

**176. Capacity of a refractory brick to withstand-sudden changes in temperature is denoted by the property called**

- (A) Spalling resistance
- (B) Refractoriness
- (C) Refractoriness under load (RUL)
- (D) None of these

Answer: Option A

**177. Addition of zircon to silica refractory brick improves its**

- (A) Crushing strength
- (B) Resistance to slag attack
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option B

**178. Refractoriness/fusion points of 'Superduty' refractories is \_\_\_\_\_ °C.**

- (A) 1520-1630
- (B) 1630-1670
- (C) > 1730
- (D) > 2000

Answer: Option C

**179. Refractories subjected to alternate cycles of heating & cooling are liable to loose their resistance to**

- (A) Thermal spalling
- (B) Slag attack
- (C) Fusion under load
- (D) CO attack

Answer: Option A

**180. With increase in the porosity, thermal spalling resistance of fireclay brick**

- (A) Increases
- (B) Decreases
- (C) Remain same
- (D) May increase or decrease

Answer: Option A

**181. Refractory bricks with lower permeability is produced by using**

- (A) Higher firing temperature
- (B) Higher moulding pressure
- (C) Finer grog size
- (D) All (A), (B) and (C)

Answer: Option D

**182. Quartz is**

- (A) Stable form of silica upto 870°C
- (B) Converted to Tridymite on firing between 870 to 1470°C
- (C) Transformed to Cristobalite on heating above 1470°C
- (D) All (A), (B) and (C)

Answer: Option D

**183. Pure oxide refractories are generally monocrystalline in nature and are self bonded \_\_\_\_\_ bricks are generally used as moderator in nuclear reactors.**

- (A) Beryllia
- (B) Carborundum
- (C) Corundum
- (D) Thoria

Answer: Option A

**184. Beryllia (which is used in making crucibles for melting uranium & thorium) is superior to alumina in all respects for high temperature (> 1900°C ) use, except**

- (A) Cost
- (B) Electrical conductivity
- (C) Thermal conductivity
- (D) Fusion point

Answer: Option A

**185. Ceramic recuperators used for waste heat recovery from high temperature flue gas going out of the furnace is made of**

- (A) Fireclay
- (B) Silicon carbide
- (C) Corundum
- (D) Siliceous fireclay

Answer: Option B

**186. Water content in ground refractory material to be shaped into bricks by hand moulding is about \_\_\_\_\_ percent.**

- (A) 5
- (B) 20
- (C) 40
- (D) 55

Answer: Option B

**187. Refractory bricks having lower porosity have**

- (A) High insulating properties
- (B) Low heat capacity
- (C) Low thermal conductivity
- (D) Greater strength

Answer: Option D

**188. Maximum alumina content in high alumina refractory can be as high as \_\_\_\_\_ percent.**

- (A) 30
- (B) 50
- (C) 70
- (D) 90

Answer: Option D

**189. Silica bricks are never used for lining the**

- (A) Beehive coke ovens
- (B) By-product coke ovens
- (C) Dome of blast furnace stoves
- (D) Roof of open hearth furnace

Answer: Option A

**190. Panel test determines the \_\_\_\_\_ of refractories.**

- (A) Fusion point
- (B) Spalling resistance
- (C) Slag penetration resistance
- (D) Refractoriness under load (RUL)

Answer: Option B

**191. Fireclay refractories**

- (A) Are not resistant to the action of basic slags
- (B) Combine with salts (e.g. chlorides sulphates etc.) & bases (e.g. lime, magnesia etc.) forming fusible aluminates silicates etc
- (C) Shrink during firing
- (D) All (A), (B) and (C)

Answer: Option D

**192. Chemically, mullite refractories is**

- (A)  $3Al_2O_3 \cdot 2SiO_2$
- (B)  $Al_2O_3$
- (C)  $ZrSO_4$
- (D)  $ThO_2$

Answer: Option A

**193. Fireclay bricks is not used for lining the**

- (A) Cupola
- (B) Gas producer

- (C) Bottom of hot metal mixer
  - (D) Roof of open hearth furnace
- Answer: Option C

**194. Presence of MgO in alumino-silicate refractories \_\_\_\_\_ its refractoriness.**

- (A) Increases
- (B) Lowers
- (C) Does not affect
- (D) Either (A) or (B); depends on its quantity

Answer: Option B

**195. In panel test for spalling resistance, the average face temperature of panel assembly is maintained at \_\_\_\_\_ °C for 24 hours.**

- (A) 700
- (B) 1000
- (C) 1600
- (D) 2000

Answer: Option C

**196. Hot metal runner in blast furnace are lined with \_\_\_\_\_ bricks.**

- (A) Silica
- (B) Carborundum
- (C) Fireclay
- (D) Magnesite

Answer: Option C

**197. Which is an acidic refractory?**

- (A) Magnesite
- (B) Dolomite
- (C) Fireclay
- (D) Chrome magnesite

Answer: Option C

**198. Fireclay bricks are not used in the**

- (A) Beehive coke oven
- (B) By-product coke oven walls
- (C) Combustion chamber of B.F. stoves
- (D) Coke oven regenerators

Answer: Option B

**199. Which is a neutral refractory?**

- (A) Graphite
- (B) Magnesite chrome
- (C) Silica
- (D) Magnesia

Answer: Option A

**200. High porosity refractory bricks have**

- (A) Poor resistance to the penetration of molten slag, metal & flue gases
- (B) Poor heat conductivity & low strength
- (C) Better thermal spalling resistance
- (D) All (A), (B) and (C)

Answer: Option D

**201. Which is not an acidic refractory?**

- (A) Silica
- (B) Fireclay
- (C) High alumina refractory
- (D) Carbon black

Answer: Option D

**202. Fireclay bricks are used in the**

- (A) Coke ovens regenerator
- (B) Outer lining of L.D. converter
- (C) Hearth bottom of blast furnace

(D) Coke oven walls  
Answer: Option A

**203. Magnesite refractories are generally not used in the**

- (A) Electric furnace walls
  - (B) Steel melting furnace
  - (C) Open hearth furnace
  - (D) Burning zone of cement kilns
- Answer: Option B

**204. Fusion point of a basic refractory material is**

- (A) Reduced by the addition of acid oxides
  - (B) Increased by the addition of acid oxides
  - (C) Not affected by the addition of acid oxides
  - (D) Always less than 1000°C
- Answer: Option A

