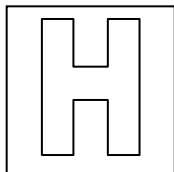


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PIONEER JUNIOR COLLEGE

2014 JC2 PRELIMINARY EXAMINATION
HIGHER 1

CHEMISTRY
Paper 1

8872/01

26 September 2014

Additional Materials: Data Booklet
 Multiple Choice Answer Sheet

50 minutes

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name and index number on the Answer Sheet in the spaces provided unless this has been done for you.

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.

Section A

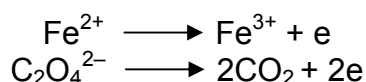
For each question, there are four possible answers labelled **A**, **B**, **C** and **D**. Choose the **one** you consider to be correct.

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

How many neutrons are present in 0.13 g of ^{13}C ? [L = Avogadro constant]

- A** 0.06 L **B** 0.07 L **C** 0.13 L **D** 0.91 L

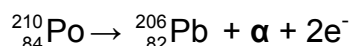
- 2 Consider the following half-equations.



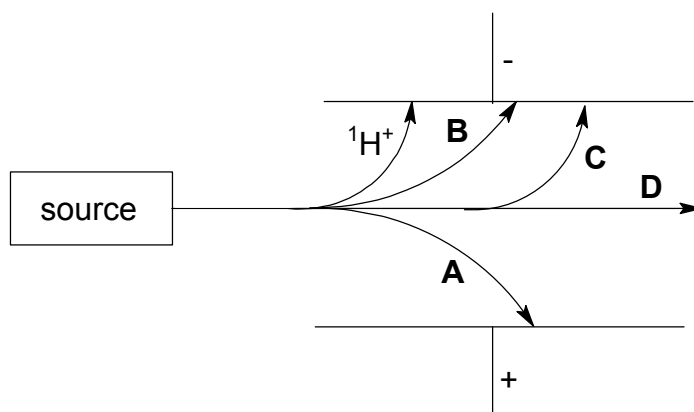
What volume of $0.01 \text{ mol dm}^{-3} \text{K}_2\text{Cr}_2\text{O}_7$ is required to oxidise 20 cm^3 of an acidified solution of $0.01 \text{ mol dm}^{-3} \text{FeC}_2\text{O}_4$?

- A** 10 cm^3 **B** 20 cm^3 **C** 30 cm^3 **D** 40 cm^3

- 3 The radioactive decay of polonium, $^{210}_{84}\text{Po}$, can be simply represented by the following equation.



What would be the path taken by the alpha particle, α , when it is passed through an electric field?



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

An ionic compound **Q**

- has an empirical formula NH_2O
- reacts with NaOH(aq) to produce ammonia gas

How many electrons are present in the anion of **Q**?

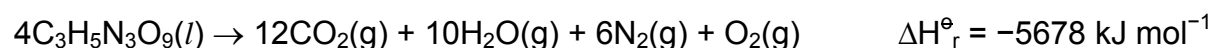
- A** 23 **B** 24 **C** 31 **D** 32

- 5 Which of the following statements **cannot** be explained by reference to hydrogen bonding?
- A At 0 °C, ice floats on water.
- B The boiling point of propan-1-ol is 82 °C while that of propanone is 56 °C.
- C The relative molecular mass of ethanoic acid in CCl_4 is 120.
- D At 20 °C, propanone and propanal mix completely.

- 6 Which of the following enthalpy changes is positive?

- A $\text{HCl}(\text{aq}) + \text{NaOH}(\text{aq}) \longrightarrow \text{NaCl}(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- B $2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \longrightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l})$
- C $2\text{Br}(\text{g}) \longrightarrow \text{Br}_2(\text{g})$
- D $\text{Na}(\text{g}) \longrightarrow \text{Na}^+(\text{g}) + \text{e}^-$

- 7 The explosive nitroglycerin ($\text{C}_3\text{H}_5\text{N}_3\text{O}_9$) decomposes rapidly upon ignition or sudden impact according to the following equation:



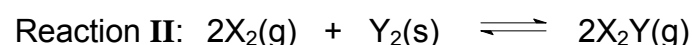
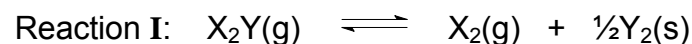
Given the following data, what is the standard enthalpy change of formation of nitroglycerin in kJ mol^{-1} ?

