PRAADIS EDUCATION

CHEMISTRY XI

STATES OF MATTER

OBJECTIVE QUESTIONS

Thermal Energy

1. Which energy is generated from due to the motion of its particles?
a) Thermal
b) Muscular
c) Momentary
d) Potential

Answer: a
Explanation: Thermal energy is the result of the motion of a body's atoms and molecules. It depends on the temperature and is directly proportional to each other. It's the average of kinetic energy and is responsible for a body's motion.

2. Which of the following posses highest thermal energy?
a) Water at 0°
b) Iron at 37°
c) Milk at 50°
d) Chocolate at 26°

Answer: c
Explanation: As we know that, the thermal energy is dependent on temperature, among the options milk at given temperature has a higher temperature, so milk posses higher thermal energy than others (temperature is proportional to thermal energy).

3. Thermal energy is an example of _____
a) kinetic energy
b) potential energy
c) muscular energy
d) momentary energy

Answer: a
Explanation: Thermal energy is also defined as an average measure of kinetic energy. It is a result of a body's motion and that of its atoms and molecules. Thermal energy, which is an example of kinetic energy is responsible for a body's motion.

4. The faster the body moves, the higher the thermal energy.
a) True
b) False

Answer: a
Explanation: As thermal energy is a type of kinetic energy, the faster the object moves, the higher the thermal energy. The measure of an average of kinetic energy is thermal energy. So the above statement regarding thermal energy is true.

5. _____ of particles results in the rise of thermal energy.
a) Direction
b) Vibration
c) Shape
d) Atoms

Answer: b
Explanation: Temperature increases due to the vibration of particles. As we know that temperature is directly proportional to the thermal energy, the vibration of particles results in the rise the thermal energy.

6. Which of the following may not be a source of thermal energy?
a) Micro-oven
b) Sun

c) Moon
d) Heater

Answer: c
Explanation: Thermal energy is also known as heat energy, it's source s are the same as heat energy. As we know that micro-oven produces heat waves to raise food's temperature and bake them, sun for solar energy and heater produces heat. Moon doesn't.

7. Choose the best option. Boiling kettle is an example of _____
a) only thermal energy
b) both thermal and Kinetic energy
c) only kinetic energy
d) potential and Kinetic energy

Answer: b
Explanation: A boiling kettle produces heat, and causes the liquid's temperature to rise. As the temperature rises, it results in thermal energy, but as kinetic energy is a type of kinetic energy, the answer both thermal and kinetic energy is the best option.

8. Thermal energy transfer can occur through _____ ways.
a) 2
b) 1
c) 3
d) 0

Answer: c
Explanation: Thermal can transfer through ways, there are namely conduction, convection, and radiation. Conduction needs direct contact of particles, convection is possible to fluids and radiation through electromagnetic waves.

9. In which of the following particles, convection is not possible?
a) Milk
b) Water

c) Atmosphere
d) Iron

Answer: d
Explanation: Convection is a way of transferring thermal energy. It is possible in fluids only. Fluids include liquids and gases. Milk and water are liquids, whereas the atmosphere is a gas. So convection is not possible in iron, which is a solid.

10. Sunlight and heat reaching earth is an example of _____
a) conduction
b) radiation
c) convection
d) both convection and conduction

Answer: b
Explanation: Thermal energy is transferred in the form of heat and sunlight. This process occurs through radiation, which is a type of transfer of thermal energy. It requires no direct contact and uses electromagnetic waves.

Intermolecular Forces vs Thermal Interactions

1. What is the result of balancing between intermolecular forces and thermal energy?
a) matter
b) three States of matter
c) four States of matter
d) chemical bond formation

Answer: b
Explanation: In a molecule, intermolecular forces always tend to keep molecules with each other while the thermal energy always tries to

separate them. So the result of balancing between intermolecular energy and thermal energy is three States of matter.

2. Which state of matter is likely to form when there is a predominance of intermolecular energy?
a) solid
b) liquid
c) gas
d) both solid and gas

Answer: a
Explanation: When there is a predominance of intermolecular energy in the matter, the order of states of matter that are the likely to form is solids, liquids and then gases. It follows reverse order in case of the predominance of thermal energy.

3. A gas can be liquefied only through an increase in compression.
a) true
b) false

Answer: b
Explanation: The above statement is false because gas cannot be liquefied only through compression, even the temperature needs to be lowered in order to compress the gas. This is because of the reaction of intermolecular forces and thermal energy between the molecules.

4. Gas is readily formed in case of predominance of _____
a) intermolecular energy
b) thermal energy
c) both intermolecular energy and thermal en energy
d) neither intermolecular energy nor thermal energy

Answer: b
Explanation: In the case of the predominance of thermal energy, the gas is likely to be formed rather than liquids and solids. This happens

because the thermal energy tends to separate the molecules in a substance.

5. In the case of ice which energy do you think that is predominant?
a) Thermal energy
b) Intermolecular energy
c) Intermolecular energy
d) Heat energy

Answer: b
Explanation: In case of ice the molecules are tightly packed and we do know that in solid the intermolecular forces are so high that they are tightly packed so intermolecular energy is predominant in case of ice.

