States of Matter

Question 1.
Three containers A, B, C of equal volume contain oxygen, neon and methane respectively at same temperature and pressure. The increasing order of their masses is
(a) A < B < C
(b) B < C < A
(c) C < A < B
(d) C < B < A

▼ Answer

Answer: (d) C < B < A
Explanation:
Under similar conditions of temperature and pressure, equal volumes of different gases contain equal number of moles.
Therefore, Masses of O_2, Ne and CH_4 will be in the ratio 32 : 20 : 16
So, increasing order of their mass is oxygen > neon > methane

---

Question 2.
A gas will approach ideal behaviour at
(a) Low temperature, low pressure
(b) Low temperature, high pressure
(c) High temperature, low pressure
(d) High temperature, high pressure

▼ Answer

Answer: (c) High temperature, low pressure
Explanation:
At high temperature and low pressure, the gas volume becomes large and both intermolecular force as well as the molecular volume can be neglected. Under this condition postulate of kinetic theory applies appropriately and gas approaches ideal behavior.

Question 3.
Containers A and B have same gas. Pressure, volume and temperature of A are all twice those of B. The ratio of number of molecules of A and B is
(a) 1 : 2
(b) 2 : 1
(c) 1 : 4
(d) 4 : 1

▼ Answer

Answer: (b) 2 : 1
Explanation:
For B, $P_1 = P$, $V_1 = V$, $T_1 = T$.
For A, $P_1 = 2P$, $= 2P$, $V_2 = 2P$,$T_1 = 2T$
Applying ideal gas equation, PV = nRT.
$(P_1V_1)/ (n_1RT_1) = (P_2V_2)/ (n_2RT_2)$
or $(PV)/(n_1RT) = (2p \times 2V)/(n_2R(2T))$
or $(n_2/n_1) = (2/1)$

Question 4.
According to kinetic theory of gases,in an ideal gas,between two successive collisions a gas molecule travels
(a) In a circular path
(b) In a wavy path
(c) In a straight line path
(d) With an accelerated velocity

▼ Answer

Answer: (c) In a straight line path
Explanation:
In between two successive collisions, no force is acting on the gas molecules. Resultantly they travel with uniform velocity during this interval and hence, moves along a straight line.

Question 5.
When did substances exist in different crystalline forms the phenomenon is called :
(a) Allotropy
(b) Polymorphism
(c) Polymerization
(d) Isomorphism

▼ Answer

Answer: (b) Polymorphism
Explanation:
Polymorphism, in crystallography, the condition in which a solid chemical compound exists in more than one crystalline form; the forms differ somewhat in physical and, sometimes, chemical properties, although their solutions and vapours are identical.

Question 6.
SI unit of pressure is :
(a) Pascal
(b) torr
(c) mm of Hg
(d) none of the above

▼ Answer

Answer: (a) Pascal
Explanation:
Pressure is the effect of a force applied to an area of any surface. The basic unit of pressure is obtained from combining base units which are force over area.
Pressure = (Force/Area)
Unit of force is: Newton(N)
Unit of Area is: m^2(metre)
$P = N/m^2$
And the unit of pressure in SI system is Pascal which is denoted by Pa.
$1\ Pa = 1\ (N/m^2)$

Question 7.
If the pressure of a gas is increased then its mean free path becomes:
(a) 0
(b) Less
(c) More
(d) Infinity

▼ Answer

Answer: (b) Less
Explanation:
As gas pressure increases mean free path of the gas decreases.
Mean free path is the distance travelled by a gas molecule between two successive collisions.
So, as pressure increases number of collisions also increases. Hence, mean free path decreases.

Question 8.
1 atmosphere is equal to:
(a) 1 torr
(b) 760 cm
(c) 760 mm
(d) 76 torr

▼ Answer

Answer: (c) 760 mm
Explanation:
Standard atmosphere, unit of pressure, equal to the mean atmospheric pressure at sea level. It corresponds to the pressure exerted by a vertical column of mercury (as in a barometer) 760 mm (29.9213 inches) high. One standard atmosphere, which is also referred to as one atmosphere, is equivalent to 101,325 pascals, or newtons of force per square metre (approximately 14.7 pounds per square inch).