Standard enthalpy change of formation of $\text{CO}_2(\text{g}) = -394 \text{ kJ mol}^{-1}$

Standard enthalpy change of formation of $\text{H}_2\text{O}(\text{g}) = -242 \text{ kJ mol}^{-1}$

- A -368
- B -1470
- C -3207
- D +5042

- 8 Two equilibria are shown below.

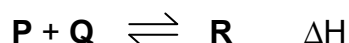


The numerical value of K_{c} for reaction I is 2.

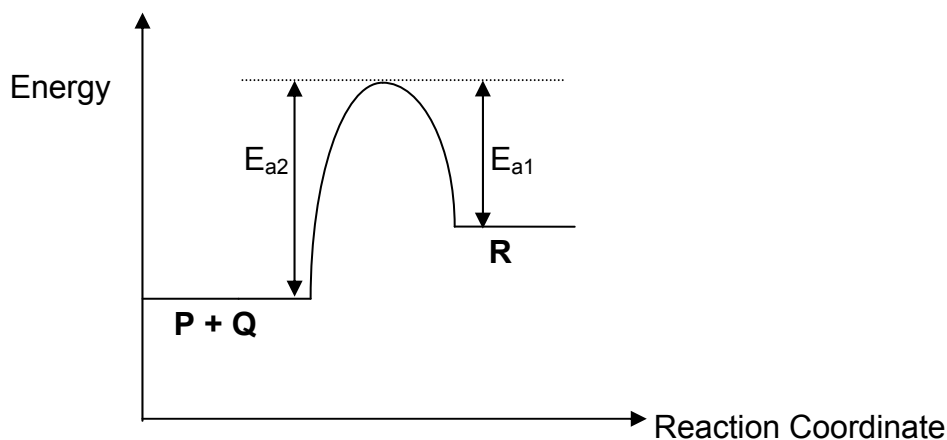
Under the same conditions, what is the numerical value of K_{c} for reaction II?

- A $\frac{1}{4}$ B 4 C $\sqrt{\frac{1}{2}}$ D $\frac{1}{2}$

- 9 The energy profile for the reaction



is shown below.



Which of the following statements is **false**?

- A** $E_{a1} = E_{a2} - \Delta H$
- B** The formation of **P** and **Q** is an endothermic reaction.
- C** The temperature of surrounding decreases during the formation of **R**.
- D** The activation energy of the backward reaction is lower than the activation energy of the forward reaction.
- 10** The rate of removal of the pain-killing drug paracetamol from the body is a first-order reaction with a rate constant, $k = 0.26 \text{ h}^{-1}$.
Given that half-life for a first order reaction, $t_{1/2} = \frac{\ln 2}{k}$, determine how long it will take for 87.5 % of the paracetamol to be removed from the body?
- A** 2.7 h **B** 5.3 h **C** 8.0 h **D** 10.7 h

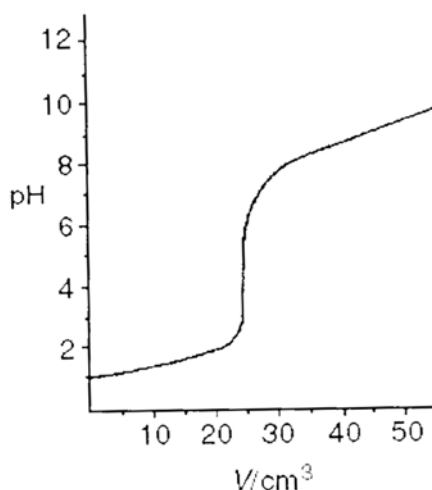
- 11 The table below shows the values of the ionic product of water, K_w , at two different temperatures.