**205. Thermal conductivity of refractory bricks**

- (A) Increases with decrease in porosity
  - (B) Decreases with decreases in porosity
  - (C) Is independent of its porosity and is maximum for insulating bricks
  - (D) Increases with the amount of air entrapped in pores
- Answer: Option A

**206. Thermal diffusivity of a refractory brick is high, when its \_\_\_\_\_ is high.**

- (A) Density
  - (B) Specific heat
  - (C) Thermal conductivity
  - (D) None of these
- Answer: Option C

**207. Which form of silica has the highest specific gravity?**

- (A) Quartz
  - (B) Cristobalite
  - (C) Tridymite
  - (D) All have the same specific gravity
- Answer: Option A

**208. With increase in the alumina content, the refractoriness of high alumina refractories**

- (A) Increases
  - (B) Decreases
  - (C) Remain same
  - (D) May increase or decrease
- Answer: Option A

**209. Pick out the wrong statement.**

- (A) Refractories used in muffle furnace should have low thermal conductivity
  - (B) The electrical resistivity of refractories drops rapidly with rise in temperature
  - (C) For reducing spalling tendency, the refractory should be well fired and its porosity should be more
  - (D) Refractoriness under load (RUL) of a refractory is always less than its refractoriness
- Answer: Option A

**210. Test piece for determination of RUL of a refractory is heated in a/an**

- (A) Oxidising atmosphere
  - (B) Reducing atmosphere
  - (C) Electric furnace
  - (D) Neutral atmosphere
- Answer: Option C

**211. Fireclay bricks are not used in the**

- (A) Blast furnace
- (B) Hot blast stove
- (C) Cupola
- (D) Wall of coke oven

Answer: Option D

**212. An insulating refractory brick should have high porosity and low thermal conductivity. Which of the following is not used for inducing porosity in the insulating refractory bricks during its manufacture?**

- (A) Cork
- (B) Saw dust
- (C) Sand
- (D) Chemically prepared foam

Answer: Option C

**213. Permeability of bricks is a measure of the**

- (A) Refractoriness
- (B) Melting point
- (C) Rate at which a fluid will pass through the pores
- (D) Expansion during heating

Answer: Option C

**214. Magnesite refractories are used for the construction of those furnaces, which are**

- (A) Not required to resist the corrosive action of basic slag
- (B) Not subjected to fluctuation in temperature
- (C) Used for raising & maintaining high temperature
- (D) Both (B) and (C)

Answer: Option D

**215. Pick out the wrong statement.**

- (A) Insulating refractories used in place of regular refractory bricks are usually called light weight refractories, and they have similar composition as heavy bricks
- (B) Graphite refractories are also called plumbago refractories
- (C) Superduty fireclay bricks correspond to a pyrometric cone equivalent of 26-28
- (D) Calcined magnesite is also called dead burnt magnesite

Answer: Option C

**216. Outer combustion chamber of blast furnace stove is lined with \_\_\_\_\_ bricks.**

- (A) Fireclay
- (B) Silica
- (C) Chrome magnesite
- (D) Zirconia

Answer: Option A

**217. Carborundum used for making crucibles for melting non-ferrous metals is chemically**

- (A) Silicon carbide
- (B) Silicon nitride
- (C) Crystalline magnesia
- (D) Zirconium sulphate

Answer: Option A

**218. Roof of a basic electric furnace is made of \_\_\_\_\_ bricks.**

- (A) Superduty fireclay
- (B) Silica
- (C) Chromite
- (D) None of these

Answer: Option B

**219. Faster rate of drying of moulded refractories results in high \_\_\_\_\_ of refractories.**

- (A) Green strength
- (B) Voids
- (C) Shrinkage
- (D) Both (B) and (C)

Answer: Option D

**220. Which property of refractories is the most important for top section of the blast furnace?**

- (A) Resistance to abrasion
- (B) Resistance to slag penetration
- (C) Stability of volume at high temperature

(D) Resistance to corrosion by slag

Answer: Option A

**221. Refractories used in/for \_\_\_\_\_ should have low thermal conductivity.**

(A) Coke ovens

(B) Insulation

(C) Regenerators

(D) Muffle furnaces

Answer: Option B

**222. Spalling of silica bricks occurs due to abrupt volume changes, when it is cooled below a temperature of \_\_\_\_\_ °C.**

(A) 770

(B) 570

(C) 270

(D) 70

Answer: Option C

**223. Lower wall courses of soaking pits are made of \_\_\_\_\_ bricks to avoid the action of molten slag & scale.**

(A) Chrome or magnesite

(B) Silicon carbide

(C) Silica

(D) Low duty fireclay

Answer: Option A

## Stoichiometry

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**01. In the reaction,  $\text{Ca} + 2\text{H}_2\text{O} = \text{Ca}(\text{OH})_2 + \text{H}_2$ ; what volume (c.c.) of hydrogen at STP would be liberated, when 8 gm of calcium reacts with excess water ? (Atomic weight of calcium = 40)**

(A) 4480

(B) 2240

(C) 1120

(D) 0.4

Answer: Option A

**02. A vapor whose partial pressure is less than its equilibrium vapor pressure is called a \_\_\_\_\_ vapor.**

(A) Saturated

(B) Supersaturated

(C) Superheated

(D) None of these

Answer: Option C

**03. Dissolving a solute in a solvent does not change its**

(A) Specific heat

(B) Vapour pressure

(C) Viscosity

(D) None of these

Answer: Option D

**04. Applicability of Clausius-Clapeyron Equation is subject to the condition that the**

(A) Vapor follows ideal gas law

(B) Volume in the liquid state is negligible

(C) Both (A) & (B)

(D) Neither (A) nor (B)

Answer: Option C

**05. 'Cox' chart which is useful in the design of a distillation column (particularly suitable for petroleum hydrocarbons) is a plot of the**

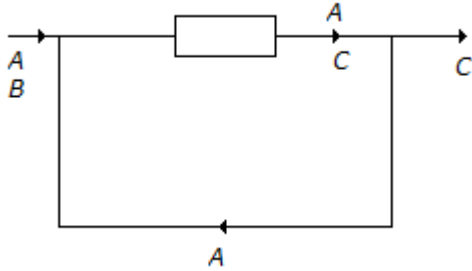
(A) Temperature vs. log (vapor pressure)

