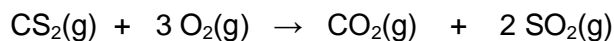


Section A

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

- 1 Carbon disulfide, CS_2 , is a volatile liquid used in the manufacture of cellophane. On combustion, CS_2 , is oxidised as follows.



A 25 cm^3 sample of carbon disulfide vapour is ignited with 125 cm^3 of oxygen. The final volume of gas after burning is treated with an excess of aqueous alkali.

Which percentage of this final volume dissolves in the alkali?

- A** 25% **B** 50% **C** 60% **D** 75%

- 2 Aqueous acidified potassium manganate(VII) is used to oxidise iron(II) ethanedioate, FeC_2O_4 , to Fe^{3+} and CO_2 .

What is the concentration in mol dm^{-3} of 25 cm^3 aqueous acidified potassium manganate(VII) is required to oxidise completely 0.05 mole of FeC_2O_4 ?

- A** 0.4 **B** 0.8 **C** 1.2 **D** 3.33

- 3 An element shows oxidation states of +4 and +6 in forming compounds with both fluorine and oxygen. What is the most likely outer electronic configuration for the element?

- A** $2s^2 2p^4$ **B** $2s^2 2p^6$
C $3s^2 3p^2$ **D** $3s^2 3p^4$

- 4 Which one of the following has the most covalent character?

- A** MgO
B AlBr_3
C AlF_3
D MgCl_2

5 In which set of species do the species all have the same shape?

- A** BCl_3 , NH_3 , PCl_3
B BeCl_2 , H_2O , SO_2
C CH_4 , NH_4^+ , SiF_4
D CO_2 , H_2O , SO_2

6 Carbon dioxide is a gas at room temperature while silicon dioxide is a solid because

- A** carbon-oxygen bonds are less polar than silicon-oxygen bonds.
B van der Waals' forces are much weaker than covalent bonds.
C carbon dioxide contains double covalent bonds while silicon dioxide contains single covalent bonds.
D the relative molecular mass of carbon dioxide is less than that of silicon oxide.

7 When 0.10 mol of chloride of Period 3 element **A** is reacted with limited amount of water, white fumes are observed. Upon dissolving the white fumes in water, the resultant solution is found to react with 0.20 mol of aqueous sodium hydroxide.

To which Group of the Periodic Table does **A** belong?

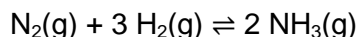
- A** II **B** III **C** IV **D** V

8 Elements **X**, **Y** and **Z** are from the same period. Element **X** has the highest melting point and smallest ionic radius among the 3 elements. The chloride and oxide of element **Y** has the highest pH compared to the chlorides and oxides of elements **X** and **Z**.

Which of the following can be the correct identities of elements **X**, **Y** and **Z**?

	X	Y	Z
A	Al	Na	Mg
B	Na	Mg	P
C	Al	S	P
D	S	P	Al

- 9 Haber process involves the formation of ammonia gas from nitrogen and hydrogen gases.

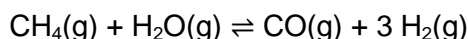


The value of equilibrium constant, K_c , is 2.40×10^{-3} at 1000 K.

Which of the following statements is true?

- A Equilibrium constant increases when temperature of the system is increased.
- B Concentration of NH_3 increases when temperature of the system is increased.
- C Equilibrium constant increases when pressure of the system is increased by reducing the volume.
- D Number of moles of NH_3 increases when pressure of the system is increased by reducing the volume.

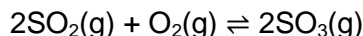
- 10 In the study of the conversion of methane to other fuel, 0.41 mol of methane and 0.74 mol of steam are mixed in a 500 cm^3 vessel at 1200 K. At equilibrium, the mixture is found to contain 0.14 mol of CO.



Calculate the equilibrium constant, K_c , of this reaction.

- A 0.0095 B 0.064 C 0.26 D 0.36

- 11 Catalysts are used in many reactions in the chemical industry. Vanadium(V) oxide is used in this way in the Contact process for the formation of SO_3 .



Which of the following is **not** an effect that vanadium(V) oxide has on this reaction?

- A It increases the yield of SO_3 at equilibrium.
- B It decreases the half-life of the reaction.
- C It speeds up the forward reaction.
- D It provides alternative pathway with a lower value of E_a for the reverse reaction.

