

Q1:

- 1) 3 outermost shell electrons.
 - ☐ 2) 7 outermost shell electrons.
 - 3) 2 outermost shell electrons.
 - 4) 1 outermost shell electrons.
 - 5) 6 outermost shell electrons.
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Q2:

As the trivalent cation (+3 ion) has 24 electrons, the atom has 27 electron.

For an atom, the number of electrons is equal to the number of protons. Therefore, the atom has 27 protons.

As the atom has 32 neutrons, the mass number is $32 + 27 = 59$.

Only the atom of ☐ (4) has a mass number of 59. Hence, it is the answer.

Alternative The atomic number of the atom is 27, where the corresponding element symbol is *Co*. Therefore, the answer is ☐ (4).

Q3:

The number of molecules is directly proportional to the number of moles. Now that the mass of gases are the same, the larger the molecular mass, the smaller the number of moles and hence the smaller number of molecules.

The molecular masses are:

1) 40

2) $2 \cdot 36 = 72$

3) $12 + 16 = 28$

4) $3 \cdot 16 = 48$

5) $32 + 2 \cdot 16 = 64$

Q4:

As I_2 is very volatile, it sublimes to gas easily and leave the impurities. Collect the sublimed gas can obtain a pure I_2 .

KNO_3 is a solution, where the impurities are dissolved inside and cannot be separated by distillation. However, the impurities become solid in KNO_3 crystal and we can purify it by recrystallisation.

Given the above, the correct combination is $\boxed{(4)}$.

Q5:

The mass fraction of Na_2SO_4 in the compound = $\frac{2 \cdot 23 + 32 + 4 \cdot 16}{18n + 2 \cdot 23 + 32 + 4 \cdot 16} = \frac{71}{9n + 71}$.

When heating the compound, the mass of the anhydrous compound obtained will be $\frac{71}{9n + 71}$ times the mass of the compound. Therefore, we have

$0.322 \cdot \frac{71}{9n + 71} = 0.142$, and $n = \boxed{10}$.

Q6:

As the forward reaction is exothermic, by Le Chatelier's principle, the equilibrium position shifts to the left and more NO_2 will be produced when the temperature is increased, which will result in a darker colour $\boxed{(a)}$.

As the number of gas molecules at the reactant side is more than that at the product side, by Le Chatelier's principle, the equilibrium position shifts to the right when the pressure is increased. At first, the increase in pressure will decrease the concentration of chemicals, hence the colour is darkened. However, after a sufficient duration, the increased N_2O_4 yield due to the shift will counter the effect and lighten the colour $\boxed{(c)}$.

Q7:

1) Is linear but contains $C \equiv C$ triple bond instead of double bond.

$\boxed{2)}$ Is linear and contains $C = O$ double bond.

3) Is bent and contains no double bonds.

4) Is planar and contains no double bonds.

5) Is tetrahedral although it contains $C = C$ double bond.

Q8:

The formula mass of air = $2 \cdot 14 \cdot \frac{4}{1+4} + 2 \cdot 16 \cdot \frac{1}{1+4} = 28.8$.

By $pV = nRT$, we have $p = \frac{\rho}{m}RT$, or $\rho = \frac{mp}{RT}$. Therefore, under the same pres-

sure and temperature, the density of gas is directly proportional to its formula mass.

Comparing the formula masses:

1) $12 + 4 = 16 < 28.8$

2) $3 \cdot 12 + 8 = 44 > 28.8$

3) $1 + 19 = 20 < 28.8$

4) $2 \cdot 14 = 28 < 28.8$

5) $14 + 3 = 17 < 28.8$

Q9:

The oxidation number of S atom in H_2SO_4 is +6 and that in SO_2 is +4.

Therefore, the change in oxidation number is $6 - 4 = 2$.

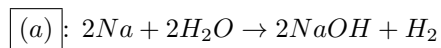
Q10:

The ions present in the solution are Cu^{2+} , SO_4^{2-} , H^+ and OH^- . Among them, Cu^{2+} has the highest oxidising power. The only reducing agent that can reduce Cu^{2+} is the Cu electrode.