6. The following are the temperatures of milk in Celsius. In which of the following, do you think intermolecular forces are predominant than thermal energy?
a) 35
b) 82
c) 50
d) 9

Answer: d
Explanation: The rise in temperature depicts thermal energy. So among the given options at 82 degrees Celsius the milk has the highest thermal energy and at 9 degrees Celsius the milk has higher intermolecular energy. So at 9 degrees, the intermolecular forces are predominant than thermal energy in milk.

7. What is a term used for the conversion of solid into gas directly?
a) Evaporation
b) Sublimation
c) Condensation
d) Melting

Answer: b
Explanation: The process of direct conversion of solid to gases is sublimation while the process of conversion of liquid to gas is evaporation whereas the process of conversion of solid to liquid is melting and liquid to solid is condensation.

8. Particles in a solid _____
a) are tightly packed
b) are loosely packed
c) move continuously
d) collide with each other

Answer: a
Explanation: When there is a predominance of intermolecular energy instead of thermal energy, the molecules are tightly packed and have a definite shape and structure; these are called solids. So in solid, the particles are tightly packed.

9. Compressibility is high in case of _____
a) solids
b) liquids
c) gases
d) both solids and liquids have the same amount of compressibility

Answer: c
Explanation: Compressibility is high in the case of gases because thermal energy is predominant in gases. This energy enables the molecules of gases to move away from each other so that when compressed together they compress easily by reducing the distance between each other comparatively.

10. During the process of freezing the temperature is _____
a) constant
b) increasing
c) decreasing

d) irregular

Answer: a
Explanation: During the process of freezing the water, water converts into ice that means new bonds are creating during this process and the temperature remains constant but the internal energy changes during this phase.

Gaseous State

1. What is the lowermost layer of the earth?
a) stratosphere
b) troposphere
c) ionosphere
d) mesosphere

Answer: b
Explanation: It is the lowest layer of the earth's atmosphere and is held to the earth by the gravitational force. It is very vital for human life and it protects us from harmful radiation. It contains important molecules like dioxygen, carbon dioxide, water vapor, etc.

2. Which of the following statement is true regarding gases?
a) gases are highly incompressible
b) gases exert equal pressure on each and every direction
c) its volume and shape is fixed
d) gases have the highest density among the 3 States of matter

Answer: b
Explanation: The correct statement is that gases exert equal pressure on each and every direction. Among the given options the corrected statements of other options are that gases are highly compressible, they occupy the shape and volume of the container as they have no fixed shape and volume and also that they have the least density among the three states of matter.

3. Which of the following element is not a gas?
a) Hydrogen
b) Oxygen
c) Mercury
d) Nitrogen

Answer: c
Explanation: Mercury is not a gas, it is a liquid in room temperature and it is a metal. There are 11 gases which are gases at room temperature they are hydrogen, Nitrogen, Oxygen, fluorine, chlorine, Helium, Neon, Argon, Krypton, Xenon, and Radon.

4. Gases have low density than that of solids and liquids because of _____
a) no thermal energy
b) higher intermolecular energy
c) both intermolecular energy and thermal energy are the same
d) higher thermal energy

Answer: d
Explanation: In gases, there is less amount of intermolecular energy and higher amount of thermal energy. As we know that thermal energy separates some molecules from one another so gases have low density than that of solids and liquids.

5. Gases mix properly without any mechanical aid.
a) true
b) false

Answer: a
Explanation: As the forces of interaction between molecules of a gas is negligible when compared with solids and gases. They mix properly because of higher thermal energy and lower intermolecular energy, so the above statement is true.

6. Which of the following is not a gas law?
a) Boyle’s law
b) Charles law
c) Hooks law
d) Gay lussac’s law

Answer: c
Explanation: Boyle’s law is about the relationship between pressure and volume while Charles law about temperature and volume. Gay lussac’s law is about pressure-temperature relationship & hooks law is a law that is in Physics relating to stress.

7. What is the percentage of Nitrogen in the atmosphere approximately?
a) 78.09
b) 21
c) 20
d) 32

Answer: a
Explanation: That composition of earth’s atmospheric gases is as follows; 78.09 percent of Nitrogen, 24.95 percent of oxygen, 0.93 percent of argon, 0.04 percentage of carbon dioxide and a small amount of water vapor and other gases in the atmosphere.

8. What can you say about particles motion in gases?
a) only vibratory
b) very slow
c) both vibratory and irregular
d) too Rapid and random

Answer: d
Explanation: A particle’s motion in the gaseous state is too rapid and random while in solids it’s restricted to vibratory motion and in liquids, it’s very slow. This is one of the very basic properties of substances in the gaseous state.

9. How many moles of oxygen are present in 64 grams of oxygen?
a) three moles
b) two moles
c) one mole
d) 16 moles

Answer: b
Explanation: As we know that the number of moles of a gas is given by the amount of the substance in weight divided by the molecular weight of the substance. So in case of oxygen, it is 64 grams divided by 32 grams and that is two moles.