Temperature / °C	$K_w / \text{mol}^2 \text{dm}^{-6}$
25	1.00×10^{-14}
62	1.00×10^{-13}

Which of the following statements is correct?

- A The ionic dissociation of water is an exothermic process.
 B The pH of water increases with temperature.
 C At 62 °C, $\text{pH} = 14 - \text{pOH}$.
 D At 62 °C, water with a pH of 6.5 is neutral.
- 12 In an acid-base titration, a 0.10 mol dm^{-3} solution of a base is added to 25.0 cm^3 of a 0.10 mol dm^{-3} solution of an acid.

The pH value of the solution is plotted against the volume, V , of base added as shown in the diagram.



Which of the following substances could have given these results?

- | | <i>acid</i> | <i>alkali</i> |
|---|---|--------------------------|
| A | $\text{CH}_3\text{CO}_2\text{H}(\text{aq})$ | $\text{KOH}(\text{aq})$ |
| B | $\text{HCl}(\text{aq})$ | $\text{KOH}(\text{aq})$ |
| C | $\text{HCl}(\text{aq})$ | $\text{NH}_3(\text{aq})$ |
| D | $\text{CH}_3\text{CO}_2\text{H}(\text{aq})$ | $\text{NH}_3(\text{aq})$ |

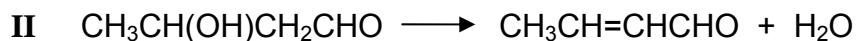
- 13** Consecutive elements **P**, **Q** and **R** are in Period 3 of the Periodic Table. Element **Q** has the lowest first ionisation energy and the highest melting point.

What could be the identities of **P**, **Q** and **R**?

- A** magnesium, aluminium, silicon
 - B** aluminium, silicon, phosphorus
 - C** silicon, phosphorus, sulfur
 - D** phosphorus, sulfur, chlorine
- 14** A mixture of the oxides of two elements of the third period is dissolved in water. The solution is approximately neutral.

What could be the constituents of the mixture?

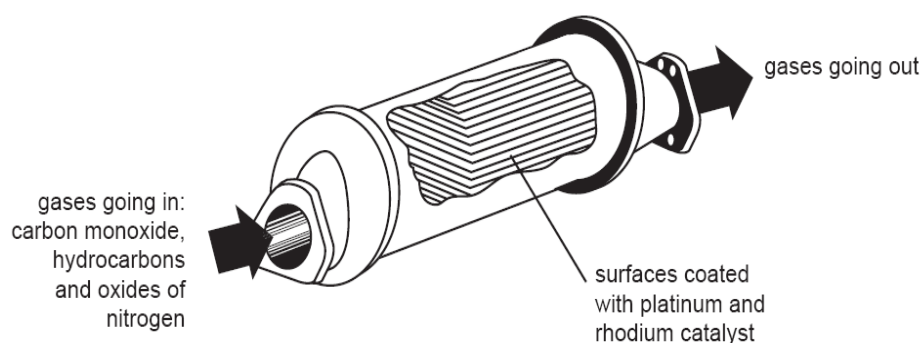
- A** Al_2O_3 and MgO
 - B** Na_2O and MgO
 - C** Na_2O and P_4O_{10}
 - D** SO_3 and P_4O_{10}
- 15** The Russian composer Borodin was also a research chemist who discovered a reaction in which two ethanal molecules combine to form a compound commonly known as aldol (reaction **I**). Aldol forms another compound on heating (reaction **II**).



Which of the following best describes reactions **I** and **II**?

- | | I | II |
|----------|--------------|-------------|
| A | addition | elimination |
| B | addition | reduction |
| C | elimination | reduction |
| D | substitution | elimination |