Therefore, Cu is oxidised to Cu^{2+} at the anode (i.e. A) and Cu^{2+} is reduced to Cu at the cathode (i.e. B).

The changes at A and B will hence be a decrease and an increase in mass respectively (3) .

Q11:



(b): No reaction.

$\boxed{(c)}$: H^+ ions are reduced to H_2 at the cathode and OH^- ions are oxidised to O_2 at the anode.

(d): MnO_2 is reduced to Mn^{2+} at the anode and Cl^- ions are oxidised to Cl_2 at the cathode.

Q12:

(a): $NaCl(aq)$ or $NaCl(l)$ does contain electricity. However, $NaCl(s)$ does not, as the ions are not mobilised (T).

(b): T, refer to (a).

(c): For concentrated $NaCl(aq)$, Cl^- are oxidised to Cl_2 instead of OH^- (T).*

Therefore, the answer is $\boxed{(1)}$.

*: However, it is not the case of not sufficiently concentrated $NaOH(aq)$. The question didn't state very clearly.

Q13:

(a): Al_2O_3 is amphoteric. CaO and Na_2O are basic.

(b): Both HCl , HI and H_2S are acidic.

(c): The hydrogen compounds of C , N and P are CH_4 , NH_3 and PH_3 respectively.

Given the above, the correct combination is $\boxed{(4)}$.

Q14:

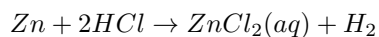
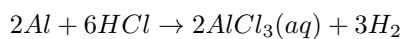
The question is equivalent to the metal that cannot displace Ag^+ ion from its aqueous solution.

Therefore, we are going to spot the metal that has a lower reactivity than Ag .

Among the four options, \boxed{Pt} has a lower reactivity than Ag .

Q15:

(1): True for both Al and Zn :

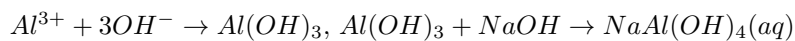


(2): Not true for both Al and Zn . Metals have no direct reaction with alkalis.

$\boxed{(3)}$: True for Zn but not Al :



(4): True for both Al and Zn :



Q16:

The answer is $\boxed{(6)}$, which is just some memorising tasks.

Q17:

Compounds with hydrogen bonds are generally easily soluble in water:

(1): Both compounds can form hydrogen bond with water.

(2): Both compounds can form hydrogen bond with water.

(3): Phenol can form hydrogen bond with water.

$\boxed{(4)}$: Both compounds cannot form hydrogen bond with water.

(5): Formaldehyde can form hydrogen bond with water.

Q18:

(a): But-1-ene + $Cl_2 \rightarrow$ 1,2-dichlorobutane, where the second carbon atom is a chiral carbon. Therefore, optical isomers are formed.

Methylpropene + $Cl_2 \rightarrow$ dichloromethylpropane, where no chiral carbons exist.

Therefore, no optical isomers are formed.

(b): The first carbon's braches are the same (-H) for but-1-ene. Therefore, no cis-trans isomers exist.

cis-but-2-ene and trans-but-2-ene exist for but-2-ene.

The first carbon's braches are the same (-H) for methylpropene. Therefore, no

cis-trans isomers exist.

Given the above, the correct combination is $\boxed{(2)}$.

Q19:

Oletic acid contains 1 $C = C$ double bond.

As the fat contains 3 oletic acids, it contains 3 $C = C$ double bond.

1 mol of H_2 is required to saturate 1 mol of $C = C$ double bond. Therefore,

$3 \cdot 0.10 = 0.3 \text{ mol}$, i.e. $0.3 \cdot 22.4 = \boxed{6.72} \text{ L}$ of H_2 is required.

Q20:

The polymerisation is a condense polymerisation with a carboxylic acid and an amine.

It can be identify that the two monomers are $HOOC - (CH_2)_4 - COOH$ and $H_2N - (CH_2)_6 - NH_2$.

Therefore, the answer is $\boxed{(3)}$.