10. At STP conditions how much volume does one mole of a gas comprise of _____
a) 22.4 liters
b) 24 liters
c) depends on the molecular weight of the gas
d) depends on some other conditions

Answer: a
Explanation: Every one Mole of gas at STP consists of 22.4 liters of volume, that is at 0° Celsius of temperature and one-atmosphere pressure or 76 mm of Mercury pressure. Also, note that one mole of a gas is the amount of gas in weight divided by the molecular weight of the gas.

Gas Laws

1. At a constant temperature, the pressure of a gas is given as one atmospheric pressure and 5 liters. When the atmospheric pressure is increased to 2 atm, then what is the volume of the gas?
a) 1 liter
b) 5 liters
c) 10 liters
d) 2.5 liters

Answer: d
Explanation: As we know that, Boyle's law states at a constant temperature, the pressure of a gas is inversely proportional to its volume so P_1V_1 equals to P_2V_2 by substituting P_1 as one atmospheric pressure V_1 as 5 liters P_1 as to atmospheric pressure we get V_2 as 5/2 that is 2.5 liters.

2. What is the shape of the graph that is drawn between pressure and volume?
a) A straight line
b) Circular
c) Parabola
d) Hyperbola

Answer: d
Explanation: Boyle's law states that at constant temperature pressure is inversely proportional to the volume of gas so here the graph between the pressure as y-axis volume as x-axis is in the shape of a hyperbola.

3. What is the name of the graph that is drawn, when the temperature is kept constant?
a) Isotherm
b) Isochoric and isobar
c) Isochoric
d) Isobar

Answer: a
Explanation: The graphs with constant temperature plot are isotherms. For example, the graph that is used to detect the Boyle's law, that is between pressure and volume is an isotherm as the temperature is constant in this graph.

4. There is a ball that will burst if the pressure exceeds 0.12 bars. The pressure of the gas is 1 bar and the volume is 2.5 liters. What can be the maximum volume that the ball can be expanded?
a) 0.12 liters

b) 2.5 liters
c) 0.3 liters
d) 1 liter

Answer: c
Explanation: According to Boyle's law at a constant temperature, the pressure is inversely proportional to the temperature so here P_1V_1 is equaled to P_1V_2 by equating P_1V_1 is equaled to 1 x 2.5 = 2.5, so the maximum volume of the ball that can be expanded is 2.5/0.12 =0.3 liters.

5. How much does the volume of the gas increase if we increase the temperature by 1 Degree?
a) 273 liters
b) 1 by 273rd of the original volume of the gas
c) 1 liter
d) Hundred liters

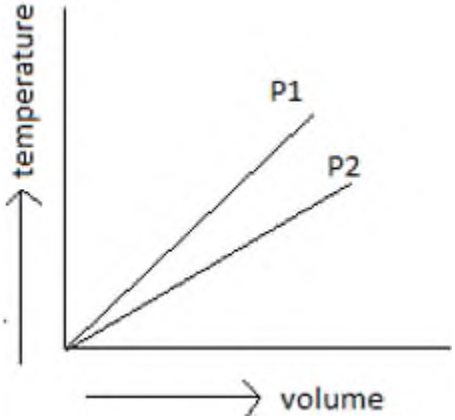
Answer: b
Explanation: According to Charles law, the volume of the fixed gas at constant pressure is directly proportional to the Absolute Temperature of the gas. So we thereby represent this as $V_t = V_0(1 + t/273)$ where V_t is the volume of the gas at temperature t and V_0 is the volume of the gas at 0 degrees Celsius that is absolute temperature.

6. There is a balloon filled with a gas at 26-degree centigrade and has a volume of about 2 liters when the balloon is taken to a place which is at 39-degree centigrade, what would be the volume of the gas that is inside the balloon?
a) 2 liters
b) 3 liters
c) 1.5 liters
d) 0.67 liters

Answer: b
Explanation: As we know that temperature is directly proportional to the

volume at constant pressure, 26/39 = 2/ X; so here by equating X equals to 3 liters. Hence required a volume of the balloon at 39 degrees is 3 liters.

7. By observing the below-given figure which of the options do you think is the correct one?



a) P_1 is greater than P_2
b) P_2 is greater than P_1
c) P_1 is equal to P_2
d) P_1 may be equal to P_2

Answer: a
Explanation: By using Boyle's law, draw a parallel line to volume axis, so as to maintain a constant temperature. Draw perpendicular lines to the point of intersection of pressure lines to constant temperature and volume axis. Now see to the lower the volume, higher the pressure. So P_1 is greater than P_2.

8. An ideal gas of 10 moles occupies _____ volume.
a) 22.4 liters
b) 2.24 liters
c) 224 liters
d) 2240

Answer: c
Explanation: As we know that the number of moles is proportional to the volume as per Avogadro's law and we also know that an ideal gas at

STP occupies 22.4 liters of volume. So here 10 moles of gas occupies 224 liters of volume.

9. When a graph is drawn between the pressure and temperature of the gas it is known as _____
a) isochoric
b) isobar
c) isotherm
d) isotopic

Answer: a
Explanation: When a graph is plotted between pressure on y-axis and temperature on x-axis straight line is formed at a constant volume and this graph is known as isochoric. As we know that gay lussac's law proposes that at the constant volume the pressure and temperature are directly proportional.