(B) Vapor pressure vs. log (temperature)

(C) Log (temperature) vs. log (vapor pressure)

(D) Vapor pressure vs. temperature  
Answer: Option A

06. The reaction  $A + B \rightarrow C$  has been conducted in a reactor as shown below. The number of boundaries around which material balance can be written, are



- (A) 1
- (B) 6
- (C) 3
- (D) 4

Answer: Option D

07. Methane is mixed with stoichiometric proportion of oxygen and completely combusted. The number of additional specifications required to determine the product flow rate and composition is

- (A) 0
- (B) 1
- (C) 2
- (D) 3

Answer: Option A

08. The number of water molecules present in a drop of water weighing 0.018 gm is  $6.023 \times$

- \_\_\_\_\_.
- (A)  $10^{26}$
  - (B)  $10^{23}$
  - (C)  $10^{20}$
  - (D)  $10^{19}$

Answer: Option C

09. Concentration of a solution expressed in terms of \_\_\_\_\_ is independent of temperature.

- (A) Molarity
- (B) Normality
- (C) Molality
- (D) None of these

Answer: Option C

10. The amount of Zn (atomic weight = 65) required to form 224 c.c. of  $H_2$  at N.T.P. on treatment with dilute  $H_2SO_4$  will be \_\_\_\_\_ gm.

- (A) 0.065
- (B) 0.65
- (C) 6.5
- (D) 65

Answer: Option B

11. Pick out the correct conversion.

- (A) 1 BTU = 453.6 calories
- (B) 1 BTU = 252 calories
- (C) 1 calorie = 252 BTU
- (D) 1 calorie = 453.6 BTU

Answer: Option B

12. A vapor that exists above its critical temperature is termed as a \_\_\_\_\_ vapor.

- (A) Saturated
- (B) Unsaturated
- (C) Gaseous
- (D) Sub-cooled

Answer: Option C

13. Othmer chart is useful in estimating the heat of

- (A) Mixing
- (B) Wetting
- (C) Adsorption
- (D) None of these

Answer: Option C

14. Pick out the wrong unit conversion of temperature.

- (A)  $^{\circ}\text{R} = 273 + ^{\circ}\text{F}$
- (B) Temperature difference of  $1^{\circ}\text{K} = 1^{\circ}\text{C} = 9/5^{\circ}\text{F}$
- (C)  $^{\circ}\text{C} = (\text{F} - 32) \times 0.555$
- (D)  $^{\circ}\text{F} = (^{\circ}\text{C} + 17.778) \times 1.8$

Answer: Option A

15. Pick out the wrong unit conversion of heat transfer rate.

- (A)  $1 \text{ kcal/hr} = 1.163 \text{ Watt}$
- (B)  $1 \text{ Watt} = 1.163 \text{ kcal/hr}$
- (C)  $1 \text{ BTU/ft}^2 \cdot \text{hr} = 2.712 \text{ kcal/m}^2 \cdot \text{hr}$
- (D)  $1 \text{ kcal/m}^2 \cdot \text{hr} = 0.3687 \text{ BTU/ft}^2 \cdot \text{hr} = 1.163 \text{ Watt/m}^2$

Answer: Option B

16. Viscosity of 1 centipoise is equal to 1 Centistoke in case of

- (A) Water
- (B) Mercury
- (C) Carbon tetrachloride
- (D) None of these

Answer: Option A

17.  $^{\circ}\text{API}$  gravity of water at N.T.P. is about

- (A) 0
- (B) 1
- (C) 10
- (D) 100

Answer: Option C

18. Colligative properties of a dilute solution are those which depend entirely upon the

- (A) Constitution of the solute
- (B) Chemical composition of the solute
- (C) Number of solute molecules contained in a given volume of the solvent
- (D) None of these

Answer: Option A

19. Which of the following is insensitive to changes in pressure?

- (A) Heat of vaporisation
- (B) Melting point
- (C) Heat of fusion
- (D) Both (B) and (C)

Answer: Option D

20. The heats of vaporisation of  $\text{CS}_2$ ,  $\text{C}_2\text{H}_5\text{OH}$  &  $\text{H}_2\text{O}$  are 26.8, 38.6 & 40.6 KJ/kg.mole respectively. The order of decreasing inter-molecular forces in these liquids is

- (A)  $\text{H}_2\text{O} > \text{C}_2\text{H}_5\text{OH} > \text{CS}_2$
- (B)  $\text{CS}_2 > \text{C}_2\text{H}_5\text{OH} > \text{H}_2\text{O}$
- (C)  $\text{H}_2\text{O} > \text{CS}_2 > \text{C}_2\text{H}_5\text{OH}$
- (D)  $\text{CS}_2 > \text{H}_2\text{O} > \text{C}_2\text{H}_5\text{OH}$

Answer: Option A

21. 1 BTU/lb. $^{\circ}\text{F}$  is equivalent to \_\_\_\_\_ kcal/kg. $^{\circ}\text{C}$ .

- (A) 1
- (B) 2.42
- (C) 1.987
- (D) 4.97

Answer: Option A



**22. The gravimetric (i.e., by weight) composition of a vapor saturated gas is independent of the**

- (A) Nature of both the gas & the liquid
- (B) Temperature
- (C) Total pressure
- (D) None of these

Answer: Option D

**23. A gas occupies a volume of 283 c.c at 10°C. If it is heated to 20°C at constant pressure, the new volume of the gas will be \_\_\_\_\_ c.c.**

- (A) 283
- (B) 566
- (C) 293
- (D) 141.5

Answer: Option C

**24. Heat of \_\_\_\_\_ of a fuel is called its calorific value.**

- (A) Formation
- (B) Combustion
- (C) Reaction
- (D) Vaporisation

Answer: Option B

**25. Dry air is a mixture of**

- (A) Vapors
- (B) Gases
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option B

**26. A solution having a pH value of 5 is less acidic than the one having a pH value of 2 by a factor of**

- (A) 3
- (B) 100
- (C) 1000
- (D) None of these

Answer: Option C

**27. An equation for calculating vapour pressure is given by,  $\log_{10} P = A - B(t + c)$ . This is called the**

- (A) Kistyakowsky equation
- (B) Antoine equation
- (C) Kopp's rule
- (D) Trouton's rule