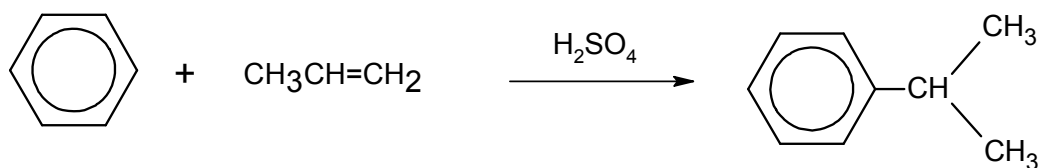
- 16 1,2-dibromo-3-chloropropane (DBCP) has been used in the control of earthworms in agricultural land. Which of the following would be the best synthesis of this compound?
- A $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} + 2\text{Br}_2 \longrightarrow \text{DBCP} + 2\text{HBr}$
- B $\text{CH}_3\text{CHBrCH}_2\text{Br} + \text{Cl}_2 \longrightarrow \text{DBCP} + \text{HCl}$
- C $\text{CH}_2=\text{CHCHBr}_2 + \text{HCl} \longrightarrow \text{DBCP}$
- D $\text{CH}_2=\text{CHCH}_2\text{Cl} + \text{Br}_2 \longrightarrow \text{DBCP}$
- 17 Which reaction in the catalytic converter does **not** remove hazardous and polluting gases from the exhaust fumes of a motor car?



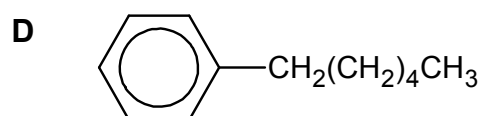
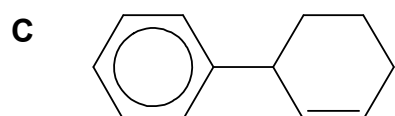
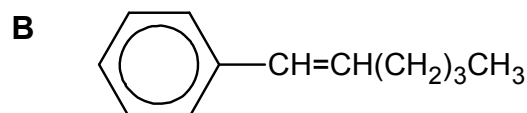
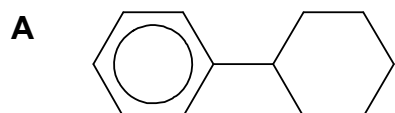
These equations are qualitative and unbalanced.
 [HC = unburnt hydrocarbons; NO_x = oxides of nitrogen]

- A $\text{HC} + \text{NO}_x \longrightarrow \text{H}_2\text{O} + \text{CO} + \text{N}_2$
- B $\text{CO} + \text{NO}_x \longrightarrow \text{CO}_2 + \text{N}_2$
- C $\text{HC} + \text{NO}_x \longrightarrow \text{H}_2\text{O} + \text{CO}_2 + \text{N}_2$
- D $\text{CO} + \text{O}_2 \longrightarrow \text{CO}_2$

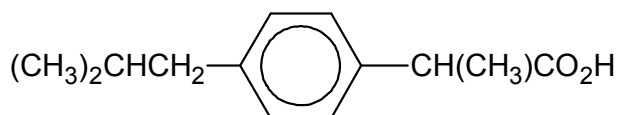
- 18 The first stage of the cumene process for the industrial production of phenol is as follows.



Which of the following would be the product of reaction, under similar conditions, between benzene and cyclohexene?

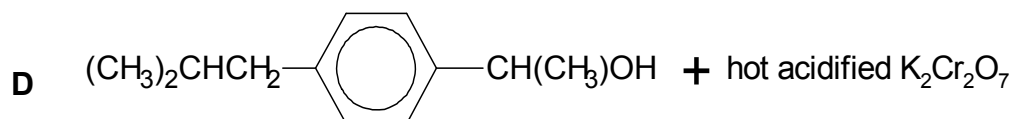
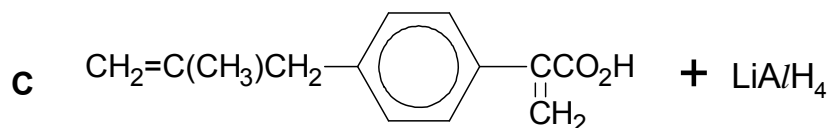
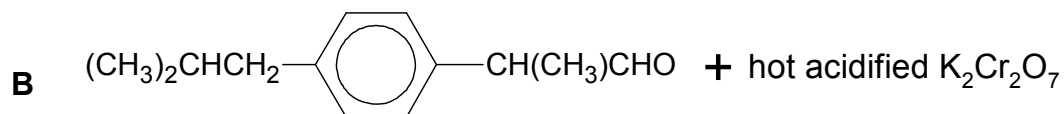
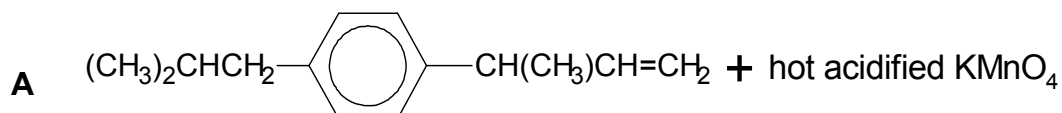


