

Answers for 6092 Prelim Paper 1 (2024)

S/N	Ans	Explanation
1	D	
2	D	Higher molecular mass and lower temperature, particles move slower. Hence, lower rate of diffusion.
3	C	At -190°C , nitrogen exists as a gas, hence weakest forces of attraction between particles.
4	B	Y will distil first since it has a lower boiling point than Z. Y will float on Z, hence, Z will be collected first using separating funnel.
5	D	The presence of zinc ions forms white ppt with aqueous ammonia and dissolves in excess to form a colourless solution.
6	D	The two sub-atomic particles are electron (-1 charge) and neutron (0 charge). Hydrogen atom has one proton (one electron) but no neutron. Hydrogen atom gives away one electron to form hydrogen ion, hence, no electrons present in hydrogen ion.
7	D	Evaporating the resulting solution is a physical change. Hence, statements from 1 to 3 are incorrect as there is no chemical change. Molecules of an element are formed because hydrogen is produced when magnesium reacts with hydrochloric acid.
8	B	Hydrocarbons are covalent compounds. As relative molecular mass increases, the stronger the intermolecular forces of attraction between molecules.
9	C	Graphite has delocalised electrons from the carbon atoms which will move along the layers of carbon atoms. Potassium chloride is an ionic compound, hence conduct electricity in aqueous state due to the presence of mobile ions.
10	D	Graphene has similar structure as graphite, hence, similar properties.
11	A	The number of moles of ammonia is the highest, 0.117 mol, compared to the other compounds. Hence, ammonia has the greatest number of molecules.
12	D	number of moles of $\text{B}_2\text{O}_3 = 2.50 \text{ g} / 70 = 0.0357 \text{ mol}$ number of moles of $\text{CO}_2 = 0.80 \text{ g} / 44 = 0.01818 \text{ mol}$ mol ratio of B_2O_3 to $\text{CO}_2 = 2: 1$, hence, 4 boron atoms to 1 carbon atom, B_4C
13	C	When added to hydrochloric acid, carbon dioxide gas is produced. number of moles of $\text{CO}_2 = 0.6 / 24 = 0.025 \text{ mol}$ mol ratio of CO_2 to $\text{CaCO}_3 = 1 : 1$, hence, 0.025 mol CaCO_3 mass of $\text{CaCO}_3 = 0.025 \times 100 \text{ g} / \text{mol} = 2.5 \text{ g}$ percentage purity = $2.5 / 3 \times 100\% = 83.3\%$

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14	B	number of moles produced in reaction 1 = $1.2 / 24 = 0.05 \text{ mol}$ number of moles produced in reaction 2 = $4.0 / 40 = 0.10 \text{ mol}$ number of moles produced in reaction 1 = $8.2 / 84 = 0.0976 \text{ mol}$
15	C	As the elements are arranged in increasing proton number, W has the least number of valence electrons. Since all three elements are in period 3, all have three electron shells. Hence, statements 1 and 3 are correct.
16	B	Going down group 17, the reactivity of halogen decreases. Chlorine being more reactive than bromine can displace bromine from its solution producing aqueous bromine (orange solution).
17	D	Manganese is a transition element and form ions with variable oxidation states.
18	B	This is a dilute solution of acid, hence, concentration of hydrogen ions should be lesser than water molecules. As an acid, the concentration of hydrogen ions is greater than the concentration of hydroxide ions. Hence, pH less than 7.
19	D	Potassium chloride is a SPA salt; soluble salt. Hence, method of preparation is titration.
20	C	Oxide of M is an acidic oxide; non-metal and oxygen. Oxide of N is a basic oxide as it produces hydroxide ions in water; metal and oxygen. Oxide of O is an amphoteric oxide. Possible oxides: ZnO, Al_2O_3, PbO. Given that all three are in the same period and elements on the periodic table changes from metal to non-metal (moving from left to right), increasing proton number: N, O and M.
21	B	Referencing the equivalence points indicated on the graph, X is around pH 4 while Y is around pH 9. To determine these two end-points, the indicator chosen has to reflect a colour change in pH 4 and pH 9.
22	D	Carbonate of metal X can be decomposed when heated (colour change observed). Carbonate of metal Y cannot be decomposed by heat. Hence, Y is more reactive than X. Both carbonates will react with acid to produce carbon dioxide gas. X could be a transition metal since the carbonate of X is green in colour. Transition metals form coloured compounds.

