CHEMISTRY ONLINE TUITION

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CHEMISTRY
PHYSICAL CHEMISTRY

Level & Board	CIE (A-LEVEL)
TOPIC:	STATE OF MATTER
PAPER TYPE:	SOLUTION - 1
TOTAL QUESTIONS	6
TOTAL MARKS	51

States of Matter

(a) (i) The volume of gas molecules is negligible as compared to total volume of the gas.

(ii) There are no intermolecular forces between gas molecules.

(b) P: It is the pressure exerted by the gas measured in pascals (Pa).

V: The volume of gas, means volume of the container of gas measured in (m^3).

T: The absolute temperature measured in kelvin (K).
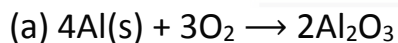
(c) (i) $pV = \dfrac{m}{M_r} RT$

$$M_r = \dfrac{mRT}{pV}$$

$$= \dfrac{0.103 \times 8.31 \times 297}{99.5 \times 10^3 \times 63.8 \times 10^{-6}}$$

= 40.0 gmol^{-1}

This gas is argon.

(ii) Ammonia molecules have intermolecular hydrogen bods hence deviates most from
Ideal behavior while in nitrogen and argon weak van der waal's forces of attraction
Are present between molecules

2)

(a) 4Al(s) + 3O$_2$ $\longrightarrow$ 2Al$_2$O$_3$

(b) (i) Al$_2$O$_3$ has giant ionic crystal lattic structure, oppositely charged ions held by strong
Electrostatic forces of attraction. Hence very high melting point.

(ii) SO$_3$ is macromolecular covalent compound with weak van der waal's forces of
attraction between molecules hence low boiling point.

(iii) SiO_2 is macromolecular covalent compound large number of strong inter atomic

Covalent bonds which are very difficult to break hence high melting point. While P_4O_{16}

Is simple molecular with very weak intermolecular forces between molecules hence its

Melting point is less than SiO_2.

(c) (i) an alkaline solution: $Na_2O + H_2O \longrightarrow 2NaOH$

(ii) an acidic solution: $SO_2 + H_2O \longrightarrow H_2SO_3$

3)

(a) $H \overset{x}{\bullet} C \overset{\circ\circ}{\underset{\circ\circ}{\vdots}} C \overset{\circ}{\times} H$

(b) $pV = nRT$

$$n = \frac{Pv}{RT} = \frac{(1515\times10^3)(76\times10^{-3})}{8.31\times298} = 46.5 \; moles$$

(c) (i) $CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$

(ii) $n(C_2H_2) = n(CaC_2) = 100\times 46.5$

Mass oc CaC_2 $= 100\times 46.5 \times 64$

$= 297570$ g

$= 297$ kg

4)

(a) particle: Simple molecules.

Formula: I_2

(b) (i) Copper has metallic bond with strong electrostatic forces of attractions between copper

cation and sea of electrons hence high melting point and remains solid of 50 ^{0}C.

(ii) iodine is simple molecular covalent compound with weak van der waal's forces of

Attraction between molecules hence low melting point, boiling point and easily

Vaporizes at 50 ^{0}C.

(c) (i) Chlorine is acting as oxidizing agent.

(ii) Iodine is weaker oxidizing agent than chlorine hence cannot oxidize copper solid to

copper ions.

5)

(a) Carbon dioxide is a simple covalent molecule. There are weak intermolecular forces i.e.

Induced dipole – induced dipole interactions, between molecules. SiO_2 has a giant covalent

Macro molecular structure. That is why CO_2 is a gas and SiO_2 is a solid at room

Temperature.

(b)

● : O

● : SI

(c) (i)

- Molecules have weak intermolecular forces between molecules.
- The collision between the molecules are perfectly elastic.
- The volume of molecule is negligible.
- The kinetic energy of molecules is directly proportional to the temperature.
- The pressure exerted by the gas is due to the collision between the gas molecules and

the walls of the container.

- The molecules move in random motion.

(i) Inter – molecular forces among CO2 molecules are strong enough to deviate from ideal gas behavior.

(d) Each carbon atoms is covalently bonded with three carbon atoms, having one free electron, which is delocalized to make it conductor of electricity.

(e) (i) $2C + SiO_2 \rightarrow SiC + CO_2$

(ii) form: diamond.

Reason: Si and C bond alternately to give diamond like structure, which makes it hard.

6)

(a)

element	Particle	Formula
copper	cations	Cu^{2+}
argon	Atoms or molecules	Ar

(b) In copper metal cations are surrounded by sea of electrons to form strong metallic bond while in case of argon weak Vander waal's forces of attractions are presented between the molecules.

(c) (i) Chlorine behaves as an oxidizing agent because copper is oxidized from 0 oxidation state to +2.

(ii) Ar has very high first ionisaton energy. Its outer most shell is completely filled and is highly unreactive.

(d) From Neon to Xenon, size of the molecule increases and number of electrons also Increases, hence strength of Vander waal's forces increases, Therefore, melting point Increases from Ne to Xe.

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