



TAMPINES MERIDIAN JUNIOR COLLEGE

JC2 PRELIMINARY EXAMINATION

H2 CHEMISTRY

9729/01

Paper 1 Multiple Choice

23 September 2021

1 hour

Additional materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

There are **thirty** questions in this paper. Answer **all** questions. For each question, there are four possible answers labelled **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in soft pencil on the separate Answer Sheet.

Read very carefully the instructions on the use of Answer Sheet.

You are advised to fill in the Answer Sheet as you go along; no additional time will be given for the transfer of answers once the examination has ended.

Use of Answer Sheet

Ensure you have written your name, class register number and class on the Answer Sheet.

Use a **2B** pencil to shade your answers on the Answer Sheet; erase any mistakes cleanly. Multiple shaded answers to a question will not be accepted.

For shading of class register number on the **Answer Sheet**, please follow the given examples:

If your register number is **1**, then shade **01** in the index number column.

If your register number is **21**, then shade **21** in the index number column.

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

In research on the atomic nucleus, scientists have been comparing the stability of isotopes with the same neutron : proton ratio.

Which isotope has the same neutron : proton ratio as ^{14}N ?

- A ^{35}S B ^{35}Cl C ^{40}K D ^{40}Ca

- 2 A stream of gaseous $^{16}_8\text{O}^{2-}$ ions was passed between two oppositely charged plates. Analysis of the deflection shows that these ions deflected at an angle of 10.0° .

Under the same electric field, an unknown gaseous ion Z^- is deflected at an angle of 2.58° .

What is the isotopic mass of Z?

- A 8 B 15 C 16 D 31

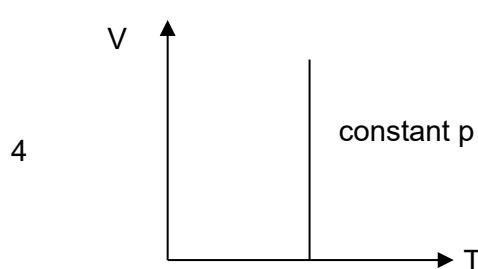
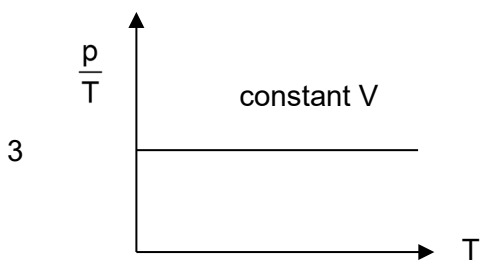
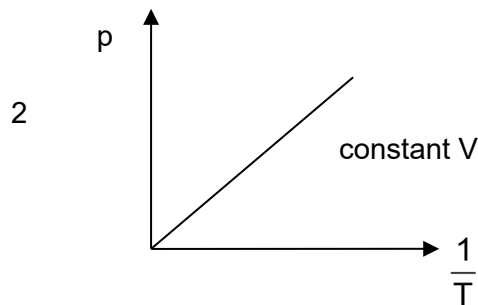
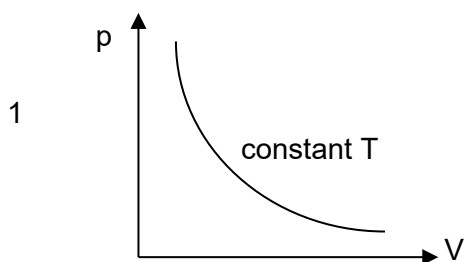
- 3 In which pair of molecules is the bond angle in the first molecule smaller than that in the second molecule?

- A BF_3 and PH_3
 B BeCl_2 and H_2S
 C SO_3 and CCl_4
 D F_2O and SO_2

- 4 What is the most predominant forces formed when each of the following compounds is dissolved in water?

	HNO_3	CH_3OH	HCOONa
A	hydrogen bonds	hydrogen bonds	ion-dipole interactions
B	hydrogen bonds	ion-dipole interactions	hydrogen bonds
C	ion-dipole interactions	hydrogen bonds	ion dipole interactions
D	ion-dipole interactions	ion-dipole interactions	hydrogen bonds

- 5 Which of the following diagrams correctly describes the behaviour of a fixed mass of an ideal gas?



