



National  
Qualifications  
2021 ASSESSMENT RESOURCE

**X813/76/12**

**Chemistry  
Paper 1 — Multiple choice**

Duration — 40 minutes

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**Total marks — 25**

Attempt ALL questions.

**You may use a calculator.**

Instructions for the completion of Paper 1 are given on *page 02* of your answer booklet X813/76/02.

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

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

Space for rough work is provided at the end of this booklet.

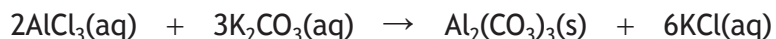
Before leaving the examination room you must give your answer booklet to the Invigilator; if you do not, you may lose all the marks for this paper.



\* X 8 1 3 7 6 1 2 \*

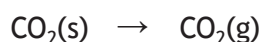
Total marks — 25  
Attempt ALL questions

1. Aluminium carbonate can be produced by the following reaction.



The most suitable method for separating the aluminium carbonate from the mixture is

- A filtration
  - B distillation
  - C evaporation
  - D collection over water.
2. The difference in the size of sodium and chlorine atoms is mainly due to the difference in the
- A mass of each atom
  - B number of electrons
  - C number of neutrons
  - D number of protons.
3. Solid carbon dioxide is known as 'dry ice'. It changes directly to a gas when it is heated.

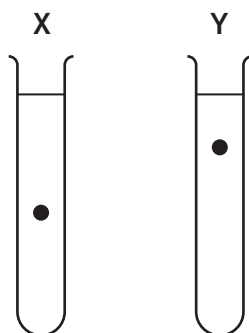


The strongest bonds broken in this process are

- A polar covalent bonds
  - B London dispersion forces
  - C non-polar covalent bonds
  - D permanent dipole-permanent dipole interactions.
4. Which of the following statements is correct?
- A Elements with high electronegativities tend to be reduced
  - B Elements with high electronegativities tend to act as reducing agents
  - C Elements with low electronegativities tend to gain electrons
  - D Elements with low electronegativities tend to act as oxidising agents

5. The viscosities of two liquids, X and Y, were investigated by dropping a metal ball into a tube of each liquid.

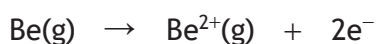
The diagram shows the position of the metal balls after 10 seconds.



Which line in the table correctly describes the viscosity and relative strengths of the van der Waals forces in liquids X and Y?

	X	Y
A	most viscous	strongest van der Waals forces
B	least viscous	weakest van der Waals forces
C	least viscous	strongest van der Waals forces
D	most viscous	weakest van der Waals forces

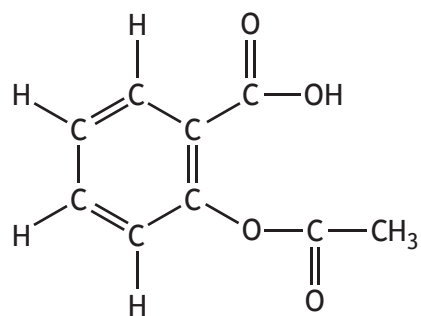
6. What is the enthalpy change, in  $\text{kJ mol}^{-1}$ , for the following reaction?



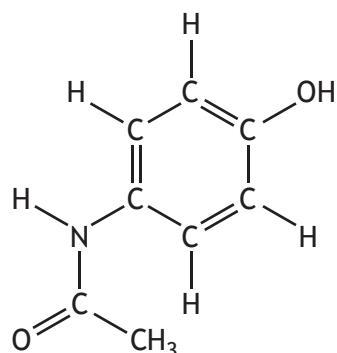
- A 900  
B 1757  
C 2657  
D 3514
7. Which of the following is an isomer of pentanoic acid?
- A 2-methylpropanoic acid  
B propyl methanoate  
C 2-ethylbutanoic acid  
D ethyl propanoate

[Turn over

8. The structures of two common painkillers are shown below.



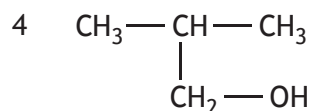
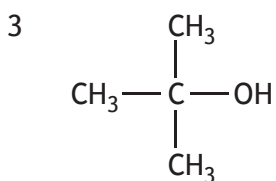
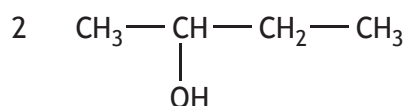
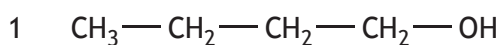
aspirin



paracetamol

Which of the following is true?