Answer: Option B

**28. The heat evolved in the combustion of benzene is represented by the equation:**

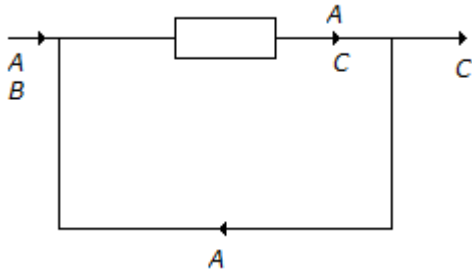


**The heat energy change, when 39 gm of  $\text{C}_6\text{H}_6$  is burnt in an open container, will be \_\_\_\_\_ kJ/kgmole.**

- (A) +816.15
- (B) +1632.3
- (C) -1632.3
- (D) -2448.45

Answer: Option C

29. The reaction  $A + B \rightarrow C$  has been conducted in a reactor as shown below. The numbers of balances (material) that can be made around the reactor are



- (A) 1
- (B) 2
- (C) 3
- (D) 4

Answer: Option C

30. A gas at  $0^\circ\text{C}$  is cooled at constant pressure until its volume becomes half the original volume. The temperature of the gas at this state will be

- (A)  $-136.5^\circ\text{C}$
- (B)  $-136.5^\circ\text{K}$
- (C)  $-273^\circ\text{C}$
- (D)  $0^\circ\text{K}$

Answer: Option A

31. With rise in temperature, the solubility of ammonia in water at a fixed pressure

- (A) Increases
- (B) Decreases
- (C) Remains unchanged
- (D) Increases exponentially

Answer: Option B

32. One of the specific gravity scales is "Brix" (used specifically for sugar solution). It is defined as

- (A)  $\text{Brix} = (400/G) - 400$
- (B)  $\text{Brix} = 200 (G-1)$
- (C)  $\text{Brix} = 145 - (145/G)$
- (D) None of these

Answer: Option A

33. For an ideal solution, the total vapor pressure varies \_\_\_\_\_ with the composition (expressed as mole fraction).

- (A) Inversely
- (B) Exponentially
- (C) Linearly
- (D) Negligibly

Answer: Option C

34. With rise in temperature, the heat capacity of a substance

- (A) Increases
- (B) Decreases
- (C) Remains unchanged
- (D) Either (A) or (B); depends on the substance

Answer: Option A

35. The unit of specific heat at constant pressure,  $C_p$ , in SI unit is

- (A)  $\text{W/m}^2\text{C}$
- (B)  $\text{J/kg}^\circ\text{K}$
- (C)  $\text{W/m}^\circ\text{K}$
- (D)  $\text{J/m}^3\text{K}$

Answer: Option B

36. For a neutral solution ( $\text{pH} = 7$ ), the value of  $[\text{H}^+]$   $[\text{OH}^-]$  is equal to

- (A) 0
- (B) 1

(C) < 1

(D) > 1

Answer: Option B

**37. Kopp's rule is useful for the determination of**

(A) Molal heat capacities of gases

(B) Heat capacities of solids

(C) Activation energy

(D) Heat capacities of gases

Answer: Option B

**38. A compound was found having nitrogen and oxygen in the ratio 28 gm and 80 gm respectively. The formula of the compound is**

(A)  $N_2O_4$

(B)  $N_2O_5$

(C)  $N_2O_3$

(D) None of these

Answer: Option B

**39. One micron is equal to \_\_\_\_\_ cm.**

(A)  $10^{-2}$

(B)  $10^{-4}$

(C)  $10^{-6}$

(D)  $10^{-8}$

Answer: Option B

**40. The heat capacity of a solid compound is calculated from the atomic heat capacities of its constituent elements with the help of the**

(A) Trouton's rule

(B) Kopp's rule

(C) Antoine equation

(D) Kistyakowsky equation

Answer: Option B

**41. A liquid is in equilibrium with its vapor at its boiling point. On an average, the molecules in the liquid and gaseous phases have equal**

(A) Kinetic energy

(B) Intermolecular forces of attraction

(C) Potential energy

(D) Total energy

Answer: Option A

**42. A solution with reasonably permanent pH is called a/an \_\_\_\_\_ solution.**

(A) Ideal

(B) Non-ideal

(C) Buffer

(D) Colloidal

Answer: Option C

**43. A saturated vapor on being compressed would**

(A) Condense

(B) Form wet steam

(C) Both (A) & (B)

(D) Neither (A) nor (B)

Answer: Option C

**44. Molality is defined as the number of gm moles of solute per \_\_\_\_\_ of solvent.**

(A) Litre

(B) kg

(C) gm.mole

(D) gm

Answer: Option B

**45. Pick out the wrong statement.**

- (A) Atomic heat capacities of the crystalline solid elements are nearly constant and equal to 6.2 kcal/kg-atom according to the law of Petit and Dulong
- (B) Atomic heat capacities of all solid elements decrease greatly with decrease in temperature, approaching a value of zero at absolute zero temperature, when in the crystalline state
- (C) Generally, the heat capacities of compounds are lower in the liquid than in the solid state
- (D) The heat capacity of a heterogeneous mixture is an additive property, but when solutions are formed, this additive property may no longer exist

Answer: Option C

**46. Pick out the wrong statement:**

- (A) Clausius-Clapeyron equation relates the latent heat of vaporisation to the slope of the vapor pressure curve
- (B) At the boiling point of liquid at the prevailing total pressure, saturated absolute humidity is infinite
- (C) Percentage saturation and relative saturation are numerically equal for an unsaturated vapor gas mixture
- (D) Clapeyron equation is given by  $dP/dT = (\lambda/T) (V_G - V_L)$ ; where,  $P$  = vapor pressure,  $T$  = absolute temperature,  $\lambda$  = latent heat of vaporisation,  $V_G$  and  $V_L$  = volumes of gas and liquid respectively

