



National  
Qualifications  
2018

**X713/77/02**

**Chemistry**  
**Section 1 — Questions**

MONDAY, 21 MAY

9:00 AM – 11:30 AM

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Instructions for the completion of Section 1 are given on *page 02* of your question and answer booklet X713/77/01.

Record your answers on the answer grid on *page 03* of your question and answer booklet.

You may refer to the Chemistry Data Booklet for Higher and Advanced Higher.

Before leaving the examination room you must give your question and answer booklet to the Invigilator; if you do not, you may lose all the marks for this paper.



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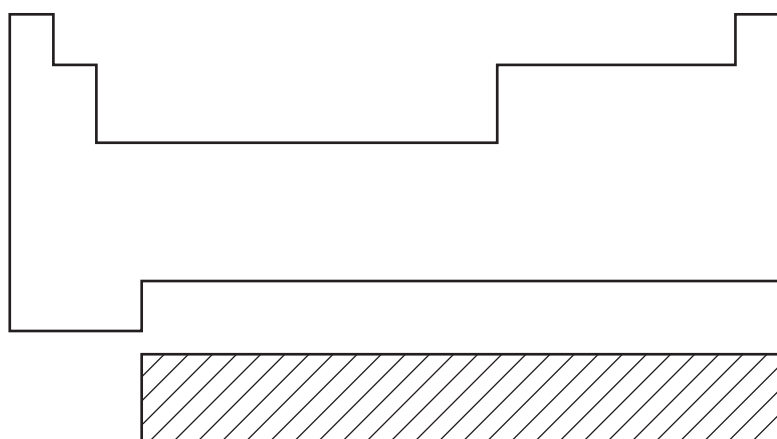
SECTION 1 — 30 marks

Attempt ALL questions

1. Which of the following is **not** a form of electromagnetic radiation?

- A Beta
- B Gamma
- C Infrared
- D Ultraviolet

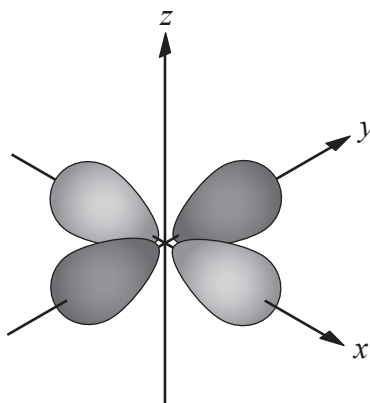
2. The diagram represents the periodic table.



The shaded area is the

- A s-block
- B p-block
- C d-block
- D f-block.

3. A representation of a d-orbital is shown.



The maximum number of electrons that can occupy this orbital is

- A 2
  - B 4
  - C 8
  - D 10.
4. For the reaction

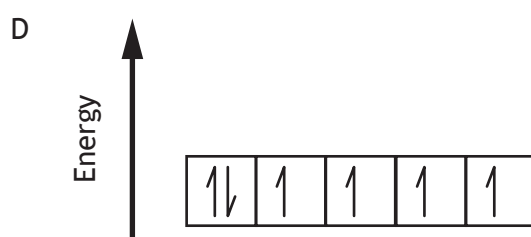
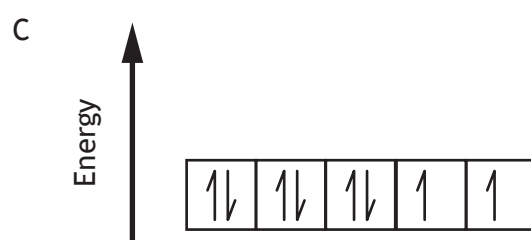
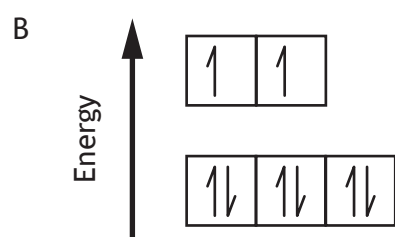
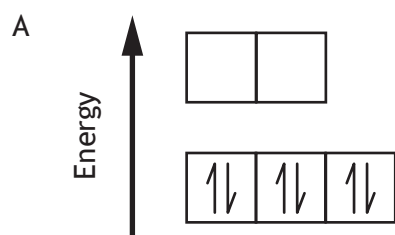


the three-dimensional arrangement of the bonds around the B atom changes from

- A trigonal pyramidal to square planar
- B trigonal pyramidal to tetrahedral
- C trigonal planar to square planar
- D trigonal planar to tetrahedral.