- 12 Given that the ΔH_f^θ of $\text{H}_2\text{O}(\text{l})$ is -285 kJ mol^{-1} and the ΔH_f^θ of $\text{CO}_2(\text{g})$ is -394 kJ mol^{-1} , what is the ratio of the heat generated by hydrogen gas to that of carbon if the same mass of each substance is burned?

- A 1:5 B 7:5
C 13:3 D 43:5

- 13 The second ionisation energy of magnesium is 1450 kJ mol^{-1} .

Which of the following correctly represents this statement?

- A $\text{Mg(g)} \rightarrow \text{Mg}^{2+}(\text{g}) + 2\text{e}^-$ $\Delta H^\theta = +1450 \text{ kJ mol}^{-1}$
- B $\text{Mg}^+(\text{g}) \rightarrow \text{Mg}^{2+}(\text{g}) + \text{e}^-$ $\Delta H^\theta = +1450 \text{ kJ mol}^{-1}$
- C $\text{Mg}^+(\text{g}) \rightarrow \text{Mg}^{2+}(\text{g}) + \text{e}^-$ $\Delta H^\theta = -1450 \text{ kJ mol}^{-1}$
- D $\text{Mg(s)} \rightarrow \text{Mg}^{2+}(\text{g}) + 2\text{e}^-$ $\Delta H^\theta = +1450 \text{ kJ mol}^{-1}$

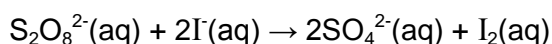
- 14 For the reaction $2\text{X(aq)} + \text{Y(aq)} \longrightarrow \text{Z(aq)}$, the rate equation is

$$\text{Rate} = k [\text{X}]^2 [\text{Y}]$$

Given that the rate of reaction doubles for every 10°C increase in temperature, which of the following will **not** increase the rate by a factor of 4?

	Temperature	[X]	[Y]
A	no change	no change	increases by 4 times
B	10°C increase	no change	increases by 2 times
C	10°C decrease	increases by 2 times	increases by 2 times
D	10°C increase	increases by 2 times	no change

- 15 An experiment was carried out to investigate the initial rate of reaction between ammonium peroxodisulfate, $(\text{NH}_4)_2\text{S}_2\text{O}_8$, an oxidising agent, and potassium iodide, KI.



The initial concentrations of the $(\text{NH}_4)_2\text{S}_2\text{O}_8$ and KI solutions in the mixture, together with the time taken for the mixture to darken for the various experimental runs are given below:

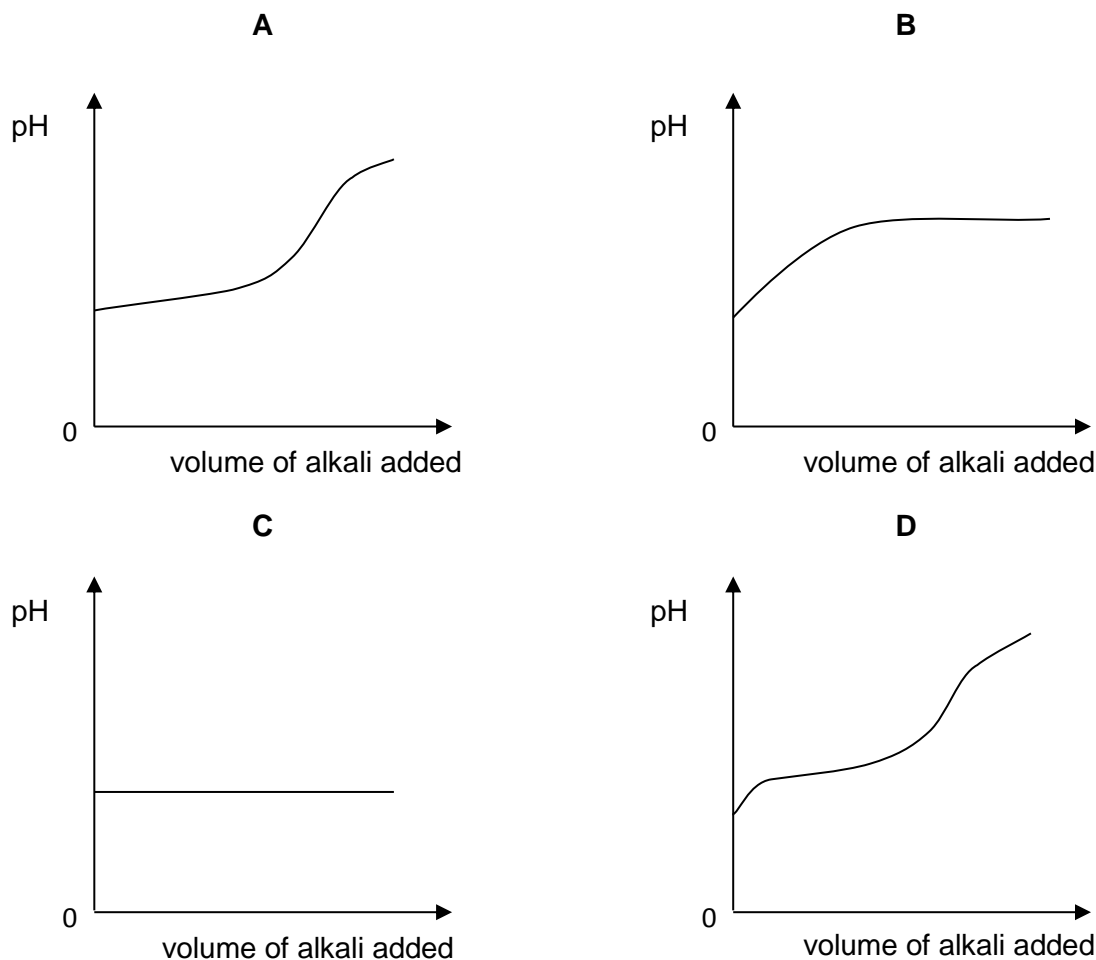
Experiment	Initial $[\text{K}_2\text{S}_2\text{O}_8]$ / mol dm^{-3}	Initial $[\text{KI}]$ / mol dm^{-3}	Time taken to darken / seconds
1	0.10	0.20	35
2	0.05	0.20	70
3	0.10	0.067	105
4	0.02	0.75	T

What is the value of **T** in the table?

- A 72 B 60 C 47 D 40

- 16** Solution **Y** is prepared by mixing 0.4 mol of ethanoic acid and 0.2 mol of sodium hydroxide, NaOH.

Which diagram shows how the pH varies when an aqueous alkali is added in excess to solution **Y**?



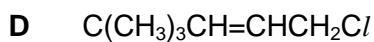
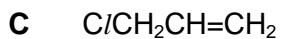
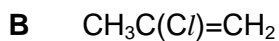
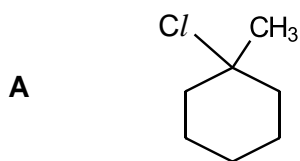
- 17** Chlorophenol red is an acid–base indicator with a pH range of 4.8 to 6.4. The acidic colour of the indicator is yellow and the alkaline colour is red.

Two drops of the indicator are added to each of the four aqueous solutions listed below.

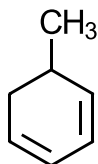
Which solution has its colour correctly stated?

- | | | |
|----------|--|--------|
| A | Aqueous solution of MgCl_2 | yellow |
| B | Mixture of $\text{NH}_4^+(\text{aq})$ and $\text{NH}_3(\text{aq})$ | orange |
| C | Dilute H_2SO_4 of concentration $3.0 \times 10^{-5} \text{ mol dm}^{-3}$ | orange |
| D | Aluminium oxide in aqueous solution | red |

- 18 Which of the following compounds, when warmed separately with ethanolic AgNO_3 , would not give a precipitate?

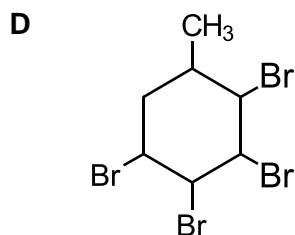
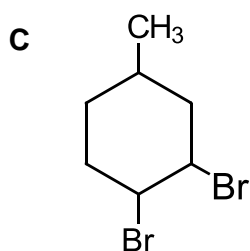
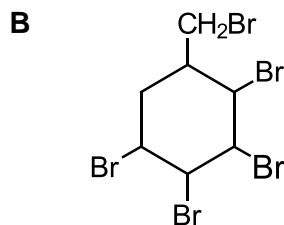
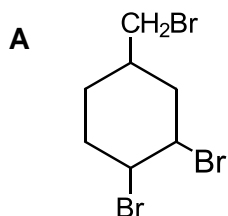


- 19 5-methyl-1,3-cyclohexadiene is added to a solution containing liquid bromine dissolved in an organic solvent. The mixture is immediately placed in the dark and left until no further changes take place. .



