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Answers to 2018 O level Chemistry 6092 Paper 1

Question	Answer	Explanation
1	**B**	Under the same conditions, the rate of diffusion of gases is dependent on their molecular weight. Mr(N_2)= Mr(CO)= 28
2	**B**	Paper chromatography is used to separate mixtures of substance into their components. To identify which two dyes make up the ink sample, they should contain spots that are present in the ink sample only (same Rf).
3	**C**	For solution W, when aqueous ammonia is added, white precipitate that is insoluble in excess is present. Thus, we know that solution W contains either Al^{3+} or Pb^{2+} ions. When aqueous sodium hydroxide and aluminium foil is added and warmed, an alkaline gas (ammonia) is produced. This indicates that NO_3^- is present. For solution X, when dilute nitric acid is added followed by aqueous barium nitrate, white precipitate is produced. This indicates the presence of SO_4^{2-}. When aqueous ammonia is added, white precipitate is produced which is soluble in excess giving a colourless solution. This indicates that Zn^{2+} is present. Putting together these information, we can conclude that option C is the answer.
4	**D**	The basic apparatus needed for a titration set up: pipette to withdraw the sample for titration, burette to contain hydrochloric acid, and conical flask to contain the sample and to observe colour change.
5	**A**	The atomic mass is dependent on the number of protons and neutrons in an atom (nucleus).
6	**A**	In order to conduct electricity, a substance must have free charged particles. In a giant lattice, the positive and negative charged ions are held firmly in place when solid. However, when molten, the ions are free to move to conduct electricity. For substance with giant lattice structure, they also have high melting point.
7	**B**	In a unit cell of the lattice, it consists of 4 positive ions and 8 negative ions. Therefore, it gives a formula of YZ_2 and option B is the answer.
8	**C**	Drawing out the structure of CH_2CHCH_3, we can see that there are 7 single bonds and a double bond. Therefore, there are 9 covalent bonds in total.
9	**D**	Copper metal has a metallic structure. It conducts electricity because the electrons are free to move. So statement 2 is correct. Copper ions are held together due to the interactions between the positive copper ions and the negative 'sea of electrons'. The high melting point of copper is due to the strong interactions between the positive copper ions and the electrons. Copper conducts heat because the electrons can move through copper. Therefore, only statement 2 is correct.
10	**B**	A catalytic converter converts pollutants into less toxic substances. It promotes the oxidation of CO to produce CO_2 and the reduction of NO to produce N_2.
11	**C**	n(H_2SO_4) = 0.49/98 = 0.005mol Since H_2SO_4 and NaOH is present in 1:2 ratio,

		n(NaOH) = 0.005 x 2 = 0.01mol Volume(NaOH) = 0.01/ 0.20 = 0.05 dm^3 = 50.0 cm3
12	**C**	n(C_4H_9OH) reacted = 10/74 = 0.135 mol n(C_4H_9Br) produced = 12/137 = 0.0875mol Since 1 mole of C_4H_9OH reacted to give 1 mole of C_4H_9Br, the theoretical yield of C_4H_9Br = 0.135 mol Percentage yield = $\frac{\text{experimental yield}}{\text{theoretical yield}}$ x 100 = (0.0875/0.135) x 100 = 65%
13	**B**	The current flowing at any part of the circuit is the same. Therefore, the cations in the cells must have been different for the increase in mass to be different. (The lower charge ion will cause an increase in mass at a faster rate per flow of current as compared to the higher charge ion). Concentration of the solution does not affect the mass since the current flow is the same. The electrodes used are inert and hence, no loss of mass of electrode should occur.
14	**B**	Copper is lower than hydrogen in the reactivity so it will be reduced. Aluminium oxide is molten so Al will be reduced.
15	**A**	During electrolysis, positively charge ions migrate to the negative electrode (cathode) and get reduced.
16	**D**	Bond formation is an exothermic reaction while bond breaking is an endothermic reaction. As the combustion of ethane is an overall exothermic reaction, we know the total enthalpy of the bonds broken is less than the total enthalpy of the bonds formed. More bonds being formed than broken do not equate to an exothermic reaction as different bonds have different energy.
17	**C**	As the coke cools, the heat is transferred and absorbed by the reaction mixture (products). Therefore, the reaction is an endothermic reaction with the products having higher energy than the reactants. Activation energy in an energy profile diagram is measured from the energy of the reactants to the peak of the energy profile diagram.
18	**D**	A catalyst lowers the activation energy of the reaction without changing the energy levels of the reactants and products.
19	**B**	The volume of gas produced remains the same for both graphs. Thus, we know that to obtain line U, 1 mole of X is reacted with 1 mole of Y. Therefore, only options B and C are possible. However, line U shows a steeper curve which implies an increase in speed of reaction. Speed of reaction can be increased by increasing the concentration of reactant used. Therefore, option B is the answer.
20	**A**	All three reactions involve reduction. In reaction 1, the oxidation state of nitrogen decreases from 0 in N_2 to -3 in NH_3. In reaction 2, the oxidation state of iron decreases from +3 in Fe_2O_3 (haematite) to 0 in Fe. In reaction 3, acidified potassium manganite (VII) is an oxidizing agent and thus, the colour change implies that Mn is reduced from +7 to +2.
21	**B**	For reaction B: the oxidation state of Cl increases from 0 in Cl_2 to +1 in NaOCl. Hence, Cl is oxidized. The oxidation state of Cl decreases from 0 in Cl_2 to -1 in NaCl. Hence it is also reduced.