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

- 6 Element G is one of the first five elements in Period 3 of the Periodic Table. The following four statements were made about the properties of element G or its compounds.

Three statements are correct descriptions and one is false.

Which statement does **not** fit with the other three?

- A** The oxide of G dissolves in excess dilute NaOH(aq).
B G exhibits only one possible oxidation number in its chloride, which is not a solid at room temperature.
C The oxide of G has a very high melting point.
D The chloride of G reacts with water to give an acidic solution of pH 2.

- 7 Fluorine, chlorine and bromine react with sulfur to form SF₆, SCl₂ and S₂Br₂ respectively.

Which of the following trends can be deduced from the above information?

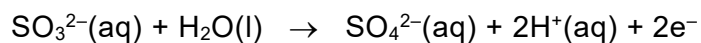
- 1 Sulfur has variable oxidation states.
 2 Oxidising strength decreases from fluorine to bromine.
 3 Covalent bond strength decreases from fluorine to bromine.

- A** 1, 2 and 3 **B** 1 and 2 **C** 2 and 3 **D** 1 only



- 8 In an experiment, 0.0050 mol of a metallic salt reacted with 0.0025 mol of aqueous sodium sulfite, Na_2SO_3 .

The half-equation for the oxidation of sulfite ion is shown below.



If the original oxidation number of the metal in the salt was +3, what would be the new oxidation number of the metal?

- A 0 B +1 C +2 D +4
- 9 The reaction between compounds E and F is found to follow the rate equation $\text{rate} = k[\text{E}]^m[\text{F}]$ where k is the rate constant and has units of $\text{mol}^{-2}\text{dm}^6\text{s}^{-1}$ and m is the order of reaction with respect to E.

Two experiments were carried out to study the kinetics of this reaction and the data obtained are tabulated below.

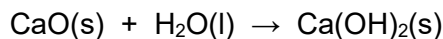
experiment	initial $[\text{E}] / \text{mol dm}^{-3}$	initial $[\text{F}] / \text{mol dm}^{-3}$	initial rate / $\text{mol dm}^{-3} \text{s}^{-1}$
1	0.040	0.080	X
2	0.020	Y	$\frac{1}{2}X$

What is the value of Y in experiment 2?

- A 0.020 B 0.040 C 0.160 D 0.320
- 10 Which equation corresponds to the enthalpy change stated?

A	standard enthalpy change of formation of iodomethane $\text{C}(\text{s}) + \frac{1}{2}\text{H}_2(\text{g}) + \frac{3}{2}\text{I}_2(\text{s}) \rightarrow \text{CHI}_3(\text{s})$
B	standard enthalpy change of solution of ammonia $\text{NH}_3(\text{g}) \rightarrow \text{NH}_3(\text{l})$
C	bond energy of C–Cl bond in tetrachloromethane $\text{CCl}_4(\text{l}) \rightarrow \text{C}(\text{g}) + 4\text{Cl}(\text{g})$
D	standard enthalpy change of neutralisation $\text{Ba}(\text{OH})_2(\text{aq}) + 2\text{HCl}(\text{aq}) \rightarrow \text{BaCl}_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$

- 11** With self-heating technology, instant food becomes more portable and convenient. Self-heating hot pots allow heating of food content without any external heat source. The bottom of the hot pot contains a packet of quicklime (CaO) which will release heat when mixed with water. This reaction provides adequate heat for cooking the food content in the hot pot.



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

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

- 12** Nitrogen dioxide can decompose to form nitrogen monoxide and oxygen as shown by the equation.

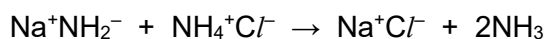


When 4.0 mol of nitrogen dioxide is allowed to undergo decomposition in a container of volume 0.5 dm³, 0.8 mol of oxygen was present in the equilibrium mixture.

What is the numerical value of the equilibrium constant, K_c , for this reaction?

- A** 0.357 **B** 0.711 **C** 1.41 **D** 2.80

- 13** The following reaction takes place in a suitable solvent.



Which statements explain why this reaction should be classified as a Brønsted-Lowry acid-base reaction?

- 1 NH_2^- is an electron pair acceptor.
- 2 NH_2^- and NH_3 are a conjugate acid-base pair.
- 3 The ammonium ion acts as a proton donor.

