of the following chemical species would you expect to exhibit paramagnetism?

- 1 Cr
- 2 Mn
- 3 Cu^+

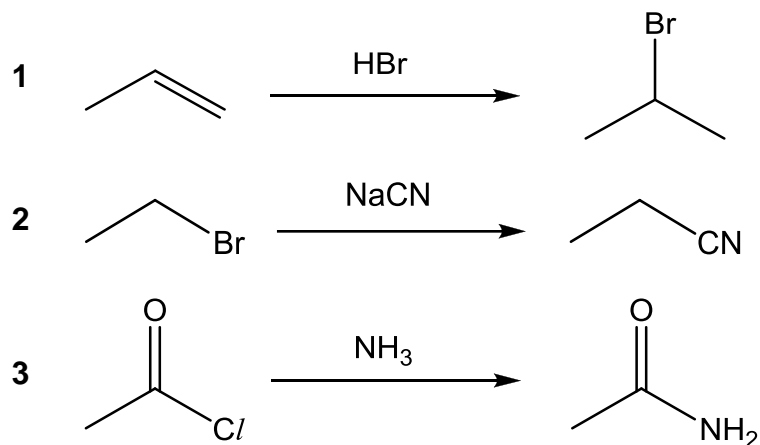
A	B	C	D
1, 2 and 3 are correct	1 and 2 only are correct	2 and 3 only are correct	1 only is correct

37 Deuterium, D, is the ^2H isotope of hydrogen.

Which of the following reactions could give an organic compound having a deuterium atom incorporated?

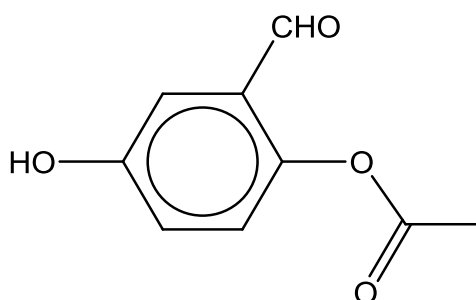


38 In which of the following reactions will the inorganic reagent act as the nucleophile?



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

39 Compound X is a flavouring agent in food.



X

Which of the following reagents will cause a colour change when the reagent is added to a sample of compound X?

- 1 aqueous bromine
- 2 neutral iron(III) chloride solution
- 3 hot acidified potassium dichromate(VI)

40 Which of the following descriptions about haemoglobin are correct?

- 1 Both O₂ and CO can bind to haemoglobin.
- 2 The quaternary structure of haemoglobin consists of two α -helices and two β -pleated sheets.
- 3 A maximum of six oxygen molecules may be bound to each haemoglobin molecule.

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