- 19 Ibuprofen is an anti-inflammatory drug.

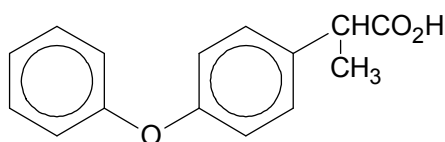


Ibuprofen

Which reaction would lead to its formation?

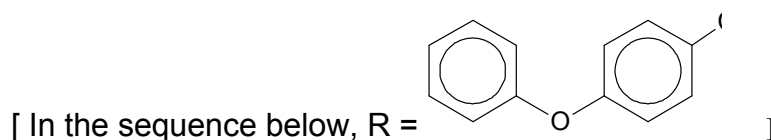


- 20 What will react differently with the two isomeric alcohols, $(\text{CH}_3)_3\text{CCH}_2\text{OH}$ and $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{OH}$?
- A acidified aqueous potassium manganate(VII)
 B concentrated sulfuric acid
 C phosphorus pentachloride
 D sodium
- 21 Which reaction would **not** give propene as a product?
- A adding an excess of concentrated sulfuric acid to propan-1-ol and heat
 B adding hot aqueous sodium hydroxide to 2-bromopropane
 C adding hot ethanolic sodium hydroxide to 1-bromopropane
 D passing propan-2-ol vapour over heated aluminium oxide
- 22 *Fenoprofen* is an anti-arthritis agent.



Fenoprofen

Which of the following could be part of a sequence for synthesising *Fenoprofen*?

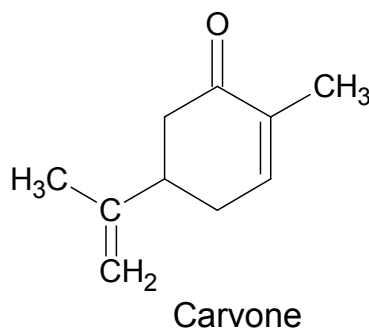


- A $\text{RCH}(\text{CH}_3)\text{COCH}_3 \xrightarrow[\text{warm}]{\text{I}_2, \text{OH}^-(\text{aq})} \text{intermediate} \xrightarrow{\text{H}^+(\text{aq})} \text{Fenoprofen}$
- B $\text{RCH}(\text{CH}_3)_2 \xrightarrow[\text{heat}]{\text{KMnO}_4, \text{OH}^-(\text{aq})} \text{intermediate} \xrightarrow{\text{H}^+(\text{aq})} \text{Fenoprofen}$
- C $\text{RCHBrCH}_3 \xrightarrow[\text{heat}]{\text{NaCN}(\text{ethanolic})} \text{intermediate} \xrightarrow[\text{heat}]{\text{H}^+(\text{aq})} \text{Fenoprofen}$
- D $\text{RCH}(\text{OH})\text{CH}_3 \xrightarrow[\text{heat}]{\text{KMnO}_4, \text{OH}^-(\text{aq})} \text{intermediate} \xrightarrow{\text{H}^+(\text{aq})} \text{Fenoprofen}$

- 23 Compound **X** changes the colour of acidified sodium dichromate(VI) from orange to green. 1 mol of **X** reacts with 2 mol of HCN.

What could **X** be?

- A $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CHO}$
B $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$
C $\text{CH}_3\text{COCH}_2\text{CHO}$
D $\text{CH}_3\text{COCH}_2\text{COCH}_3$
- 24 Carvone gives the characteristic flavour to caraway and spearmint.