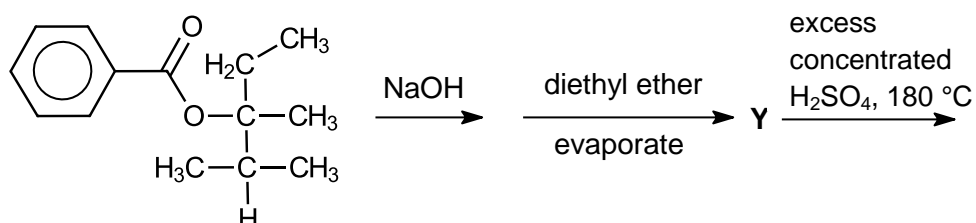
5-methyl-1,3-cyclohexadiene

What are likely to be the main product in this reaction?



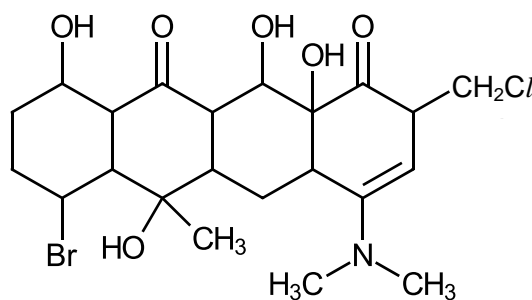
- 20 The following ester was hydrolysed by boiling with aqueous sodium hydroxide, and the resulting organic products were shaken with diethyl ether (an organic solvent) in a separating funnel. After allowing the mixture to stand, the organic layer was separated. The diethyl ether was then evaporated to leave a residual liquid, **Y**.

Y was subjected to a reaction using excess concentrated H_2SO_4 at 180°C and a final product mixture was obtained.



What is the number of isomers present in the final mixture?

- A 1
B 2
C 3
D 4
- 21 Compound **D** which is a structural isomer of the antibiotic Aureomycin is shown below.

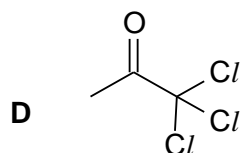
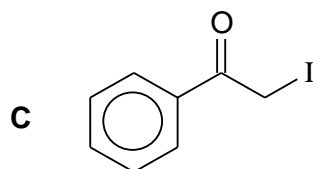
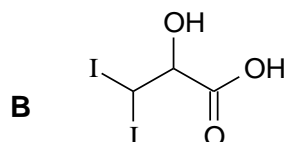
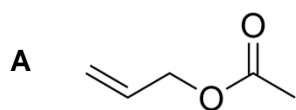


Compound **D**

Which of the following statement is true for the above compound **D**?

- A 1 mole of compound **D** reacts with excess sodium metal to produce 2 moles of hydrogen gas.
B 1 mole of compound **D** reacts with 1 mole of hydrogen gas in the presence of Ni catalyst at 140°C .
C Compound **D** does not give orange precipitate with 2,4-dinitrophenylhydrazine.
D Upon heating with aqueous sodium hydroxide, compound **D** does not give a precipitate with aqueous silver nitrate.

- 22 Which of the following will **not** give tri-iodomethane on warming with alkaline aqueous iodine?



- 23 In the 2-step synthesis to convert propan-1-ol to 2-chloropropane, which of the following pairs of reactions is involved?

- A Elimination , Nucleophilic substitution
- B Elimination , Electrophilic addition
- C Free radical substitution, Oxidation
- D Nucleophilic substitution, Reduction

- 24 0.1 mol of each of the three compounds below were added separately to 1 dm³ of water.



Which of the following shows the order of increasing pH of the solutions formed?