- A** 1, 2 and 3 **B** 1 only **C** 2 and 3 **D** 3 only

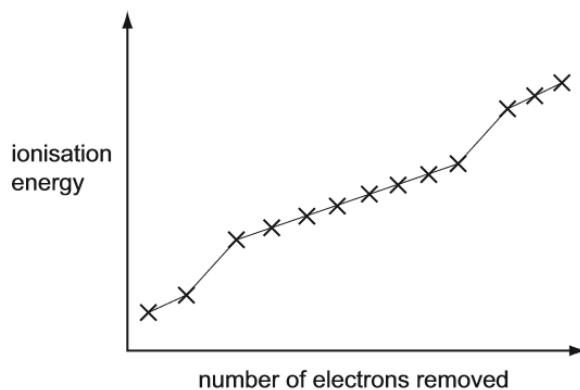
- 14** In an experiment, 500 cm^3 of 0.020 mol dm^{-3} of silver nitrate, AgNO_3 , and 500 cm^3 of 0.050 mol dm^{-3} of calcium nitrate, $\text{Ca}(\text{NO}_3)_2$, were added to a 1 dm^3 solution containing 0.200 mol dm^{-3} of sulfuric acid, H_2SO_4 .

The solubility product of Ag_2SO_4 is $1.20 \times 10^{-5}\text{ mol}^3\text{ dm}^{-9}$ and that of CaSO_4 is $7.10 \times 10^{-5}\text{ mol}^2\text{ dm}^{-6}$.

Which statement is correct?

- A** No precipitate is formed.
 - B** Only CaSO_4 is precipitated.
 - C** CaSO_4 is precipitated followed by Ag_2SO_4 .
 - D** Ag_2SO_4 is precipitated followed by CaSO_4 .
- 15** Citric acid is a weak monobasic acid. Which of the following pair of solutions, when mixed in equal volumes, will give the best buffer solution that resists pH changes when a small amount of acid or base is added?
- A** 0.50 mol dm^{-3} of citric acid and 0.50 mol dm^{-3} of sodium hydroxide
 - B** 0.25 mol dm^{-3} of citric acid and 0.50 mol dm^{-3} of sodium hydroxide
 - C** 0.50 mol dm^{-3} of sodium citrate and 0.25 mol dm^{-3} of hydrochloric acid
 - D** 1.00 mol dm^{-3} of sodium citrate and 0.50 mol dm^{-3} of citric acid

- 16 The graph shows the first thirteen successive ionisation energies for element Q.



What can be deduced about element Q from the graph?

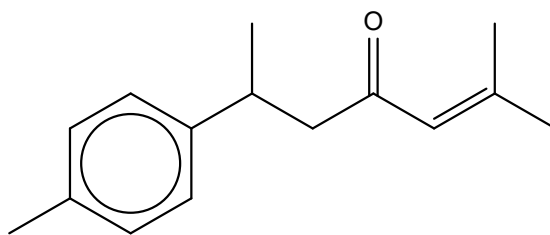
- 1 Q is in Group 2 of the Periodic Table.
- 2 Q is in Period 3 of the Periodic Table.
- 3 Q is a p-block element.
- 4 Q is aluminium.

A 1, 2 and 4 **B** 1 and 2 **C** 1 and 3 **D** 1 only

- 17 Consider the chlorides of Period 3 elements.
Which factor generally decreases across the period?

- A** covalent character
- B** melting point
- C** solubility in water
- D** pH when mixed with water

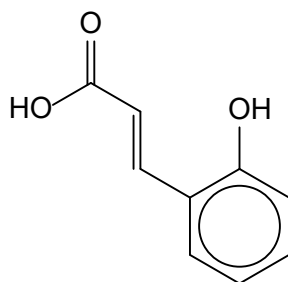
- 18 Turmerone is a compound present in turmeric spice.



turmerone

Which of the following statements about this molecule is correct?

- A It has two stereoisomers.
 - B It has two chiral centres.
 - C It has eight sp^2 hybridised carbon atoms.
 - D It can exhibit *cis* – *trans* isomerism.
- 19 *Ortho*-coumaric acid is an antioxidant in pomegranate juice.