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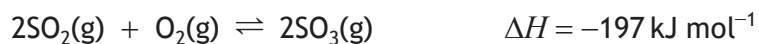
5. Which of the following correctly shows the arrangement of the 3d electrons in the  $\text{Ni}^{2+}$  ion in  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ ?



6. Manganese has an oxidation number of +5 in

- A  $\text{MnO}_4^-$
- B  $\text{MnO}_4^{2-}$
- C  $\text{MnO}_4^{3-}$
- D  $\text{MnO}_2$

7. When sulfur dioxide and oxygen react the following equilibrium is established.



Which line in the table is correct if the temperature of the equilibrium mixture is increased?

	<i>Equilibrium constant, K</i>	<i>Concentration of SO<sub>3</sub> as temperature increases</i>
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

8.  $\text{H}_2\text{CO}_3(\text{aq}) + \text{CN}^-(\text{aq}) \rightleftharpoons \text{HCN}(\text{aq}) + \text{HCO}_3^-(\text{aq})$

Which line in the table correctly describes  $\text{H}_2\text{CO}_3(\text{aq})$  and  $\text{HCN}(\text{aq})$  in the above reaction?

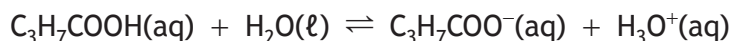
	$\text{H}_2\text{CO}_3(\text{aq})$	$\text{HCN}(\text{aq})$
A	base	conjugate base
B	base	conjugate acid
C	acid	conjugate base
D	acid	conjugate acid

[Turn over

9. What is the concentration of hydroxide ions, in  $\text{mol l}^{-1}$ , in a solution with a pH of 8.5?

- A  $8.5 \times 10^{-6}$
- B  $3.2 \times 10^{-6}$
- C  $8.5 \times 10^{-9}$
- D  $3.2 \times 10^{-9}$

10. Butanoic acid is a weak acid which dissociates as shown.



The equilibrium position can be shifted to the right by the addition of

- A a catalyst
- B sulfuric acid
- C sodium hydroxide
- D sodium butanoate.

11. Which of the following salts forms an alkaline solution in water?

- A Sodium sulfate
- B Lithium chloride
- C Ammonium nitrate
- D Potassium propanoate

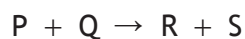
12. Which of the following combinations would produce a buffer solution?

- A Sodium chloride and ammonia
- B Ammonium chloride and ammonia
- C Sodium chloride and sodium hydroxide
- D Ammonium chloride and sodium hydroxide

13. For which of the following reactions would the value of  $\Delta G^\circ - \Delta H^\circ$  be closest to zero?

- A  $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
- B  $\text{C}(\text{s}) + \text{H}_2\text{O}(\text{g}) \rightarrow \text{CO}(\text{g}) + \text{H}_2(\text{g})$
- C  $\text{Zn}(\text{s}) + 2\text{H}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{H}_2(\text{g})$
- D  $\text{Cu}^{2+}(\text{aq}) + \text{Mg}(\text{s}) \rightarrow \text{Mg}^{2+}(\text{aq}) + \text{Cu}(\text{s})$

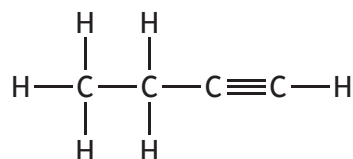
14. The following reaction is first order with respect to P and second order with respect to Q.



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

- A The reaction is third order overall.
- B The reaction occurs by a simple one step mechanism.
- C The rate of the reaction decreases as the reaction proceeds.
- D The rate of the reaction will double if the initial concentration of P is doubled.

15.

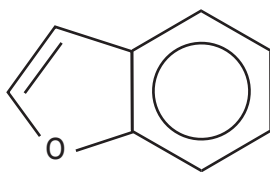


Which of the following types of hybridisation occur in the above compound?

- A  $\text{sp}^3$  only
- B  $\text{sp}^3$  and  $\text{sp}$
- C  $\text{sp}^3$  and  $\text{sp}^2$
- D  $\text{sp}^3$ ,  $\text{sp}^2$  and  $\text{sp}$

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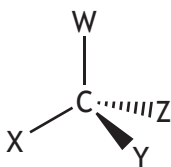
16. Benzofuran is an important starting material in the manufacture of some medicines.



benzofuran

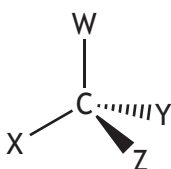
The gram formula mass of benzofuran is

- A 124 g  
B 120 g  
C 118 g  
D 114 g.
17. The diagram represents one enantiomer of an optically active compound where W, X, Y and Z are four different groups.