22	**A**	Option B is wrong as the more ionized the acid is, the lower the pH. For option C, metal hydroxides are alkaline and can reduce excess acidity. For option D, when acid reacts with a metal, the metal is oxidized. Thus, only option A provides the correct explanation.
23	**A**	The neutralization reaction between an acid and alkaline gives salt and water only, hence making the reaction pure. Reaction between potassium and chlorine is pure as well, however, it gives a violent reaction. Other two reactions do not give pure products.
24	**A**	Alkaline solution gives a pH greater than 7 and will give blue or purple colour when universal indicator is added.
25	**D**	When going down the group, the charge of the element and the number of outer shell electrons remain the same. However, the number of protons and the number of inner shell electrons increase as the group is descended.
26	**B**	For group 1 elements, the reactivity increases as you go down the group due to the increase in atomic size and the attraction from the nucleus to the outer shell electrons is weaker. Therefore, it is easier to lose an electron to form positively charged ions. For group 7 elements, reactivity decreases as you go down the group due to increase in atomic size. Therefore, it is more difficult to accept electrons to form negatively charged ions. Thus, W and Z would react less violently together.
27	**D**	Transition metals in general have: high melting and boiling points, high densities, variable oxidation states and form coloured compounds.
28	**D**	Alloys are made by combining two or more metallic elements. Thus, their structures contain a 'sea of electrons'. They are good conductors of electricity due to the mobile electrons of the metals. As they are mixture, they cannot be represented by a molecular formula.
29	**A**	A more reactive metal would displace a less reactive metals in an aqueous solution.
30	**D**	Copper, lead and silver are unreactive and do not react with water or steam. Zinc reacts with steam to give off hydrogen gas and metal oxide.
31	**C**	Metals can be obtained by reduction using carbon if it lie below carbon in the reactivity series. Electrolysis is necessary only for metals that lie above carbon in the reactvity series.
32	**D**	As magnesium is used, the symbol is Mg. Mg gets oxidized instead of the steel to protect it from corrosion.
33	**A**	Methane reacts with oxygen in the ratio of 1:2. Therefore, 100cm^3 of methane requires 200cm^3 of oxygen for complete combustion. There is insufficient oxygen for complete combustion and incomplete combustion will occur, giving CO, CO_2 and unreacted methane gas. Note that water is present in the liquid phase as the reaction is cooled to room temperature.
34	**D**	As the enthalpy change is negative, energy is released so energy from sunlight is not needed. In respiration, large glucose molecule is broken down into smaller molecules as from the equation. The

		carbon atom in glucose becomes oxidized while the oxygen atoms become reduced in respiration. The reverse of respiration is photosynthesis which takes in 2830kJ/mol of energy, thus, making option D the correct answer.
35	**B**	Propanol produces carboxylic acid on complete oxidation and the number of carbon atoms should remain the same.
36	**B**	Complete combustion of hydrocarbons produces carbon dioxide and water.
37	**D**	In the reaction between propene and bromine, the double bond breaks, and bromine atom becomes attached to each carbon atom.
38	**C**	In the preparation of ethanol from ethane, the C=C double bond is converted to C-C. In the preparation of margarine from vegetable oil, hydrogenation occurs where the double bonds are converted to single bonds. The preparation of ester from an alcohol and carboxylic acid only involves the breaking of single bonds.
39	**C**	An alcohol and a carboxylic acid reacts together to form an ester with the removal of water molecule. Ester has functional group –COO, alcohol has functional group –OH and carboxylic acid has functional group –COOH. Therefore, the ester molecule has more oxygen atoms than the alcohol molecule.
40	**C**	From the structures of compounds X and Y, statement 1 is correct. Only compound Y contains a carbon atom with four different groups attached to it. A compound can form polymer if it contains C=C double bond. Thus, only compound X can form polymer and option C is correct.