- A Both painkillers are ketones
  - B Aspirin contains a carboxyl group and an ester link
  - C Paracetamol contains a hydroxyl group and a carboxyl group
  - D Neither painkiller contains an amide link
9. Which two isomers would each produce an acid when warmed with acidified potassium dichromate solution?



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

10. When an aldehyde is converted into the corresponding alcohol a reduction reaction takes place.

Reduction of 2-methylbutanal ( $GFM = 86$ ) produces a compound with a  $GFM$  of

- A 70
- B 84
- C 88
- D 102.

11. Which of the following compounds would react with sodium hydroxide solution to form the salt sodium propanoate?

- A  $\text{HCOOC}_2\text{H}_5$
- B  $\text{CH}_3\text{COOCH}_3$
- C  $\text{C}_2\text{H}_5\text{COOH}$
- D  $\text{C}_3\text{H}_7\text{COOH}$

12. When a protein is denatured

- A it is broken into amino acids
- B hydrogen bonds are broken
- C peptide links are hydrolysed
- D water molecules are eliminated.

13. Compared with oils, fats are

- A less saturated and have higher melting points
- B less saturated and have lower melting points
- C more saturated and have higher melting points
- D more saturated and have lower melting points.

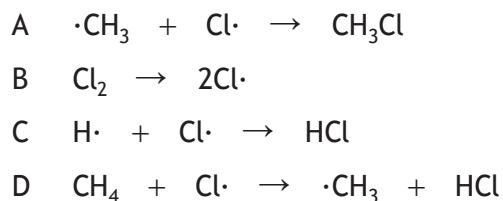
14. Vitamin C is an antioxidant used to preserve food and lengthen shelf-life.

Which of the following does **not** describe an antioxidant?

- A Electron donor
- B Oxidising agent
- C Reducing agent
- D Free-radical scavenger

[Turn over

15. On exposure to UV light, methane and chlorine undergo a chain reaction. Which of the following is a propagation step in this reaction?



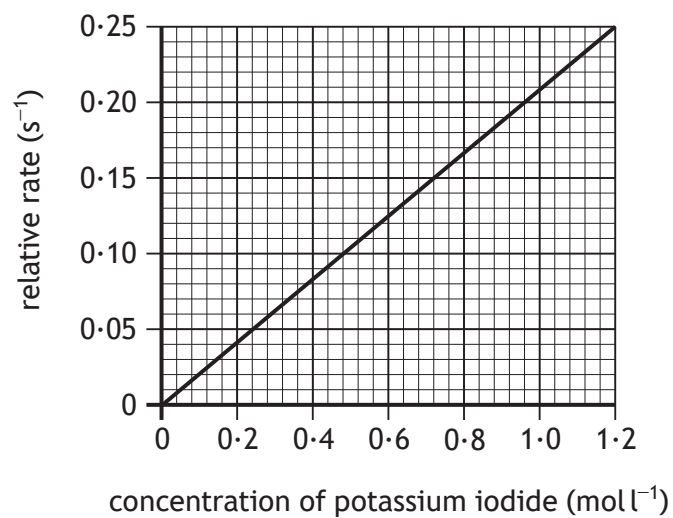
16. A reaction was carried out at four different temperatures. The table shows the times taken for the reaction to occur.

Temperature (°C)	20	30	40	50
Time (s)	60	30	14	5

The results show that

- A a small rise in temperature results in a large increase in the rate of the reaction  
B the activation energy increases with increasing temperature  
C doubling the temperature of the reaction doubles the rate of the reaction  
D the reaction is slowing down with increasing temperature.