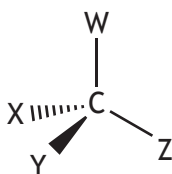


Which of the following represents the other enantiomer of this compound?

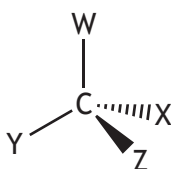
A



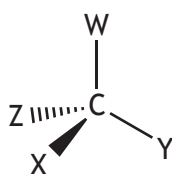
B



C



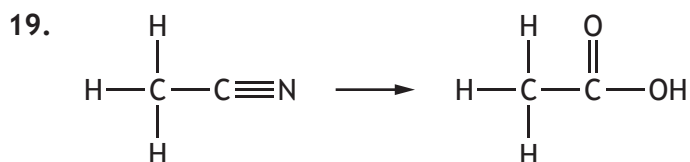
D





18. The most appropriate reactants for the synthesis of  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{O}^- \text{Na}^+$  are

- A sodium and butan-1-ol
- B sodium and butanoic acid
- C sodium hydroxide and butan-1-ol
- D sodium hydroxide and butanoic acid.



The above reaction is an example of

- A hydration
- B oxidation
- C hydrolysis
- D hydrogenation.

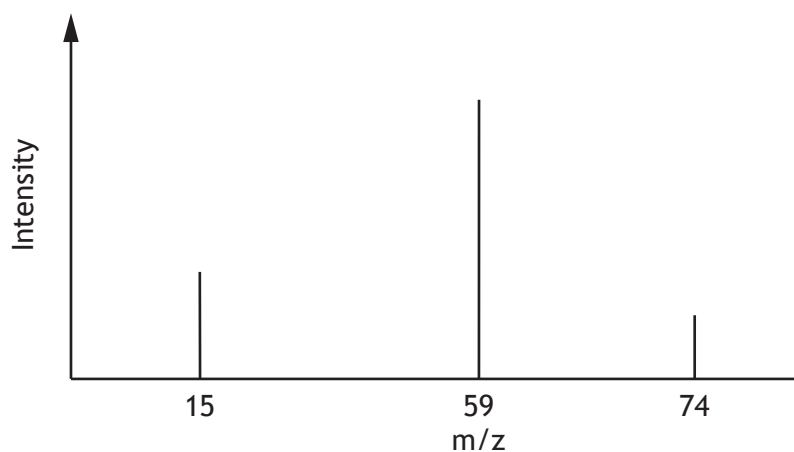
20. 18 g of an oxide of copper contains 16 g of copper.

The empirical formula of this oxide is

- A  $\text{Cu}_4\text{O}$
- B  $\text{Cu}_2\text{O}$
- C  $\text{CuO}_2$
- D  $\text{CuO}_4$ .

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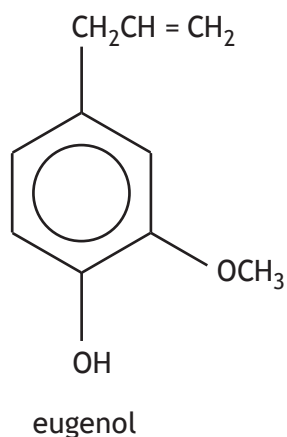
21. A simplified mass spectrum of an organic compound is shown below.



Which of the following compounds could **not** have produced this spectrum?

- A  $\text{CH}_3\text{OCOCH}_3$
- B  $\text{CH}_3\text{CH}_2\text{COOH}$
- C  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- D  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$

22.



The infrared spectrum of eugenol would **not** be predicted to have an absorption in the wavenumber range