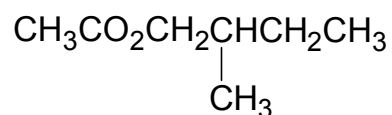
Prolonged heating of carvone with hot concentrated acidified potassium manganate(VII) produces carbon dioxide and a compound **X**.

X contains nine carbon atoms and reacts with 2,4-dinitrophenylhydrazine reagent.

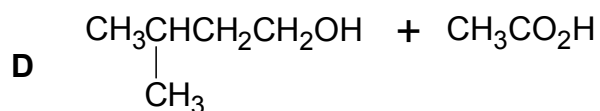
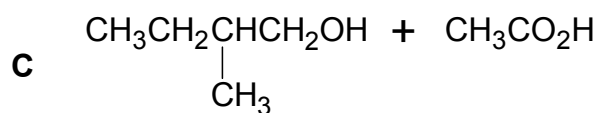
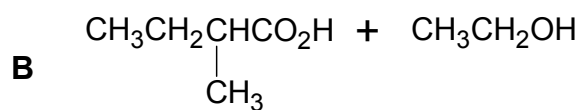
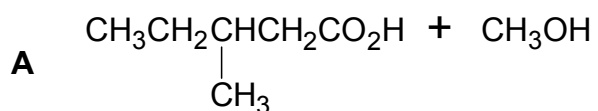
What is the maximum number of molecules of 2,4-dinitrophenylhydrazine that will react with one molecule of **X**?

- A 1 B 2 C 3 D 4

- 25 An ester with an odour of banana has the following formula.



In which of the following do the substances react together, under suitable conditions, to produce this ester?



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

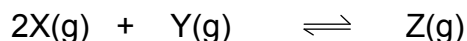
A	B	C	D
1, 2 and 3 are correct	1 and 2 only are correct	2 and 3 only are correct	1 only is correct

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

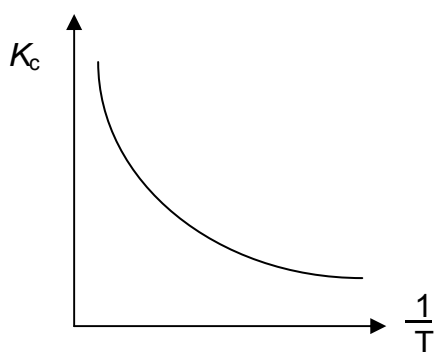
- 26** In which of the following pair is the bond angle in particle **I** greater than that in particle **II**?

	I	II
1	NO_3^-	ClO_2^-
2	SF_6	ClF_3
3	I_3^-	BeCl_2

- 27** The equilibrium constant K_c for the reaction



varies with temperature T as shown in the diagram below.



What conclusions can be drawn regarding the above reaction?

- The equilibrium mixture contains a higher proportion of Z at higher temperatures.
- The equilibrium mixture contains a higher proportion of Z at higher pressures.
- The reverse reaction is exothermic.

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

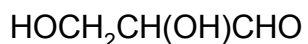
28 Which statements are correct in terms of the Bronsted-Lowry theory of acids and bases?

- 1** Water can act as either an acid or a base.
- 2** Sulfuric acid, H_2SO_4 , behaves as an acid when dissolved in ethanol, $\text{C}_2\text{H}_5\text{OH}$
- 3** The ammonium ion acts as a base when dissolved in liquid ammonia.

29 Sodium ethanoate can be prepared by heating aqueous sodium hydroxide with

- 1** ethanol and sodium manganate(VII).
- 2** ethyl ethanoate.
- 3** methyl ethanoate.

30 Compound **P** and **Q** have the following formulae:



P



Q

Which of the following statements apply to these compounds?

- 1** Both **P** and **Q** can be reduced to $\text{HOCH}_2\text{CH}(\text{OH})\text{CH}_2\text{OH}$
- 2** Both **P** and **Q** produce a silver mirror with Tollens' reagent.
- 3** **P** can be directly oxidised to **Q**.

Answers

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