17. The graph shows the effect of increasing the concentration of potassium iodide solution on reaction rate.

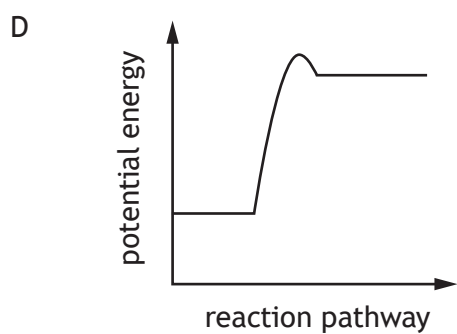
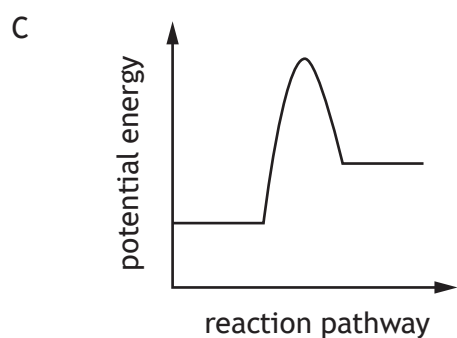
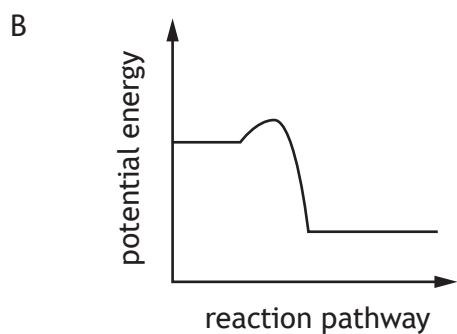
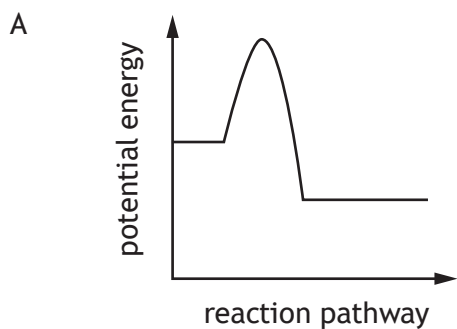


What was the concentration, in mol l<sup>-1</sup>, of the potassium iodide solution used in a reaction that took 5 s to complete?

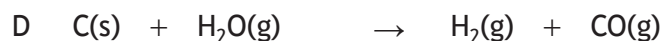
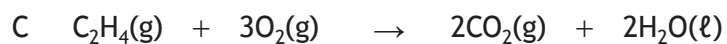
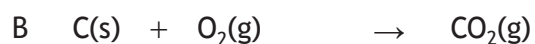
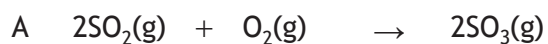
- A 0.04
- B 0.20
- C 0.24
- D 0.96

[Turn over

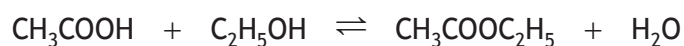
18. Which of the following diagrams represents an exothermic reaction that is more likely to take place at room temperature?



19. Which of the following will result in the volume of the products being half the volume of the reactants?



20. The ester ethyl ethanoate is produced by the following reaction.

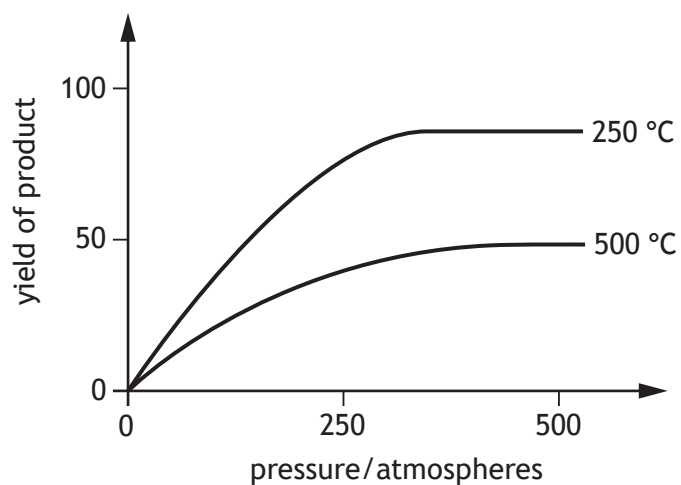


Which of the following mixtures would produce 0.8 moles of ester if the yield was 80%?