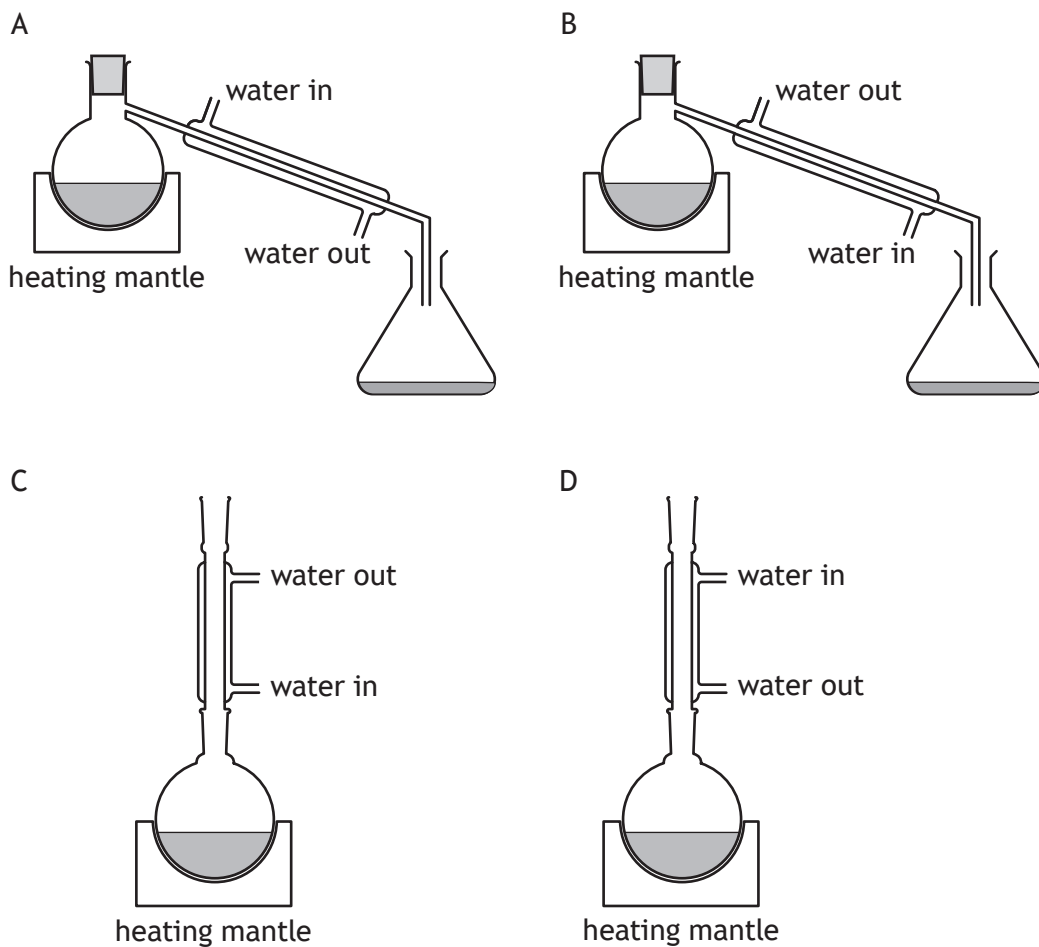
- A  $3100 - 3000 \text{ cm}^{-1}$
- B  $2962 - 2853 \text{ cm}^{-1}$
- C  $1730 - 1717 \text{ cm}^{-1}$
- D  $1150 - 1070 \text{ cm}^{-1}$ .

23. Salbutamol is used to treat asthma. It behaves like the body's natural active compound by triggering a response in the muscles of the airways.
- Salbutamol is
- A an agonist
  - B an antagonist
  - C an inhibitor
  - D a receptor.
24.  $200\text{ cm}^3$  of water is added to  $50\text{ cm}^3$  of  $2\text{ mol l}^{-1}$  sodium hydroxide solution.
- The concentration of the diluted sodium hydroxide solution in  $\text{mol l}^{-1}$ , is
- A 0.5
  - B 0.4
  - C 0.2
  - D 0.1.
25. For solvent extraction from an aqueous solution, the solvent used should be immiscible with water and relatively unreactive.
- Which of the following would be the most suitable solvent?
- A  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CHO}$
  - B  $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_2\text{CH}_3$
  - C  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$
  - D  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_2\text{CH}_3$
26. Which of the following is **not** a step in a recrystallisation technique?
- A Allow the filtrate to cool slowly.
  - B Filter the hot solution to remove insoluble impurities.
  - C Dissolve the crystals in a minimum of hot solvent.
  - D Test the filtrate to ensure no more precipitate forms.

[Turn over

27. The melting point of an impure substance was determined to be 111 °C – 114 °C. After purification, the melting point should be
- A higher and over a wider range
  - B higher and over a narrower range
  - C lower and over a wider range
  - D lower and over a narrower range.
28. During the technique of heating to constant mass, the purpose of the desiccator is to
- A prevent reaction with oxygen in the air
  - B remove water from the compound
  - C prevent reabsorption of water
  - D prevent decomposition.
29. Using thin-layer chromatography, the components of a sample can be identified by  $R_f$  values. Which of the following affects the  $R_f$  value for an individual component?
- A The distance moved by the solvent.
  - B The concentration of the sample.
  - C The length of TLC plate.
  - D The solvent used.

30. Which of the following diagrams shows the apparatus correctly set up for heating under reflux?



[END OF SECTION 1. NOW ATTEMPT THE QUESTIONS IN SECTION 2 OF YOUR QUESTION AND ANSWER BOOKLET]

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