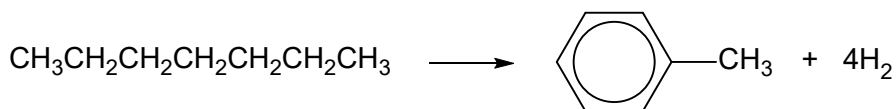


ortho-coumaric acid

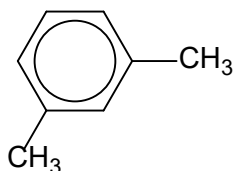
When treated with aqueous bromine, what is the maximum number of bromine atoms that can be incorporated into a molecule of *ortho*-coumaric acid?

- A 2
- B 3
- C 4
- D 6

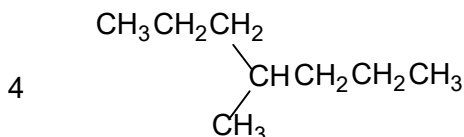
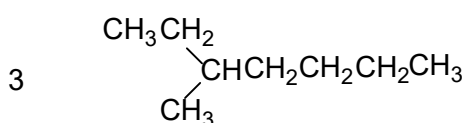
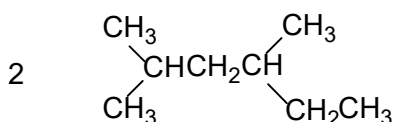
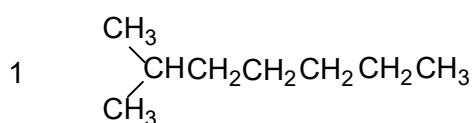
- 20 In an industrial process, heptane vapour is passed over a heated catalyst to make methylbenzene.



Under similar conditions, which of the C_8H_{18} isomers could give 1,3-dimethylbenzene?



1,3-dimethylbenzene

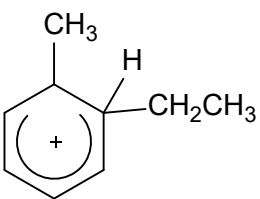
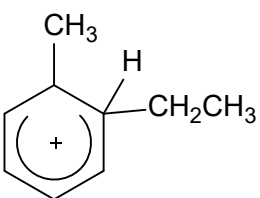
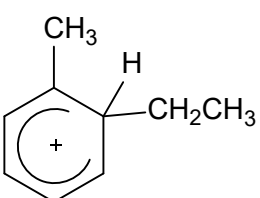
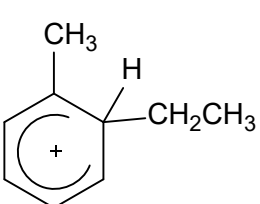


- A** 1, 2 and 3 **B** 1, 2 and 4 **C** 1 and 4 **D** 2 and 3

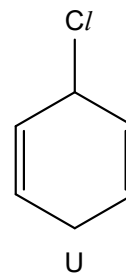
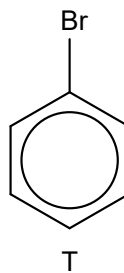
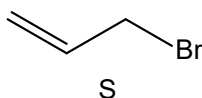
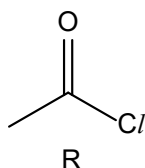
- 21 Which property does benzene have as a consequence of the delocalisation of electrons in the benzene molecule?
- A** The carbon-carbon bond lengths are between those of C–C bonds and C=C bonds.
- B** Addition reactions of benzene take place more easily than substitution.
- C** Benzene is commonly used as a non-polar solvent.
- D** Benzene is a good conductor of electricity.

- 22** The reaction between methylbenzene and chloroethane proceeds via several stages with two successive intermediates in the presence of AlCl_3 .

What could be the intermediates for this reaction?

