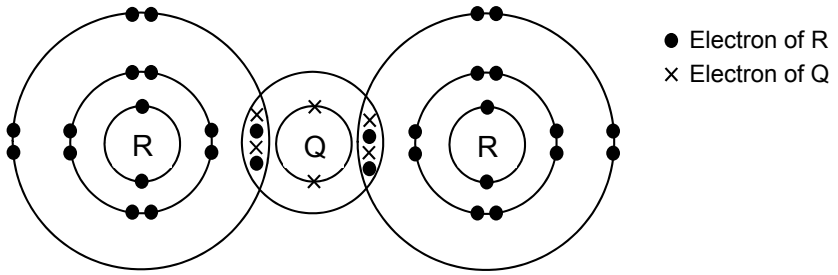
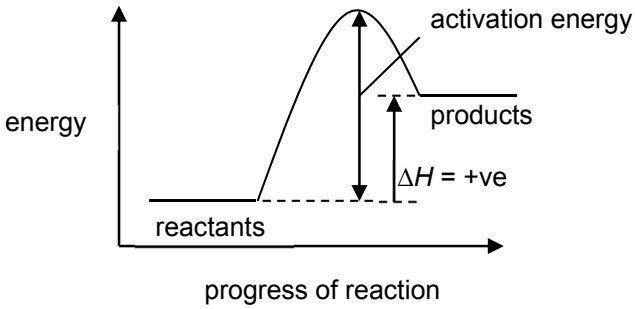
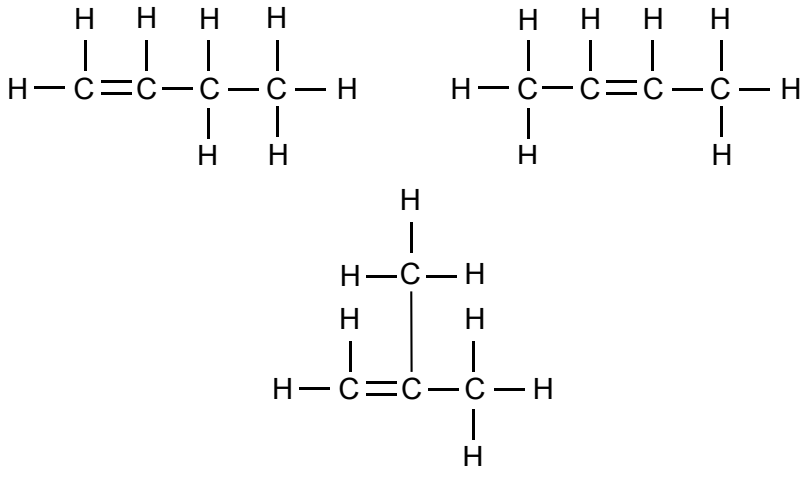
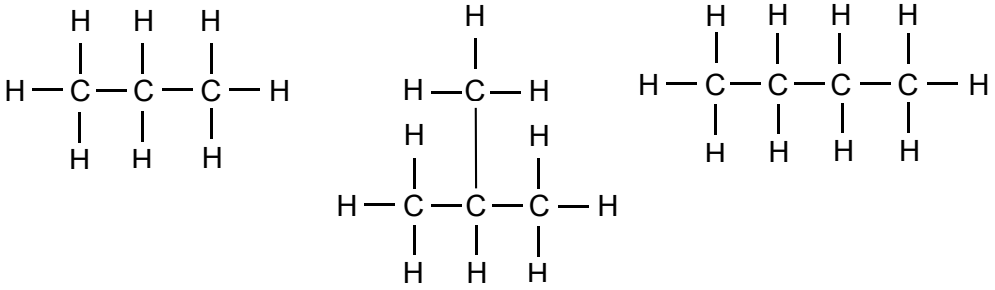
#	Ans	Workings/Remarks
1	D	The condenser is used for distillation which is not needed to determine the rate of reaction. Only option D excludes this apparatus.
2	D	Ammonia gas will turn the damp red litmus paper blue first before gaseous HC*l* turns it back to red again.
3	D	Only Zn^{2+} will form a white precipitate that will dissolve in excess aqueous ammonia.
4	A	Since the boiling point of ethanol (78 °C) is lower than that of water (100 °C), it will distil first. Concentration of ethanol would decrease over time.