Answer: Option C

**47. The density of a liquid is 1500 kg/m<sup>3</sup>. Its value in gin/litre will be equal to**

- (A) 1.5
- (B) 15
- (C) 150
- (D) 1500

Answer: Option D

**48. Weight of 56 litres of ammonia at N.T.P. is \_\_\_\_\_ gm.**

- (A) 2.5
- (B) 42.5
- (C) 56
- (D) 2800

Answer: Option B

**49. Avogadro's number is equal to**

- (A)  $6.023 \times 10^{23}$  molecules/kg.mole
- (B)  $6.023 \times 10^{23}$  molecules/gm.mole
- (C)  $6.023 \times 10^{16}$  molecules/kg.mole
- (D)  $6.023 \times 10^{26}$  molecules/gm.mole

Answer: Option B

**50. The reverse process of fractional crystallisation is called**

- (A) Stripping
- (B) Leaching
- (C) Differential distillation
- (D) Absorption

Answer: Option B

**51. The value of the gas-law constant 'R' is 1.987**

- (A) kcal/kg-mole.°C
- (B) Btu/lb-mole.°R
- (C) kcal/kg-mole.°K
- (D) Both (B) & (C)

Answer: Option D

**52. Which of the following is the Clausius-Clapeyron Equation?**

- (A)  $PV = RT + B/V + y/V^2 + \dots$
- (B)  $(P + a/V^2)(V-b) = RT$
- (C)  $\log_e (p/p_0) = (\lambda/R) (1/T_0 - 1/T)$
- (D)  $p = [RT/(V - b)] - (a/TV^2)$

Answer: Option C

**53. The atomic heat capacities of all solid elements \_\_\_\_\_ with decrease in temperature.**

- (A) Increases

- (B) Decreases
  - (C) Remains unchanged
  - (D) Approach zero at 0°C
- Answer: Option B

**54. The value of Trouton's ratio ( $\lambda_b/T_b$ ) for a number of substances is 21 (where,  $\lambda_b$  = molal that of vaporisation of a substance at its normal boiling point, KCal/kg. mole and  $T_b$  = normal boiling point, °K). The Kistyakowsky equation is used for calculation of Trouton's ratio of \_\_\_\_\_ liquids.**

- (A) Polar
  - (B) Non-polar
  - (C) Both (A) & (B)
  - (D) Neither (A) nor (B)
- Answer: Option C

**55. How many phases are present at eutectic point?**

- (A) 2
  - (B) 1
  - (C) 3
  - (D) unpredictable
- Answer: Option C

**56. Pure aniline is evaporating through a stagnant air film of 1 mm thickness at 300 K and a total pressure of 100 KPa. The vapor pressure of aniline at 300 K is 0.1 KPa. The total molar concentration under these conditions is 40.1 mole/m<sup>3</sup>. The diffusivity of aniline in air is 0.74 × 10<sup>-5</sup> m<sup>2</sup>/s. The numerical value of mass transfer co-efficient is 7.4 × 10<sup>-3</sup>. Its units are**

- (A) m/s
  - (B) cm/s
  - (C) mole/m<sup>2</sup>.s.Pa
  - (D) k.mole/m<sup>2</sup>.s.Pa
- Answer: Option C

**57. Measurement of the amount of dry gas collected over water from volume of moist gas is based on the**

- (A) Charle's law
  - (B) Dalton's law of partial pressures
  - (C) Avogadro's hypothesis
  - (D) Boyle's law
- Answer: Option B

**58. Pick out the wrong unit conversion of thermal conductivity.**

- (A) 1 BTU/ft<sup>2</sup>.hr.°F/ft = 1.488 kcal/m<sup>2</sup>. hr.°C/m
  - (B) 1 BTU/ft<sup>2</sup>.hr.°F/inch = 1.488 kcal/m<sup>2</sup>. hr.°C/m
  - (C) 1 kcal/m.hr.°C = 0.672 BTU/ft.hr.°F = 1.163 W/m. °K
  - (D) 1 W/cm.°C = 85.985 kcal/m.hr.°C = 57.779 BTU/ft.hr.°F
- Answer: Option B

**59. Saturated molal absolute humidity of the vapor-gas mixture depends upon the**

- (A) Vapor pressure at dry bulb temperature
  - (B) Total pressure
  - (C) Both (A) and (B)
  - (D) Neither (A) nor (B)
- Answer: Option C

**60. For any system, the \_\_\_\_\_ heat of solution is dependent on the temperature and the adsorbate concentration.**

- (A) Integral
  - (B) Differential
  - (C) Both (A) & (B)
  - (D) Neither (A) nor (B)
- Answer: Option C

**61. Pick out the wrong statement about the recycle stream in a process.**

- (A) Recycling in a process stream helps in utilising the valuable reactants to the maximum with minimum loss of reactants

- (B) The ratio of the quantity of a reactant present in the reactor feed of a recycling operation to the quantity of the same reactant entering the process as fresh feed is called combined feed ratio  
(C) Recycling in a process does not help in getting higher extent of reaction  
(D) Recycling is exemplified by refluxing back a part of the distillate to the distillation column to maintain the quantity of liquid within the column

Answer: Option C

**62. Which of the following expressions defines the Baume gravity scale for liquids lighter than water?**

- (A)  $^{\circ}\text{Be} = (140/G) - 130$   
(B)  $^{\circ}\text{Be} = 200(G-1)$   
(C)  $^{\circ}\text{Be} = 145 - (145/G)$   
(D)  $^{\circ}\text{Be} = (400/G) - 400$

Answer: Option A

**63. Osmotic pressure of the solution can be increased by**

- (A) Decreasing its temperature  
(B) Increasing the volume of the vessel containing the solution  
(C) Diluting the solution  
(D) None of these

Answer: Option D

**64. Variation of vapor pressure with temperature can be calculated using Clausius-Clapeyron equation, which assumes that the**

- (A) Vapor follows the ideal gas law  
(B) Molal latent heat of vaporisation is constant within the limited temperature range  
(C) Volume in the liquid state is negligible compared with that in the vapor state  
(D) All (A), (B) & (C)

Answer: Option D

**65. Two solutions  $A_1$  and  $A_2$  have pH value of 2 and 6 respectively. It implies that the solution**

- (A)  $A_2$  is more alkaline than solution  $A_1$   
(B)  $A_1$  is highly acidic  
(C)  $A_1$  is very slightly acidic  
(D) Both (A) & (C)

Answer: Option D

**66. 1 gm mole of an alcohol whose molecular weight is 74 contains 48 gms of carbon, 10 gms of hydrogen and 16 gms of oxygen. Its molecular formula is**