Increasing pH



- A $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}, \text{CH}_3\text{CHC}/\text{CO}_2\text{H}, \text{CH}_3\text{CHFCO}_2\text{H}$
 B $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}, \text{CH}_3\text{CHFCO}_2\text{H}, \text{CH}_3\text{CHC}/\text{CO}_2\text{H}$
 C $\text{CH}_3\text{CHC}/\text{CO}_2\text{H}, \text{CH}_3\text{CHFCO}_2\text{H}, \text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
 D $\text{CH}_3\text{CHFCO}_2\text{H}, \text{CH}_3\text{CHC}/\text{CO}_2\text{H}, \text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- 25 Compound **G** is boiled with aqueous sodium hydroxide and the resulting mixture cooled and acidified with dilute sulfuric acid. The final products include a compound $\text{C}_3\text{H}_6\text{O}_2$ and an alcohol. This alcohol gives a positive iodoform test.

What is the formula for compound **G**?

- A $\text{CH}_3\text{CH}_2\text{CO}_2\text{CH}_3$
 B $\text{CH}_3\text{CH}_2\text{OCOCH}_3$
 C $\text{CH}_3\text{CH}_2\text{CO}_2\text{CH}_2\text{CH}_3$
 D $\text{HOCH}_2\text{CH}_2\text{CO}_2\text{CH}_2\text{CH}_3$

Section B

For each of the questions in this section, one or more of the 3 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 which 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 Which of the following statements about the nitrate(V) ion, NO_3^- are correct?

- 1** It has the same bond angle as nitrogen trifluoride, NF_3 .
- 2** The hybridisation of the nitrogen atom is sp^2 .
- 3** The nitrogen in NO_3^- has an octet electronic configuration.

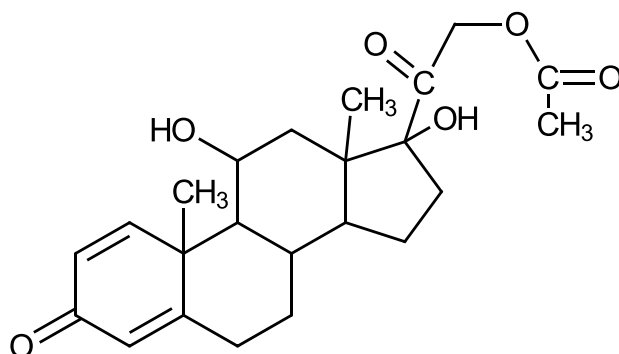
27 Which of the equations correctly define the standard enthalpy change of formation of a compound?

- 1** $2\text{C}(\text{s}) + 3\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \longrightarrow \text{C}_2\text{H}_5\text{OH}(\text{l})$
- 2** $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$
- 3** $\text{Na}(\text{s}) + \text{Cl}(\text{g}) \longrightarrow \text{NaCl}(\text{s})$

28 The reactions of beryllium and aluminium and their corresponding compounds are very similar. Which statements concerning the reactions of beryllium compounds are correct?

- 1** Beryllium oxide reacts with sodium hydroxide.
- 2** Beryllium oxide reacts with acid to give salt and water.
- 3** Beryllium chloride consists of BeCl_2 molecules that are dative bonded to one another.

- 29** Prednisolone ethanoate is used to reduce swelling, redness, itching and allergic reactions affecting the eye.

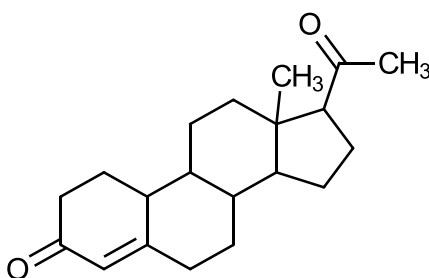


Prednisolone ethanoate

Which reagents could react with prednisolone ethanoate?

- 1 aqueous bromine
- 2 aqueous sodium carbonate
- 3 Fehling's solution

- 30** The diagram below shows the structure of a molecule of the hormone, progesterone.



progesterone

Which of the following statements are correct?

- 1 It turns hot acidified potassium dichromate(VI) orange to green.
- 2 It turns hot acidified potassium manganate(VII) purple to colourless.
- 3 It gives an orange precipitate with 2,4-dinitrophenylhydrazine reagent.

2014 TJC H1 Chemistry Preliminary Exam MCQ Solution

1	2	3	4	5	6	7	8	9	10
C	C	D	B	C	B	D	A	D	C
11	12	13	14	15	16	17	18	19	20
A	C	B	D	C	A	D	B	D	D
21	22	23	24	25	26	27	28	29	30
A	A	B	D	C	C	D	A	D	C