Question 9.
Grahams law refers to :
(a) Boiling point of water
(b) Gaseous Diffusion
(c) Gas Compression
(d) Volume changes of gases

▼ Answer

Answer: (b) Gaseous Diffusion
Explanation:
Graham found experimentally that the rate of effusion of a gas is inversely proportional to the square root of the mass of its particles. This formula can be written as:
$(Rate_1/ Rate_2) = (M_2/ M_1)^{(1/2)}$
where:
$Rate_1$ is the rate of effusion for the first gas. (volume or number of moles per unit time).
$Rate_2$ is the rate of effusion for the second gas.
M_1 is the molar mass of gas 1
M_2 is the molar mass of gas 2.

Grahams law states that the rate of diffusion or of effusion of a gas is inversely proportional to the square root of its molecular weight. Thus, if the molecular weight of one gas is four times that of another, it would diffuse through a porous plug or escape through a small pinhole in a vessel at half the rate of the other (heavier gases diffuse more slowly). A complete theoretical explanation of Grahams law was provided years later by the kinetic theory of gases. Grahams law provides a basis for separating isotopes by diffusion a method that came to play a crucial role in the development of the atomic bomb

---

Question 10.
The rise or fall of a liquid within a tube of small bore is called :
(a) Surface Tension

(b) Capillary Action
(c) Viscosity
(d) Formation of Curvature

▼ Answer

Answer: (b) Capillary Action
Explanation:
Capillarity, rise or depression of a liquid in a small passage such as a tube of small cross-sectional area, like the spaces between the fibres of a towel or the openings in a porous material. Capillarity is not limited to the vertical direction. Water is drawn into the fibres of a towel, no matter how the towel is oriented.

Liquids that rise in small-bore tubes inserted into the liquid are said to wet the tube, whereas liquids that are depressed within thin tubes below the surface of the surrounding liquid do not wet the tube. Water is a liquid that wets glass capillary tubes; mercury is one that does not. When wetting does not occur, capillarity does not occur.

Capillarity is the result of surface, or interfacial, forces. The rise of water in a thin tube inserted in water is caused by forces of attraction between the molecules of water and the glass walls and among the molecules of water themselves. These attractive forces just balance the force of gravity of the column of water that has risen to a characteristic height. The narrower the bore of the capillary tube, the higher the water rises. Mercury, conversely, is depressed to a greater degree, the narrower the bore.

Question 11.
The rates of diffusion of gases are inversely proportional to square root of their densities . This statement refers to :
(a) Daltons Law
(b) Grahams Law
(c) Avogadros Law
(d) None of the Above

▼ Answer

Answer: (b) Grahams Law
Explanation:
Grahams law states that the rate of diffusion of a gas is inversely proportional to the square root of its molecular weight. In the same conditions of temperature and pressure, the molar mass is proportional to the mass density. Therefore the rate of diffusion of different gases is inversely proportional to the square root of their mass densities.
$r \propto \sqrt{(1/d)}$
and $r \propto \sqrt{(1/M)}$

Question 12.
Cooling is caused by :
(a) Evaporation
(b) Convection
(c) Conduction
(d) none of the above

▼ Answer

Answer: (c) Conduction
Explanation:
Evaporation is a cooling process because when liquid turns to gas. When a liquid evaporates, its molecules convert from the liquid phase to the vapor phase and escape from the surface. Heat drives this process. In order for the molecule to leave the liquid surface and escape as a vapor, it

must take heat energy with it. The heat that it takes with it comes from the surface from which it evaporated. Since the molecule is taking heat with it as its leaving, this has a cooling effect on the surface left behind.