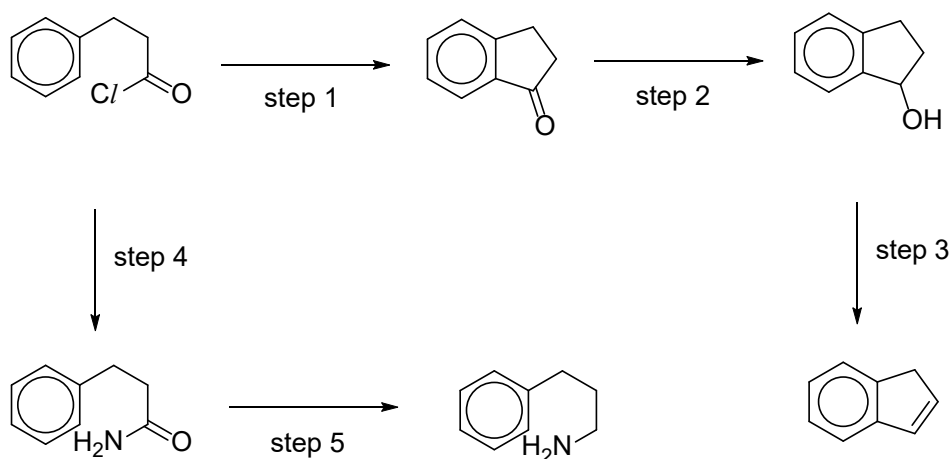
- A** CH_3CH_2^- and 
- B** CH_3CH_2^+ and 
- C** CH_3CH_2^- and 
- D** CH_3CH_2^+ and 

- 23** Which sequence shows the correct order of decreasing ease of hydrolysis of the following compounds?



- A** $\text{R} > \text{U} > \text{T} > \text{S}$
- B** $\text{R} > \text{S} > \text{U} > \text{T}$
- C** $\text{U} > \text{R} > \text{T} > \text{S}$
- D** $\text{U} > \text{S} > \text{T} > \text{R}$

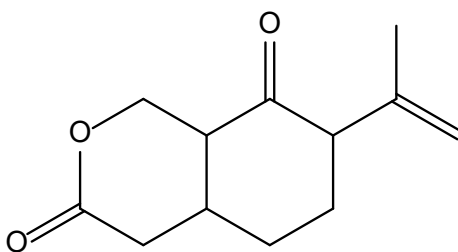
24 Consider the following reaction scheme.



Which of the following statements about the above reaction scheme is correct?

- A Step 4 requires alcoholic NaCN.
- B Steps 2 and 5 require aqueous lithium aluminium hydride.
- C Step 3 can be carried out by using hot ethanolic KOH.
- D Step 1 requires the presence of AlCl_3 .

25 Compound X has the following structure.



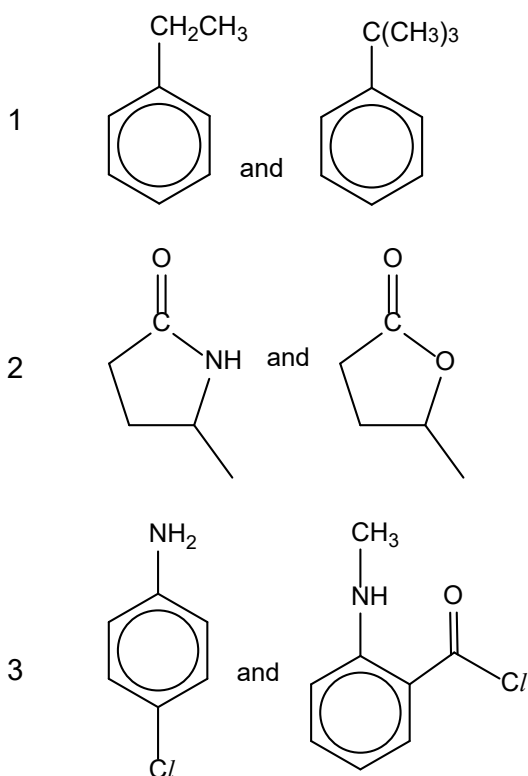
compound X

Compound X undergoes a complete reaction with reagent Y. The product of this reaction has the same number of chiral centres as compound X.

Which of the following could be reagent Y?

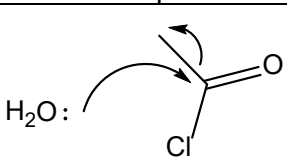
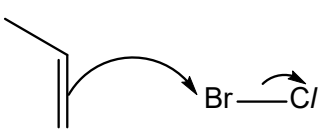
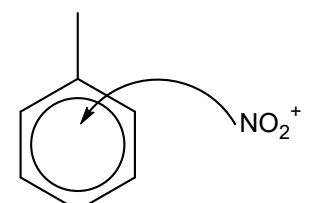
- A cold alkaline KMnO_4
- B H_2 , Ni, heat
- C HBr gas
- D LiAlH_4