	moles of $\text{CH}_3\text{COOH}$	moles of $\text{C}_2\text{H}_5\text{OH}$
A	0.4	0.4
B	0.5	0.5
C	0.8	0.8
D	1.0	1.0

[Turn over

21. The graph shows how the yield of product in a reversible reaction varies with pressure at two different temperatures.



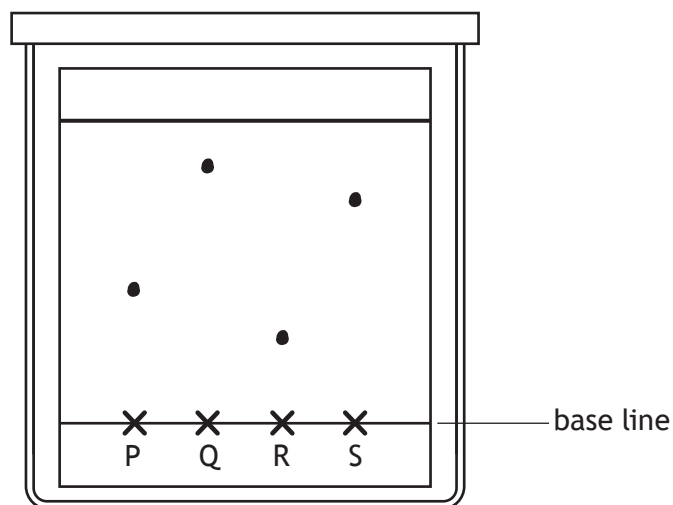
From this information it can be concluded that

- A the reaction is exothermic
  - B all reactants are converted to products at 250 °C and 300 atmospheres
  - C increasing the temperature increases the yield
  - D increasing the pressure above 200 atmospheres has no effect on yield.
22.  $2\text{KOH}(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{K}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\ell)$

How many moles of potassium hydroxide, KOH, neutralise 50 cm<sup>3</sup> of 0.2 mol l<sup>-1</sup> sulfuric acid, H<sub>2</sub>SO<sub>4</sub>?

- A 0.01
- B 0.02
- C 0.10
- D 0.40

23. Four amino acids, P, Q, R and S were analysed by chromatography. Larger molecules travel a shorter distance from the base line. Less polar molecules travel a greater distance from the base line.



Which of the following statements is correct?

- A P is less polar than S
  - B Q is a larger molecule than P
  - C R is more polar than P
  - D S is a smaller molecule than Q
24. A student produced the following results for a redox titration.

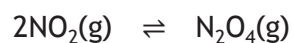
Sample	Volume of solution added (cm <sup>3</sup> )
1	21.0
2	20.3
3	20.7
4	20.4

The volume of solution, in cm<sup>3</sup>, that should be used in the titration calculation is

- A 20.35
- B 20.50
- C 20.55
- D 20.60

[Turn over for next question

25. An equilibrium mixture of  $\text{NO}_2$  and  $\text{N}_2\text{O}_4$  in a sealed gas syringe has a pale brown colour.



Increasing the pressure causes the mixture to become paler.

Increasing the temperature causes the mixture to become darker.

Which line in the table correctly identifies the colour of  $\text{NO}_2$  and the enthalpy change for the forward reaction?

	Colour of $\text{NO}_2$	Enthalpy change for the forward reaction
A	brown	exothermic
B	brown	endothermic
C	colourless	exothermic
D	colourless	endothermic

[END OF QUESTION PAPER]

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