5	B	Isotopes are atoms of the same element with different number of neutrons and same number of protons.
6	C	Melting point of aluminium oxide is much higher than the melting point of calcium oxide due to the aluminium ion (Al^{3+}) having a bigger charge than the calcium ion (Ca^{2+}), thereby forming stronger electrostatic forces of attraction between oppositely charged ions.
7	A	X and Z have very high melting and boiling points with the difference being X is unable to conduct electricity vs Z able to conduct electricity. As such, Z is graphite while W is sand (silicon dioxide). Since methane is a gas at room temperature, it would have a boiling point lesser than 25°C, making it W while Iodine would be Y.
8	C	Element Q can accept a maximum of 4 electrons while R can accept a maximum of 2 electrons. As such, Q can form bonds with 2 R atoms, giving a formula of QR_2. 
9	B	For 46 g of Na formed at the cathode, No. of moles of Na = $\frac{46}{23}$ = 2 mol $Na^+ + e^- \rightarrow Na$ $2Cl^- \rightarrow Cl_2 + 2e^-$ Overall equation: $2Cl^- + 2Na^+ \rightarrow 2Na + Cl_2$ ∴Mole ratio of Na : Cl_2, 2 : 1 ⇒ No. of moles of Cl_2 = **1 mol**

10	A	A: Aluminium sulfate ⇒ $Al_2(SO_4)_3$ (aq) → $2Al^{3+}$ (aq) + $3SO_4^{2-}$ (aq) B: Ammonium sulfate ⇒ $(NH_4)_2SO_4$ (aq) → $2NH_4^+$ (aq) + SO_4^{2-} (aq) C: Copper (II) sulfate ⇒ $CuSO_4$ (aq) → Cu^{2+} (aq) + SO_4^{2-} (aq) D: Sodium sulfate ⇒ Na_2SO_4 (aq) → $2Na^+$ (aq) + SO_4^{2-} (aq) For 1 mol / dm^3 (assuming volume of 1 dm^3) aluminium sulfate, 3 moles of SO_4^{2-} would be found as compared to the rest of the options, giving it the greatest number of negative ions.
11	B	The pH values are different because ethanoic acid is a weak acid, which only partially dissociates to give lesser H^+ ions as compared to the strong nitric acid.
12	D	Aqueous copper (II) chloride contains Cu^{2+}, Cl^- , H^+ and OH^- ions.
13	A	The energy profile diagram shows the profile of an endothermic reaction.  Endothermic reactions have: • a positive ΔH value • energy involved in bond breaking greater than the energy involved in bond forming. • activation energy that starts from the reactant energy level to the peak. Note: Option C which gives the combustion reaction of CH_4 is exothermic.
14	B	From the left to the right across a period of the Periodic Table, elements change from metals to non-metals. A: The ability to conduct electricity should decrease and not increase because of the increasingly non-metallic character of the elements. C: The number of neutrons in an atom generally increases, not decreases. D: The number of protons in an atom increases, not decreases.
15	D	When potassium iodide is oxidised, colour should change from colourless to brown. When acidified potassium manganate (VII) is reduced, colour should change from purple to colourless.
16	A	Only X, which is the conversion of ethanol to ethanoic acid, is an oxidation reaction. Reaction Y is not oxidation because the oxidation states of the elements in ethanoic acid remain the same after forming sodium ethanoate, even after the loss of hydrogen.

17	D	The volumes of both HC*l* and NaOH taken are at the maximum temperature as shown in the graph. For a HC*l* concentration of 2 mol / dm^3 and volume of 30 cm^3, No. of moles of HC*l* = $\frac{30}{1000} \times 2$ = 0.06 mol Mole ratio of HC*l* : NaOH ⇒ 1 : 1 ∴ No. of moles of NaOH = 0.06 mol Concentration of aq NaOH = $0.06 \div \frac{20}{1000}$ = 3 mol / dm^3
18	C	Oxide of T is an acidic oxide (non-metal combined with oxygen) since pH of solution formed is 2. Oxide of V is a basic oxide (metal combined with oxygen) since pH of solution formed is 10. Oxide of U being insoluble and white cannot be copper oxide but aluminium oxide.
19	B	Only B is correct. Calcium sulfate being an insoluble salt should be prepared by precipitation with two aqueous reactants. Options A, C and D all have a reactant that is insoluble (Calcium carbonate, barium sulfate, lead (II) sulfate).