Question 13.
If helium and methane are allowed to diffuse out of the container under the similar conditions of temperature and pressure, then the ratio of rate of diffusion of helium to methane is:
(a) 2 : 1
(b) 1 : 2
(c) 3 : 5
(d) 4 : 1

▼ Answer

Answer: (a) 2 : 1
Explanation:
According to Grahams law
$(r_1/ r_2) = \sqrt{(M_2/M_1)}$
$(r_{He}/r_{CH4}) = \sqrt{(16/4)}$
= (2/1)

Question 14.
Equal masses of ethane and hydrogen are mixed in an empty container at 25°C . The fraction of total pressure exerted by hydrogen is
(a) 1 : 2
(b) 1 : 1
(c) 01 : 16
(d) 15 : 16

▼ Answer

Answer: (d) 15 : 16
Explanation:
Let 30g of both are mixed.
Moles of H_2 = (30/2) =15
Moles of C_2H_6 = (30/30) = 1
Mole fraction of H_2 = (15)/(1 + 15) = (15/16)
Which is also the fraction of total pressure executed by H_2

Question 15.
The volume of 2.8 g of carbon monoxide at 27°C and 0.0821 atm is
(a) 30 L
(b) 3 L
(c) 0.3 L
(d) 1.5 L

▼ Answer

Answer: (a) 30 L
Explanation:
According to the ideal gas equation, we have
PV = nRT
PV = (w/M) RT
V = (w/M) (RT/P)
Given values are:
w = 2.8 g

M = Molar mass of CO = 28 g mol^{-1}
T = 27°C = (273 + 27) = 300 K
P = 0.821 atm
R = 0.0821 L atm mol^{-1} K^{-1}
Putting the values in the formula we get :
V = (2.8 g /28 g mol^{-1}) × (0.0821 L atm mol^{-1} K^{-1}) × (300 K)/(0.821 atm)
= 3 L

Question 16.
According to kinetic theory of gases,in an ideal gas,between two successive collisions a gas molecule travels
(a) In a circular path
(b) In a wavy path
(c) In a straight line path
(d) With an accelerated velocity

▼ Answer

Answer: (c) In a straight line path
Explanation:
In between two successive collisions, no force is acting on the gas molecules. Resultantly they travel with uniform velocity during this interval and hence, moves along a straight line.

Question 17.
Standard conditions are :
(a) 0°C and 14. 7mm
(b) 32°F and 76 cm
(c) 273°C and 760 mm
(d) 4°C and 76 m

▼ Answer

Answer: (b) 32°F and 76 cm
Explanation:
Standard conditions for temperature and pressure are standard sets of conditions for experimental measurements to be established to allow comparisons to be made between different sets of data. Until 1982, STP was defined as a temperature of 273.15 K (0 °C, 32 °F) and an absolute pressure of exactly 1 atm (101.325 kPa).
Since 1982, STP is defined as a temperature of 273.15 K (0 °C, 32 °F) and an absolute pressure of exactly 105 Pa (100 kPa, 1 bar).

Question 18.
The internal resistance to the flow of a liquid is called :
(a) Surface Tension
(b) Diffusion
(c) Viscosity
(d) Osmosis

▼ Answer

Answer: (c) Viscosity
Explanation:
Viscosity is a measure of a fluids resistance to flow. It describes the internal friction of a moving fluid. A fluid with large viscosity resists motion because its molecular makeup gives it a lot of internal friction. A fluid with low viscosity flows easily because its molecular makeup results in very

little friction when it is in motion.
Gases also have viscosity, although it is a little harder to notice it in ordinary circumstances.

Question 19.
When did substances exist in different crystalline forms the phenomenon is called :
(a) Allotropy
(b) Polymorphism
(c) Polymerization
(d) Isomorphism

▼ Answer

Answer: (b) Polymorphism
Explanation:
Polymorphism, in crystallography, the condition in which a solid chemical compound exists in more than one crystalline form; the forms differ somewhat in physical and, sometimes, chemical properties, although their solutions and vapours are identical.

Question 20.
The temperature above which the gas cannot be liquified by pressure alone is called :
(a) Melting Point
(b) Critical Temperature
(c) Transition Temperature
(d) Absolute Zero

▼ Answer

Answer: (b) Critical Temperature
Explanation:
The critical temperature of a gas is the temperature below which it can be liquefied by application of pressure.