10. At 22 degree Celsius a gas consists of pressure 1.1 bars then what is the temperature when the gas consists a pressure of 2.2 bars?
a) 11 degree Celsius
b) 44 degree Celsius
c) 33 degree Celsius
d) 22 degree Celsius

Answer: b
Explanation: According to Gay-Lussac's law, at the constant volume, the pressure is directly proportional to the temperature of gas so $P_1/P_2 = T_1/T_2$ that is 1.1 Bar/2.2 bar = 22 degrees Celsius/44 degree Celsius. So the temperature required is 44 degrees Celsius.

Ideal Gas Equation

1. What is the constant in ideal gas equation known as?
a) Universal gas constant
b) Pressure constant

c) Temperature constant
d) Boltzmann constant

Answer: a
Explanation: The ideal gas equation is given by PV = nRT where P is pressure, V is volume, n is the number of moles, T is the temperature in Kelvin and R is given by universal gas constant its value is $8.314 kgm^2s^{-2}$.

2. A certain gas occupies 200 ml of volume at 2 bar pressure at hundred degrees Kelvin. How much volume does it occupy at 5 bar pressure and 200 degrees Kelvin?
a) 200 ml
b) 160 ml
c) 240 ml
d) 320 ml

Answer: b
Explanation: From ideal gas law, we know that $P_1V_1/T_1 = P_2V_2/T_2$. Here we take P_1 as 2 bar, V_1 as 200 ml, T_1 as hundred degrees Kelvin, P_2 as 5 bar and T_2 as 200 degrees Kelvin, so by substituting the above values $200 \times 2/100 = 5 \times V_2/200$; V_2 = 160 ml.

3. Which of the following do you think is a correct relationship between the molar mass of gas temperature and its pressure?
a) M = dRT/P
b) M = dRT/V
c) PV = nRT
d) M = VRT/P

Answer: a
Explanation: We know that the ideal gas equation is given by PV = nRT. Number of moles = n; can also be written as m/M, so PV = nRT becomes, PV = mRT/M. We also have density d = m/V, so molar mass M = dRT/P.

4. If the pressure of dry gas is given by X and the total pressure is given by X + 3, then what is aqueous tension?
a) 2
b) X
c) X + 2
d) 3

Answer: d
Explanation: As we know that the pressure of the dry gas is given by the difference between the total pressure and the Aqueous tension, so aqueous tension equals x + 3 – x = 3. So the aqueous tension is three units.

5. In a cylinder of pressure 1 bar, there is the hydrogen of 20 grams and neon of 50 grams, what is a partial pressure of hydrogen?
a) 0.2
b) 0.8
c) 0.4
d) 0.6

Answer: b
Explanation: As we know that the partial pressure of a gas is the product of its mole fraction and the total pressure of the gases present, so here the partial pressure of hydrogen is 10/10 + 2.5 = 0.8. Mole fraction is given by the number of moles of required as per the total number of the gas moles.

6. If the partial pressure of oxygen is given by three bar and the partial pressure of the other gas is four bar, then what is a total pressure that is exerted?
a) 7 bar
b) 3 bar
c) 4 bar
d) 1 bar

Answer: a
Explanation: The total pressure that is exerted is given by the sum of the partial pressure of the gases present. By adding, the sum of the partial pressures is 3bar + 4bar = 7bar, so the total pressure is 7 bar in this case.

7. Who gave the law regarding the partial pressure?
a) Charles
b) Dalton
c) Lussac
d) Thomas

Answer: b
Explanation: Dalton proposed law regarding the partial pressures, that the total pressure that is exerted by non-reactive gases is the sum of the individual gas's partial pressures. $P_{tot} = \sum P_i$, i = 1, 2, 3, 4, … n.

8. The partial pressure of a gas X is given by two bar, where is the total pressure of the gaseous mixture in a cylinder is 10 bar. What is the mole fraction of the gas X in that mixture?
a) 0.5
b) 2
c) 0.2
d) 5

Answer: c
Explanation: The partial pressure of a gas equals the mole fraction of the gas in the gaseous mixture x the total pressure that is exerted by the gaseous mixture. So here 2 bar = molar fraction x 10 bar, we get that the mole fraction is 2/10 = 0.2.

9. In a balloon of total pressure 6 atm there is a gaseous composition of 44 grams of carbon dioxide 16 grams of by oxygen and 7 grams of nitrogen, what is the ratio of nitrogen partial pressure do the total pressure in the balloon?
a) 0.25
b) 0.5

c) 0.75
d) 1

Answer: a
Explanation: The partial pressure of a gas is given by the mole fraction of the gas x the total pressure, so the ratio of the partial pressure to the total pressure is the mole fraction of nitrogen is 7/14 divided by 44/44 + 16/32 2 + 7/14 = 0.25.

10. Consider a gas of n moles at a pressure of P and a temperature of T in Celsius, what would be its volume?
a) nR(T + 273)/p
b) nRT/p
c) nR(T – 273)/p
d) R(T + 273)/p

Answer: a
Explanation: The ideal gas equation is given NY PV = not where p is pressure is the volume and is the number of moles are is universal gas constant and T is a temperature in Kelvin. So by arranging, we V = nR(T + 273)/p, as T is in Celcius, we need to add 273.