20	D	The reactivity of the halogens up Group VII is as follows: I_2, Br_2, Cl_2, F_2 (in order of increasing reactivity) As such, only D is correct. Cl_2 can displace both Br^- and I^- while I_2 cannot displace Br^-.
21	A	The chemical symbol $^3_2$J contains 2 protons, 2 electrons and 1 neutron. As such, J would belong to Group 0 according to its arrangement in the periodic table and also because it has only 2 electrons, giving it a duplet electronic configuration.
22	B	Only option B is an example of thermal decomposition.
23	D	A decrease in activation energy can only be caused by using a catalyst and not by the changes listed by options A, B and C.
24	B	Only B is **not** correct. The oxidation state of N in NO is +2 and not +4.
25	B	From the equation, mole ratio of Na to H_2 ⇒ 2 : 1 ∴ 0.2 moles of Na would give 0.1 moles of H_2 Volume of hydrogen produced = 0.1 × 24 dm^3 = 2.4 dm^3
26	A	The element obtained from crude oil is hydrogen. Ammonia, upon reacting with Q, gives a salt which suggests that Q should be an acid. The resultant ammonium salt produced when reacted with R displaces ammonia which implies that R is a base.
27	C	Only C is correct. Dilute aqueous solution of strong acid HX also contains OH^- ions due to the dissociation of water molecules. A: The pH value of the acid should be below 7 and not above. B: The solution should contain a low concentration of HX molecules since it is a strong acid that would be fully dissociated. D: Because it is **dilute**, the solution should contain less H^+ ions than water molecules.

28	D	Bromine molecules would be formed at the anode.
29	C	Given that sodium is a very reactive metal, sodium carbonate will melt on heating but not decompose because it is a thermally stable carbonate.
30	C	Hydrogen is kept flowing to prevent the copper from reacting with the air.
31	A	The metal that can be obtained by the reduction of its oxide with carbon and from its aqueous chloride by electrolysis is copper. Lead (II) chloride and silver (II) chloride are not aqueous since they are insoluble. Sodium oxide cannot be reduced by carbon, but it can be reduced by electrolysis.
32	C	The gases from the hot air that enters through the bottom of the blast furnace that undergo a reaction are carbon dioxide and oxygen only. Temperatures in the blast furnace are not high enough for the fairly inert nitrogen to react, causing it to leave the top of the furnace.
33	C	The only pair of reagents that can be used to produce hydrogen is zinc and dilute hydrochloric acid. Copper metal is not reactive enough to react with acids while zinc cannot react with water (only steam).
34	B	According to the results displayed in the table, X is the most reactive since it displaces the W^{2+}, Y^{2+} and Z^{2+} ions. Y is the least reactive because it cannot displace any aqueous metal ion. Z is less reactive than W because it cannot displace W^{2+}. Hence the order of reactivity from the most to the least reactive is: X, W, Z, Y
35	D	From the ester formula, $C_2H_5CO_2C_2H_5$, ethanol combines with a carboxylic acid formula of $C_2H_5CO_2H$ (propanoic acid).
36	B	There are 3 isomers of C_4H_8  Note: technically speaking, butene has four isomers, with the inclusion of stereoisomers like cis-trans isomers that differ in their bond directions and rotations. However, since this has not been covered in the syllabus, consideration of these spatial isomers was not done. So whether Option C is acceptable will depend on Cambridge (*grrr* I really dislike such scenarios :( )
37	A	Since both Q and R have the same empirical formula, and R can be obtained by heating of Q with a catalyst, R is an addition polymer formed by monomers of Q.

38	B	From the structures, all of them are alkanes which have the same general formula of C_nH_{2n+2}. **1.** C_3H_8 **2.** C_4H_{10} **3.** C_4H_{10}  A: Only 2 and 3 are isomers of each other. C: Not all have the same physical properties since two of them are isomers of each other. D: They cannot react with aqueous bromine since they do not have C=C double bonds.
39	D	The structure shown is that of propanoic acid which is formed by the oxidation of propanol. A: Propanoic acid can react with ammonia which is a weak alkali. B: It can also react with sodium carbonate. C: It is not ethanoic acid.
40	C	From the formulas of L and M, the macromolecule formed would be a polyamide since L is a di-carboxylic compound while M is a di-amine compound.