26 Which pair of organic compounds can be distinguished by a chemical test?



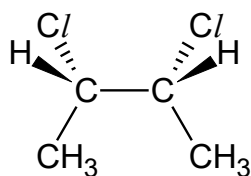
A 1, 2 and 3 **B** 1 and 2 **C** 2 only **D** 3 only

27 Which of the following shows the correct movement of electrons between the pairs of reagents?

	reagents	step
1	ethanoyl chloride and water	
2	CH ₃ radical with Br atom	
3	propene and bromine monochloride	
4	methylbenzene and nitric acid	

A 1, 2 and 3 **B** 2, 3 and 4 **C** 2 and 3 **D** 1 and 4

- 28 The structure below represents *meso*-2,3-dichlorobutane.



meso-2,3-dichlorobutane

Which of the following statements explains why this isomer of 2,3-dichlorobutane does not show optical activity?

- A The compound exists as a racemic mixture.
- B The molecule does not contain any chiral carbon atoms.
- C The molecule has a net dipole moment which cancels out the rotation of plane-polarised light.
- D The molecule has an internal plane of symmetry.
- 29 Three half-cells are constructed as follows.

Half-cell E1: an electrode of metal F in a 1.0 mol dm^{-3} solution of $\text{F}^+(\text{aq})$ ions

Half-cell E2: an electrode of metal G in a 1.0 mol dm^{-3} solution of $\text{G}^+(\text{aq})$ ions

Half-cell E3: an electrode of metal H in a 1.0 mol dm^{-3} solution of $\text{H}^{2+}(\text{aq})$ ions

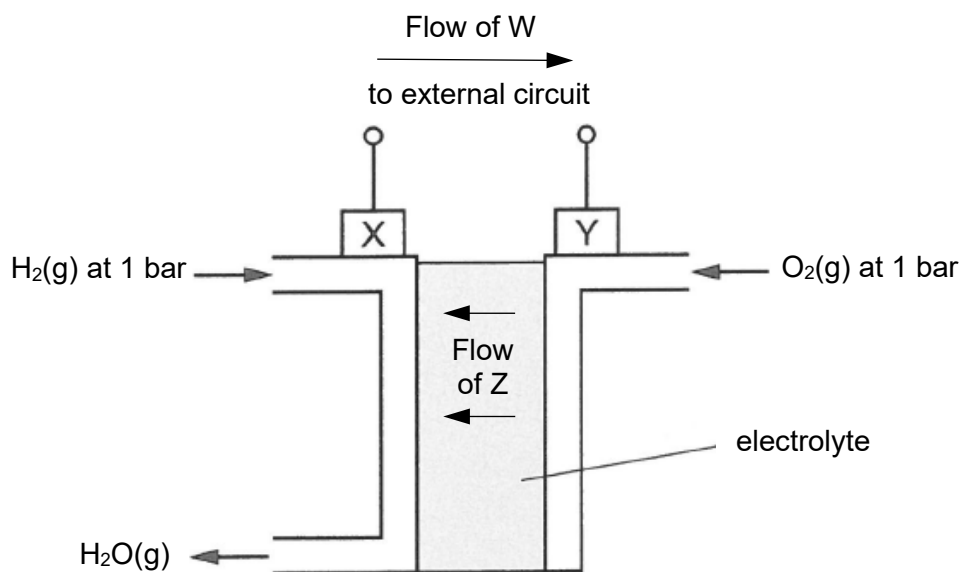
The half cells are connected in pairs, as shown below, to form a series of galvanic cells. For each cell, the polarity of the electrodes and the E°_{cell} generated are recorded as shown.

Pair of half cells	negative electrode	positive electrode	$E^\circ_{\text{cell}} / \text{V}$
E1 and E2	F	G	+1.10
E2 and E3	H	G	+0.47
E1 and E3	F	H	+0.63

Which one of the following lists the metals in order of increasing strength as reducing agents?

- A G, H, F
- B F, H, G
- C H, G, F
- D H, F, G

- 30 A hydrogen-oxygen fuel cell is shown.



Which of the following shows the correct identities of W, X, Y and Z?

	W	X	Y	Z
A	H^+	anode	cathode	OH^-
B	electrons	anode	cathode	OH^-
C	electrons	cathode	anode	H^+
D	OH^-	cathode	anode	electrons