Kinetic Energy and Molecular Speeds

1. Calculate the root mean square speed of hydrogen in m/s at 27°C?
a) 2835.43 m/s
b) 2635.43 m/s
c) 2735.43 m/s
d) 2731.43 m/s

Answer: c
Explanation: The formula of root mean square speed is given by u_{rms} = 3RT/M−−−−−−−−√. We have R = 8.314 kgm^2/s^2, M = 10^{-3} kg/mol

and T = 300 k. So by substituting the formula we get,
u_{rms} = 3×8.314×300/10−3−−−−−−−−−−−−−−−−−−√ = 2735.43 m/s.

2. What is the ratio of u_{rms} to u_{mp} in oxygen gas at 298k?
a) 1.124
b) 1.224
c) 1.228
d) 1.128

Answer: b
Explanation: The ratio of root mean square speed, represented as u_{rms} to the most probable speed, represented as u_{mp} is always the same for identical conditions and same gas. It is 3RT/M−−−−−−−√ divided by 8RT/πM−−−−−−−−√ = 1.224.

3. The speed of three particles is recorded as 3 m/s, 4 m/s, and 5 m/s. What is a root mean square speed of these particles?
a) 4.082 m/s
b) 2.07 m/s
c) 3.87 m/s
d) 3.082 m/s

Answer: a
Explanation: The root means square speed of particles is nothing but the square root over the sum of squares of the particle's speeds by a total number of particles. So by substituting, $\sqrt{3^2 + 4^2 + 5^2/3}$ = 4.082 m/s.

4. What is the ratio of root mean square speed of 16 grams of Oxygen to 4 grams of hydrogen?
a) 2
b) 3
c) 4
d) 1

Answer: a
Explanation: The formula of root mean square speed of particles is given

as 3RT/M−−−−−−−√. We know that the velocity of gas molecules is inversely proportional to the root over the mass of the gas here the mass of oxygen to the mass of hydrogen ratio is the answer. So 16/4−−−−√ = 2.

5. Which of the following is greater for identical conditions and the same gas?
a) most probable speed
b) average speed
c) root mean square speed
d) most probable and average speed have the same value

Answer: c
Explanation: According to the formula, the root mean square speed is greater than the average speed and the average speed is greater than the most probable speed at given identical conditions and for the same gas.

6. The root mean square speed of a gas at a certain condition is 1.128 times greater than the most probable speed.
a) true
b) false

Answer: b
Explanation: The ratio of root mean square speed to the mean probable speed is 1.224. So the above statement is considered to be wrong. The ratio between the main probable speed and the average speed and root mean square speed is 1: 1.128: 1.224.

7. What is the most probable speed of oxygen gas with the mass of 32 grams at 27-degree centigrade?
a) 33.74 m/s
b) 44.78 m/s
c) 57.94 m/s
d) 549.14 m/s

Answer: b
Explanation: The formula for the most probable speed of a gas is given as $8RT/\pi M}}}}}}}}}\sqrt{}$. Here R is a universal gas constant which is always equal to 8.314 kgm^2s^{-2}, T=300 Kelvin and M = 0.032 kg So by substituting, we get an answer as 44.78 m/s.

8. Which among the following options do you think has the highest average speed?
a) chlorine
b) hydrogen
c) neon
d) oxygen

Answer: b
Explanation: The formula of average speed is given by $2RT/M}}}}}}}\sqrt{}$, where R is universal gas constant, T is a temperature in Kelvin and M is the mass in kilograms. From the formula, we understand that the average speed is inversely proportional to the root over the mass. As hydrogen has the least mass among the options it has the highest average speed.

9. What is the ratio of the velocities of 2 moles of hydrogen to five moles of helium?
a) $14}}\sqrt{}$
b) $10}}\sqrt{}$
c) $20}}\sqrt{}$
d) $50}}\sqrt{}$

Answer: b
Explanation: The formula of average speed is given by $2RT/M}}}}}}}\sqrt{}$. We know that the velocity of gas molecules is inversely proportional to the root over the mass of the gas. So here the ratio of velocities is $5\times4/2\times1}}}}}}}}}}\sqrt{} = 10}}\sqrt{}$.

10. What is the mean velocity of one Mole neon gas at a temperature of 400 Kelvin?

a) 11.533 m/s
b) 357.578 m/s
c) 367.79 m/s
d) 34 m/s

Answer: a
Explanation: The formula for mean velocity of a gas is given by the expression $2RT/M\sqrt{}$. for one mole of neon gas M is taken as 0.02 kg, temperature as 400 k, R as 8.314 kgm^2s^{-2}, so by substituting we get an answer as 11.533 m/s.

Kinetic Molecular Theory of Gases

1. Which of the following assumption explains great compressibility of gases?
a) the actual volume of the gas molecules is negligible
b) there is no force of attraction
c) particles are always in random motion
d) different particles have different speeds

Answer: a
Explanation: Gas molecules are considered as point masses because the actual volume of gas molecules is negligible when compared to the space between them, so this assumption explains the greater compressibility of gases.