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23	C	Iron, a more reactive metal than copper, will displace copper from its solution to form copper solid.
24	D	All three metals are positioned below carbon in the reactivity series hence can be reduced by carbon.
25	B	Chlorofluorocarbon will break down in strong UV radiation producing chlorine atoms which will deplete the ozone layer.
26	D	Carbon dioxide is responsible for the formation of acid rain, instead of carbon monoxide. Sulfur dioxide is produced during volcanic eruptions instead of oxides of nitrogen.
27	C	Cations move towards cathode and are reduced to form metal.
28	A	Cl_2 is the oxidising agent (oxidises iron(II) ions to iron(III) ions), hence, it is reduced by iron(II) ions.
29	A	Iron is more reactive than tin. Magnesium is more reactive than iron (the setup on the top right). Zinc is more reactive than iron (bottom left). Iron is more reactive than copper (bottom right). Need to determine the reactivities between (1) copper and tin and (2) magnesium and zinc.
30	C	In concentrated NaCl , chlorine gas is produced at the anode. Left H^+ and OH^- in the solution, hence, solution is neutral. In dilute NaCl , hydrogen gas is produced at the cathode. Left OH^- ions in the solution, hence, solution is alkaline.
31	A	Since photosynthesis is the backward reaction of respiration, the value of enthalpy change remains the same but it is an endothermic change.
32	B	Since it was mentioned that reaction is very slow without a catalyst, this indicates that the reaction has a high activation energy, very few reactant molecules have energy equal or greater than activation energy.
33	C	In expt 2, the presence of lead (IV) oxide speeds up reaction as shown with the steeper gradient on graph. Hence, frequency of effective collisions increase. Without the catalyst, lead (IV) oxide, the activation energy is higher in expt 1.

S/N	Ans	Explanation
34	B	Energy released by 1g of hydrogen = $\frac{1}{2} \times -286 = 143$ kJ Energy released by 1g of ethanol = $\frac{1}{46} \times -1370 = 29.8$ kJ Energy released by 1g of methanol = $\frac{1}{32} \times -882 = 27.6$ kJ Energy released by 1g of propanol = $\frac{1}{60} \times -2010 = 33.5$ kJ
35	B	The lower the number of carbon atoms, the higher the octane number indicating that it is easier for the fuel to auto-ignite. The octane number for alkane is consistently lower than the octane number for alkene but this does not explain statement 1.
36	C	P and R has the same arrangement; hence they are the same molecule. All four hydrocarbons have the same molecular formula but only P, Q, S or R, Q, S are isomers.
37	B	Number of mol of hydrogen gas = $0.0586/24 = 0.00244$ mol Number of mol of hydrocarbon reacted = $0.1 / 82 = 0.00122$ mol Mole ratio of hydrogen to hydrocarbon = 2 : 1, indicating that 2 mol of hydrogen (H ₂) is added to 1 mol of hydrocarbon. Thus, 2 sets of carbon-carbon double bonds.
38	D	This organic compound is propanoic acid. It has acidic properties, hence will react with ammonia (alkali) to form salt and water. Also react with sodium carbonate. Oxidation of propanol will produce propanoic acid.
39	C	The polymer is a polyester, COO linkage. Hence, it's monomer has hydroxyl (-OH) and carboxyl group (COOH).
40	C	The polymer is a polyamide. Hence, it is made from di-amine and di-carboxylic acid.