- (A)  $\text{C}_4\text{H}_9\text{OH}$   
(B)  $\text{C}_3\text{H}_{21}\text{OH}$   
(C)  $(\text{C}_2\text{H}_4)_2\text{H}_2.\text{OH}$   
(D)  $\text{C}_2\text{H}_{33}\text{OH}$

Answer: Option A

**67. 1 bar is almost equal to \_\_\_\_\_ atmosphere.**

- (A) 1  
(B) 10  
(C) 100  
(D) 1000

Answer: Option A

**68. Raoult's law states that 'the equilibrium vapor pressure that is exerted by a component in a solution is proportional to the mole fraction of that component'. This generalisation is based on the assumption that the**

- (A) Sizes of the component molecules are approximately equal  
(B) Attractive forces between like and unlike molecules are approximately equal  
(C) Component molecules are non-polar and no chemical combination or molecular association between unlike molecules takes place in the formation of the solution  
(D) All (A), (B) & (C)

Answer: Option D

**69. In physical adsorption, as compared to chemisorption, the**

- (A) Quantity adsorbed per unit mass is higher  
(B) Rate of adsorption is controlled by the resistance to surface reaction

- (C) Activation energy is very high  
(D) Heat of adsorption is very large  
Answer: Option A

**70. The increase in the temperature of the aqueous solution will result in decrease of its**

- (A) Weight % of the solute  
(B) Mole fraction of the solute  
(C) Molarity  
(D) Molality

Answer: Option C

**71. If 1.5 moles of oxygen combines with aluminium to form  $\text{Al}_2\text{O}_3$ , then the weight of aluminium (atomic weight = 27) used in this reaction is \_\_\_\_\_ gm.**

- (A) 27  
(B) 54  
(C) 5.4  
(D) 2.7

Answer: Option B

**72. The vapor pressure of a substance, at its melting point, is \_\_\_\_\_ in the solid state as compared to that in the liquid state.**

- (A) Less  
(B) More  
(C) Same  
(D) Either (A) or (B); depends on the nature of the substance

Answer: Option C

**73. The number of  $\text{H}^+$  in 1 c.c solution of pH 13 is**

- (A)  $6.023 \times 10^{13}$   
(B)  $6.023 \times 10^{10}$   
(C)  $6.023 \times 10^7$   
(D)  $10^{13}$

Answer: Option C

**74. In case of vapor-liquid equilibria, which of the following does not account for gas phase deviation from ideality?**

- (A) Use of equation of state  
(B) Fugacity co-efficient  
(C) Activity co-efficient  
(D) None of these

Answer: Option C

**75. The combustion equations of carbon and carbon monoxide are as follows:**



**The heat of formation of CO is \_\_\_\_\_ kJ/kg. mole.**

- (A) -109.5  
(B) +109.5  
(C) +180  
(D) +100

Answer: Option A

**76. Which of the following ideal gas laws are not applicable to mixture of gases?**

- (A) Amagat's law  
(B) Dalton's law  
(C) Boyle's law & Charle's Law  
(D) None of these

Answer: Option C

**77. Which of the following is followed by an ideal solution?**

- (A) Boyle's law  
(B) Amagat's law  
(C) Raoult's law  
(D) Trouton's rule

Answer: Option C

**78. Solutions having the same osmotic pressure are called \_\_\_\_\_ solutions.**

- (A) Dilute
- (B) Ideal
- (C) Isotonic
- (D) Saturated

Answer: Option C

**79. Heat of neutralisation of HCl and NaOH is - 57.46 kJ/Kg mole. The heat of ionisation of water will be \_\_\_\_\_ kJ/Kg mole.**

- (A) 57.46
- (B) -57.46
- (C) 114.92
- (D) -28.73

Answer: Option A

**80. The molecular velocity of a real gas is proportional to (where,  $T$  = absolute temperature of the gas).**

- (A)  $\sqrt{T}$
- (B)  $T$
- (C)  $T^2$
- (D)  $1/\sqrt{T}$

Answer: Option A

**81. Heat of neutralisation of a strong acid and strong base is always a constant value, i.e., 57 KJ/Kg mole. This is because**

- (A) The strong base and strong acid reacts completely
- (B) The salt formed does not hydrolyse
- (C) Only  $\text{OH}^-$  and  $\text{H}^+$  ions react in every case
- (D) The strong base and strong acid reacts in aqueous solution

Answer: Option C

**82. Which of the following gases is the most soluble in water?**

- (A)  $\text{NH}_3$
- (B)  $\text{CO}_2$
- (C)  $\text{H}_2\text{S}$
- (D)  $\text{CH}_4$

Answer: Option A

**83. Raoult's law is not applicable to the**

- (A) Solutes which dissociate or associate in the particular solution
- (B) Concentrated solutions
- (C) Both (B) & (C)
- (D) Solutions containing non-volatile solute

Answer: Option C

**84. A reduction process is accompanied with increase in the**

- (A) Number of electrons
- (B) Oxidation number
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option A

**85. pH value of  $\text{H}_2\text{SO}_4$  (5% concentration) is**

- (A) 5
- (B) 7
- (C)  $> 7$
- (D)  $< 7$

Answer: Option D

**86. The unit of dynamic viscosity is**

- (A) Stoke
- (B) Poise
- (C) gm/cm sec
- (D) Both (B) & (C)

Answer: Option D



**87. Kinetic theory of gases stipulates that, the**

- (A) Energy is lost during molecular collisions
- (B) Molecules possess appreciable volume
- (C) Absolute temperature is a measure of the kinetic energy of molecules
- (D) None of these

Answer: Option C

**88. Unit of power is**

- (A) Joule
- (B) Watt
- (C) Joule/Second
- (D) Both (B) & (C)

Answer: Option D

**89. The  $\text{OH}^-$  concentration in a solution having pH value 3 is**

- (A)  $10^{-3}$
- (B)  $10^{-10}$
- (C)  $10^{-11}$
- (D)  $10^{-13}$

Answer: Option C

**90.  $1 \text{ kg/m}^2$  is equal to \_\_\_\_\_ mm water column.**

- (A) 1
- (B) 10
- (C) 100
- (D) 1000

Answer: Option A

**91. The vapor pressure of water at  $100^\circ\text{C}$  is**

- (A)  $100 \text{ N/m}^2$
- (B) 76 cms of Hg
- (C) 13.6 cms of Hg
- (D) 760 mm wc