2. Gases _____ and occupy all the space that is available to them.
a) contract
b) compress
c) expand
d) shrink

Answer: c
Explanation: At normal temperature and pressure, there is no force of

attraction between the gas particles. So they expand and occupy the space that is available. This statement supports the assumption.

3. Gases do not have a fixed shape.
a) true
b) false

Answer: a
Explanation: Particles do not have a fixed shape because they are always in random motion and particles never occupy fixed position the keep on moving and never occupy a particular shape this is the reason to prove that the above statement is true.

4. Why do you think the pressure is exerted by the gas on the walls of the container in all directions?
a) they consist of identical particles
b) collide with each other during random motion
c) lack of definite shape
d) more forces of attraction

Answer: b
Explanation: As the particles of gas travel in straight lines and move in a random motion and collide with each other and also collide with the walls of the container, the pressure is exerted on the walls of the container in all directions.

5. Collisions of gas molecules are _____
a) perfectly elastic
b) inelastic
c) always occur in a proper and predicted motion
d) not conserved

Answer: a
Explanation: The total energy of molecules before the collision is equal to the total energy after the collision. That means there may be an

exchange of energy between the molecules but the total energy does not change, so the collisions of gas molecules are elastic.

6. At an instance different particles have _____ speeds.
a) same
b) different
c) opposite
d) similar

Answer: b
Explanation: According to the kinetic molecular theory of gases, the assumption that different particles have different speeds at a time is because particles do not always have the same speeds and move in different directions but we can assume that the distribution of speeds is constant at a particular temperature.

7. There is an increase in temperature of an object then the kinetic energy of the object _____
a) decreases
b) increases
c) remains the same
d) it is not related to the temperature

Answer: b
Explanation: From the kinetic molecular theory of gases we can know that the kinetic energy of an object is proportional directly to the Absolute Temperature of that object so when the temperature of an object increases obviously the kinetic energy also increases.

8. The temperature of a gas is 100 K it is heated until it is 200 k then, what do you understand regarding kinetic energy in this process?
a) halved
b) tripled
c) quadrupled
d) doubled

Answer: d
Explanation: According to the kinetic molecular theory of gases, if the Absolute Temperature of a gas is doubled then the kinetic energy is also doubled because they are directly proportional to each other so here the answer is doubled. If the temperature doubles from 100 k to 200 k, kinetic energy also doubles.

9. Which of the following is not a postulate of Kinetic molecular theory of gases?
a) the actual volume of gas molecules is negligible
b) there are high forces of attraction between the gas molecules
c) collisions are elastic in gas molecules
d) kinetic energy of gas molecules is directly proportional to the absolute temperature

Answer: b
Explanation: According to Kinetic molecular theory of gases, there are no forces of attraction between the particles of gas at normal temperature and pressure. This is because gases expand and occupy all the space available.

10. Which of the following statements do you think is the correct one?
a) in gases there is a predominance of intermolecular energy
b) all molecules have the same speed at different temperatures
c) collisions of gas molecules are elastic
d) do not exert the same pressure in all directions

Answer: c
Explanation: Collisions are elastic as the total amount of energy before and after the collision is the same. The correct statements of the incorrect ones are: in gases, there is a predominance of thermal energy, the distribution of speeds remains constant at a particular temperature and the gases exert the same pressure in all directions of the container.

Behaviour of Real Gases: Deviation from Ideal Gas Behaviour

1. The plot PV vs v at constant temperature is a straight line for real gases.
a) true
b) false

Answer: b
Explanation: The plot of PV vs P is not a straight line for real gases because they deviate from Ideal behaviour. are there are two types of deviations one is a positive deviation and the other is a negative deviation.

2. PV/nRT is known as _____
a) compressibility factor
b) volume factor
c) pressure factor
d) temperature factor

Answer: a
Explanation: PV/nRT is known as compressibility factor and is represented by the letter Z. It is a ratio of PV and nRT; where p is pressure, V is volume, n is the number of moles, R is the universal gas constant and T is temperature.

3. Which of the following conditions do you think a real gas behaves as an ideal gas?
a) high pressure
b) low pressure
c) intermediate pressure
d) at any pressure

Answer: b
Explanation: At low-pressure conditions, Z = 1 handset behaves as an ideal gas but at high-pressure Z is greater than 1 and for intermediate pressure that is less than 1. So at low-pressure condition, a real gas behaves as an ideal gas.

4. What is the temperature known as where a real gas obeys Boyle's law or as an ideal gas?
a) Boyle temperature
b) Charge temperature
c) Critical temperature
d) Absolute Temperature

Answer: a
Explanation: The temperature at which a real gas obeys Boyle's law and other ideal gas law at a certain range of pressure is called Boyle temperature or Boyle point. It is unique for every gas and depends upon its nature.

5. Compressibility can be expressed as _____
a) real volume divided by the ideal volume
b) real universal gas constant by ideal universal gas constant
c) real temperature by ideal temperature
d) real volume divided by real pressure

Answer: a
Explanation: The deviation of real gas behaviour from ideal gas behaviour is known from the compressibility factor. This compressibility factor can also be measured as the ratio of real volume to ideal volume.