Answer: Option B

**92. Pick out the wrong statement.**

- (A) To make 100 kg of a solution containing 40% salt by mixing solution A (containing 25% salt) and solution B (containing 50% salt), the amount of solution A required is 40 kg
- (B) 1.2 gm atoms of carbon and 1.5 gm moles of oxygen are reacted to give 1 gm mole of carbon dioxide. The limiting reactant is carbon. The percent excess reactant supplied is 25
- (C) A gas bubble at a pressure of  $P_g$  is passed through a solvent with a saturation vapour pressure of  $P_s$ . If the time of passage of the bubble is long and air is insoluble in the solvent, the mole fraction of solvent in the bubble will be equal to  $P_s/P_g$
- (D) A supersaturated solution of a sparingly soluble solute, at a concentration of  $C$ , is being fed to a crystalliser at a volumetric flow rate of  $V$ . The solubility of the solute is  $C_l$ . The output rate of solids from an efficient crystalliser is  $(C + C_l) V$

Answer: Option D

**93. Heat of transition is the heat evolved or absorbed, when a substance is converted from**

- (A) Vapor to liquid
- (B) Vapor to solid
- (C) Solid to liquid
- (D) One allotropic form to another allotropic form

Answer: Option D

**94. Except for monatomic gases, the molal heat capacity at constant volume for all gases is \_\_\_\_\_ Kcal/Kg mole.  $^\circ\text{K}$ .**

- (A) 3
- (B)  $> 3$
- (C)  $< 3$
- (D)  $< 1$

Answer: Option B

**95. Acidity or alkalinity of a solution is expressed by its pH value, which is defined as (where,  $[H^+]$  = hydrogen ion concentration in the solution).**

- (A)  $\log (1/H^+)$
- (B)  $-\log (1/H^+)$
- (C)  $1/\log H^+$
- (D) None of these

Answer: Option A

**96. The crystallisation of a solute from a solution may be done by**

- (A) Removal of pure solvent by evaporation
- (B) Change of temperature thereby causing super-saturation
- (C) Changing the nature of the system by the addition of a more soluble material
- (D) All (A), (B) & (C)

Answer: Option D

**97. \_\_\_\_\_ fuels require the maximum percentage of 'excess air' for complete combustion.**

- (A) Solid
- (B) Liquid
- (C) Gaseous
- (D) Nuclear

Answer: Option A

**98. Boiling point of a non-homogeneous mixture of immiscible liquids is \_\_\_\_\_ that of any one of its separate components.**

- (A) Lower than
- (B) Higher than
- (C) Equal to
- (D) Either (A) or (B); depends on the liquids

Answer: Option A

**99. The forces causing the vaporisation of liquid are derived from the Kinetic energy of translation of its molecules. The heat of vaporisation**

- (A) Increases with pressure rise
- (B) Decreases with increasing pressure
- (C) Becomes zero at the critical point
- (D) Both (B) & (C)

Answer: Option D

**100. The vapour pressure of a solution (made by dissolving a solute in a solvent) is \_\_\_\_\_ that of the pure solvent.**

- (A) Less than
- (B) More than
- (C) Equal to
- (D) Either more or less; depends on the solvent

Answer: Option A

**101. In case of a solution (not of a solid in a liquid), whose total volume is more than the sum of volumes of its components in their pure states, solubility is**

- (A) Independent of the temperature
- (B) Increased with the increase in pressure
- (C) Decreased with the increase in pressure
- (D) Unchanged by the pressure change

Answer: Option C

**102. At what temperature, given mass of a gas that occupies a volume of 2 litres at N.T.P. will occupy a volume of 4 litres, if the pressure of the gas is kept constant?**

- (A)  $273^\circ\text{C}$
- (B)  $273^\circ\text{K}$
- (C)  $100^\circ\text{C}$
- (D)  $200^\circ\text{C}$

Answer: Option A

**103.  $1\text{m}^3$  is approximately equal to**

- (A) 28 litres
- (B)  $35\text{ft}^3$

- (C) 4.5 litres
  - (D) 4.5 ft<sup>3</sup>
- Answer: Option B

**104. 2 litres of nitrogen at N.T.P. weighs \_\_\_\_\_ gms.**

- (A) 14
- (B) 2.5
- (C) 28
- (D) 1.25

Answer: Option B

**105. Which of the following gravity scales is used exclusively for liquids heavier than water?**

- (A) Baume scale
- (B) Twaddell scale
- (C) API scale
- (D) None of these

Answer: Option B

**106. Heat of reaction is a function of the**

- (A) Pressure
- (B) Temperature
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option C

**107. "The total volume occupied by a gaseous mixture is equal to the sum of the pure component volumes". This is the \_\_\_\_\_ law.**

- (A) Dalton's
- (B) Amagat's
- (C) Gay-Lussac's
- (D) Avogadro's

Answer: Option B

**108. The average translational kinetic energy with which a gas molecule is endowed is dependent on its**

- (A) Nature
- (B) Size
- (C) Absolute temperature
- (D) All (A), (B) & (C)

Answer: Option C

**109. Internal energy is independent of the \_\_\_\_\_ for an ideal gas.**

- (A) Pressure
- (B) Volume
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option C

**110. Sometimes, in chemical processes, a part of the outlet stream is rejected as waste in order to keep the impurity level in the system within limits. This phenomenon is termed as the**

- (A) Recycling
- (B) Purging
- (C) Bypassing
- (D) Recirculation

Answer: Option B

**111. Recycling in a chemical process facilitates**

- (A) Increased yield
- (B) Enrichment of product
- (C) Heat conservation
- (D) All (A), (B) & (C)

Answer: Option D

**112. The vapor pressure of liquids (having similar chemical nature) at any specified temperature \_\_\_\_\_ with increasing molecular weight.**

- (A) Increases
- (B) Decreases
- (C) Remains unchanged
- (D) Increases linearly

Answer: Option B

**113. The temperature at which a real gas obeys Boyle's law is termed as the**

- (A) Triple point
- (B) Boyle's temperature
- (C) Eutectic point
- (D) Inversion temperature