6. Above Boyle temperature real gases show _____ deviation from ideal gases.
a) positive
b) negative
c) no
d) both positive and negative

Answer: a
Explanation: Above Boyle temperature, the value of the compressibility factor is greater than 1. So the gases show positive deviation from ideal gases as the forces of attraction between the gas molecules are very low.

7. Which of the following is a corrected equation of ideal gas equation?
a) $(P – an^2V^2)(V – nb) = nRT$
b) $(P – an^2/V^2)(V + nb) = nRT$
c) $(P + an^2/V^2)(V – nb) = nRT$
d) $(P – an^2/V^2)(V – nb) = nRT$

Answer: d
Explanation: $(P – an^2/V^2)(V – nb) = nRT$; where p is pressure, a is the magnitude of intermolecular attractive forces within a gas, n is the number of moles, v is volume, b is a van der Waal constant, R is the universal gas constant and T is temperature.

8. The value of a in van der Waal equation is _____ /dependent on _____
a) pressure
b) temperature
c) pressure and temperature
d) independent of pressure and temperature

Answer: d
Explanation: Value of an in van der Waal equation represents a measure of the magnitude of intermolecular attractive forces within the gas and it is also independent of temperature and pressure. The van der Waal's equation is given by $(P – an^2/V^2)(V – nb) = nRT$.

9. What are the units of "b" in van der Waals equation?
a) L/mol
b) L mol
c) 1/L mol
d) L

Answer: a
Explanation: The ideal gas equation is given as $(P – an^2/V^2)(V – nb) = nRT$. So by considering the equation, we can understand that the units of the volume are equal to the units of a number of moles X be so the units of b. So b's units = volume / number of moles so it is L/mol.

10. A gas that is of 2 moles occupies a volume of about 500 ml at 300 Kelvin and 50 atmospheric pressure, calculate the compressibility factor of the gas.
a) 1.863
b) 0.7357
c) 0.5081
d) 1.8754

Answer: c
Explanation: Compressibility factor Z = PV/nRT; Z = 50 atm x (500/1000) ml / 2 x 0.082 x 300 k = 25/6×8.2 = 0.5081. That means Z < 1, so this is a negative deviation from ideal gas behaviour. So the gas is more compressible than expected.

Liquefaction of Gases

1. Which of The following is a critical temperature for Carbon dioxide?
a) 32-degree centigrade
b) 30.98-degree centigrade
c) 40-degree centigrade
d) 30.91 degree Kelvin

Answer: b
Explanation: The critical temperature of carbon dioxide is a maximum temperature where the carbon dioxide can remain as a liquid below this temperature. The carbon dioxide is gas so the critical temperature for Carbon dioxide is 30.98 degrees centigrade.

2. Which of the following is Greater?
a) Boyle’s temperature
b) Boyle’s temperature = critical temperature
c) Critical temperature
d) Boyle’s temperature = 1/critical temperature

Answer: a
Explanation: Boyle's temperature T_B is given by a/Rb critical temperature T_C is given by 8a/27Rb, where a is the pressure correction term and b is a volume correction term as per van der Waal's equation. So Boyle's temperature is greater than the critical temperature.

3. What is the ratio of critical temperature to Boyle's temperature of the same gas?
a) 8/27
b) 27/8
c) 8
d) 27

Answer: a
Explanation: The maximum temperature gas can remain liquid is known as critical temperature. The temperature till which a gas behaves like an ideal gas is Boyle's temperature. Boyle's temperature T_B is given by a/Rb critical temperature T_c is given by 8a/27Rb. So the ratio is 8/27.

4. A fluid is a _____
a) gas
b) liquid
c) solid
d) both gas and liquid

Answer: d
Explanation: A fluid is a gas or liquid that can be used to recognize the continuity. The fluid is something deforms under shear stress application and flows from one place to another, it is also a subset of States of matter.

5. A gas that is liquefied by applying pressure below critical temperature is called _____ of the substance.
a) vapor
b) liquid
c) solid

d) plasma

Answer: a
Explanation: At critical temperature liquid state changes into gaseous state continuously the surface that separates both this state disappears and gas below critical temperature can be liquefied by applying pressure and this is called vapor of the substance.

6. If the value of a is greater, what does it mean?
a) the gas liquefies easily
b) the gas cannot liquify easily
c) gas obeys ideal gas law
d) gas particles have random motion

Answer: a
Explanation: The value of an in van der Waals equation is a measure of the magnitude of intermolecular attractive forces within a gas. It is independent of temperature and pressure. As attractive forces are more, the gas can be liquefied easily.

7. Which of the following can be the value of "b" for Helium?
a) 23.71×10^{-6} m^2/mol
b) 23.71×10^{-6} m^3/mol
c) 23.71×10^{-6} m^3 mol
d) 23.71×10^{-6} m/mol

Answer: b
Explanation: From van der Waal's equation $(P - an^2/V^2)(V - nb) = nRT$, we have that units of volume and number of moles x b are same. So L = mol x b; units of b is L/mol otherwise can be written as m^3/mol.

8. The value of b for carbon dioxide is given as $42.69 \times 10^{-6} m^3/mol$. What do you think is the volume of a molecule?
a) 7.59 m^3
b) 7.03 m^3
c) 76.09 m^3

d) 7.09 m^3

Answer:d
Explanation: From van der Waal's equation $(P - an^2/V^2)(V - nb) = nRT$, we know that $V = b/NA = 42.69 \times 10^{-6} m^3/mol/6.023 \times 1023$ molecules/mol. That equals 7.09 m^3/molecule. So the volume of a molecule is 7.09m^3.

9. In van der Waal's equation, b is known as _____
a) volume constant
b) pressure constant
c) volume correction
d) pressure correction

Answer: c
Explanation: In the van der Waal's equation $(P - an^2/V^2)(V - nb) = nRT$, b is the volume correction term and is 4 times as the volume of a molecule. The letter a is the pressure correction term in the van der Waal's equation.

10. Which of the following is an expression for Boyle's temperature?
a) a/Rb
b) 27a/R
c) a/b
d) Ra/8b

Answer: a
Explanation: Boyle's temperature T_b is given a/Rb, where a and b are the van der Waal's constants for pressure and volume correction. The temperature till which a gas behaves like an ideal gas is Boyle's temperature.

Liquid State

1. What is the boiling point at pressure 1 atm known as?
a) Standard boiling point
b) Normal boiling point
c) Van der Waal boiling point
d) Saturated boiling point

Answer: c
Explanation: The boiling point at pressure 1 atm is known as normal boiling point. Normal boiling point is slightly greater than the standard boiling point as molecules change into the vapor phase and density of vapor increases.

2. 1 poise = _____
a) 0.1 $kgm^{-1}s^{-1}$
b) 1 $kgm^{-1}s^{-1}$
c) 10 $kgm^{-1}s^{-1}$
d) 100 $kgm^{-1}s^{-1}$

Answer: a
Explanation: Poise is the unit of viscosity. It's S.I. unit is 1 Newton second per square meter. It's Pascal second. In C.G.S. system, the unit of viscosity is poise that is named after a scientist Jean Louise Poiseuille. So, it's 1 poise = 0.1 $kgm^{-1}s^{-1}$.

3. Viscosity of liquid _____ with rise in temperature.
a) Increases
b) Decreases
c) Remains constant
d) Is independent

Answer: a
Explanation: As there is a rise in temperature the viscosity of liquid increases while the viscosity of gas decreases. In liquids, due to rise in temperature, molecules have high thermal energy so the can overcome intermolecular attractions.

4. In a liquid, the force required to maintain the flow of layers is 5N, velocity gradient in du/dx, area of contact is $20m^2$. Then what is the value of viscosity?
a) 6.25 dz/du
b) 0.15 dz/du
c) 0.2 dz/du
d) 0.25 dz/du

Answer: d
Explanation: The formula of force required to maintain the flow of layers is given by the formula $F = \eta A du/dz$, where η is the coefficient of viscosity, A is the area of contact and du/dz is the velocity gradient. So by substituting we get an answer as 0.25dz/du.

5. Path in liquid in which layers do not meet each other is _____
a) laminar flow
b) tubular flow
c) viscosity
d) straight path

Answer: a
Explanation: The type of flow in liquids when each path flows in a different path, that do not interfere with each other is laminar flow. At any point in the fluid, the velocity of a fluid is constant is a characteristic of laminar flow.

6. What is S.I. unit of Surface Tension?
a) Dyne/meter
b) Newton-meter
c) Newton/meter
d) Dyne-meter

Answer: c
Explanation: Surface Tension is the tendency of a fluid to occupy least surface area as possible. It is defined as the force per unit distance. So,

the units of surface tension are Newton/meter in S.I. the system, Dyne/cm in C.G.S system.

7. If the angle of contact between the liquid and container is 90 degrees then? (C is the cohesive and A is the Adhesive force)
a) C > A
b) C = A
c) C < A
d) C is not equal to A

Answer: b
Explanation: When the angle of contact between the liquid and container is 90 degrees then the cohesive and adhesive forces in a liquid are equal. Cohesive force is the attraction between similar atoms and adhesive between different atoms.

8. A water drop is spherical in shape due to _____
a) Viscosity
b) Poise
c) Surface tension
d) Reflection

Answer: c
Explanation: Surface Tension is the tendency of a fluid to occupy least surface area as possible. It is defined as the force per unit distance. So, the spherical shape that is acquired by a water drop is due to surface tension.

9. The surface tension of _____ at critical temperature.
a) one
b) zero
c) two
d) three

Answer: b
Explanation: The surface tension in liquids decreases with rise in

temperature. As surface tension decreases, molecules become more active when temperature increases and surface tension becomes zero at critical temperature T_C.

10. Higher the viscosity, the slower the liquid flows.
a) True
b) False

Answer: a
Explanation: Viscosity is defined as the resistance to the flow of a liquid. It opposes a liquid's layer movement with respect to one another. So, the above statement: the higher the viscosity, the slower the liquid flows is true