Answer: Option B

**114. Pick out the wrong statement.**

- (A) Ten times dilution of a normal solution (N) reduces its normality to N/10
- (B) When equal weights of oxygen and methane are mixed in an empty reactor at room temperature, then the fraction of total pressure exerted by the oxygen is 1/2
- (C) Volume occupied by  $9.034 \times 10^{23}$  atoms of oxygen in ozone ( $O_3$ ) at NTP will be 11200 c.c
- (D) One kg mole of an ideal gas at N.T.P occupies  $22400 \text{ Nm}^3$

Answer: Option D

**115. A long cylinder and a sphere both of 5 cms diameter are made from the same porous material. The flat ends of cylinder are sealed. Both the cylinder and sphere are saturated with the same solution of sodium chloride. Later both the objects are immersed for a short and equal interval of time in a large tank of water which is well agitated. The fraction of salt remaining in the cylinder and the sphere are  $X_c$  and  $X_s$  respectively. Which of the following statement is correct?**

- (A)  $X_c > X_s$
- (B)  $X_c = X_s$
- (C)  $X_c < X_s$
- (D)  $X_c$  greater/less than  $X_s$  depending on the length of the cylinder

Answer: Option C

**116. Enthalpy of a vapor gas mixture may be increased by increasing the**

- (A) Temperature at constant humidity
- (B) Humidity at constant temperature
- (C) Temperature and the humidity
- (D) All (A), (B) & (C)

Answer: Option D

**117. The density of a gas at N.T.P. is ' $\rho$ '. Keeping the pressure constant (i.e. 760 mm Hg), the 3 density of the gas will become  $\frac{3}{4} 0.75 \rho$  at a temperature of \_\_\_\_\_ °K.**

- (A) 273°
- (B) 300°
- (C) 400°
- (D) 373°

Answer: Option C

**118. During a phase change process like sublimation, vaporisation, melting etc., the specific \_\_\_\_\_ does not change.**

- (A) Enthalpy
- (B) Gibbs free energy
- (C) Internal energy
- (D) Entropy

Answer: Option B

**119. An aqueous solution of 2.45% by weight  $H_2SO_4$  has a specific gravity of 1.011. The composition expressed in normality is**

- (A) 0.2500
- (B) 0.2528
- (C) 0.5000
- (D) 0.5055

Answer: Option D

**120. The maximum adiabatic flame temperature of fuels in air is \_\_\_\_\_ the maximum flame temperature in pure oxygen.**

- (A) Lower than
  - (B) Higher than
  - (C) Same as
  - (D) Not related to
- Answer: Option A

**121. 1 torr is equivalent to**

- (A) 1 mm Hg
- (B) 1 Pascal
- (C) 1 atm
- (D) 1 mm wc

Answer: Option A

**122. A vessel of volume  $1000 \text{ m}^3$  contains air which is saturated with water vapour. The total pressure and temperature are 100 kPa and  $20^\circ\text{C}$  respectively. Assuming that the vapour pressure of water at  $20^\circ\text{C}$  is 2.34 kPa, the amount of water vapour (in kg) in the vessel is approximately**

- (A) 17
- (B) 20
- (C) 25
- (D) 34

Answer: Option A

**123. At a constant volume, for a fixed number of moles of a gas, the pressure of the gas increases with rise of temperature due to**

- (A) Decrease in mean free path
- (B) Increased collision rate among molecules
- (C) Increase in molecular attraction
- (D) Increase in average molecular speed

Answer: Option C

**124. Kinematic viscosity of  $1 \text{ m}^2/\text{second}$  is equivalent to \_\_\_\_\_ stokes.**

- (A) 10
- (B)  $10^2$
- (C)  $10^3$
- (D)  $10^4$

Answer: Option D

**125. A 'limiting reactant' is the one, which decides the \_\_\_\_\_ in the chemical reaction.**

- (A) Equilibrium constant
- (B) Conversion
- (C) Rate constant
- (D) None of these

Answer: Option B

**126. For water evaporating into unsaturated air under adiabatic conditions and at constant pressure, the \_\_\_\_\_ remains constant throughout the period of vaporisation.**

- (A) Dry bulb temperature
- (B) Wet bulb temperature
- (C) Humidity
- (D) Relative saturation

Answer: Option B

**127. Heat of reaction is not influenced by**

- (A) The route/method through which final products are obtained
- (B) The physical state (e.g., solid, liquid or gaseous) of reactants and products
- (C) Whether the reaction is carried out at constant temperature or constant pressure
- (D) None of these

Answer: Option A

**128. At higher temperature, molal heat capacities of most of the gases (at constant pressure) \_\_\_\_\_ with increase in temperature.**

- (A) Increases

- (B) Decreases
  - (C) Remains unchanged
  - (D) Increases linearly
- Answer: Option A

**129. If the pressure of a gas is reduced to half & its absolute temperature is doubled, then the volume of the gas will**

- (A) Be reduced to 1/4th
  - (B) Increase four times
  - (C) Increase two times
  - (D) None of these
- Answer: Option B

**130. An oxidation process is accompanied by decrease in the**

- (A) Number of electrons
  - (B) Oxidation number
  - (C) Number of ions
  - (D) All (A), (B) & (C)
- Answer: Option A

**131. If the absolute temperature of an ideal gas is tripled and simultaneously the pressure is reduced to one third; then the volume of gas will**

- (A) Remain unaltered
  - (B) Increase nine fold
  - (C) Increase three fold
  - (D) Decrease three fold
- Answer: Option B

**132. The osmotic pressure of a solution is directly proportional to the**

- (A) Lowering of vapor pressure
  - (B) Molecular concentration of the solute
  - (C) Absolute temperature of a given concentration
  - (D) All (A), (B) and (C)
- Answer: Option D

**133. One mole of methane undergoes complete combustion in a stoichiometric amount of air. The reaction proceeds as  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ . Both the reactants and products are in gas phase.  $\Delta H^\circ_{298} = -730$  kJ/mole of methane. Mole fraction of water vapour in the product gases is about**

- (A) 0.19
  - (B) 0.33
  - (C) 0.40
  - (D) 0.67
- Answer: Option A

**134.  $C_v$  for monatomic gases is equal to (where,  $R$  = gas constant)**

- (A)  $R$
  - (B)  $1.5 R$
  - (C)  $2R$
  - (D)  $3R$
- Answer: Option B

**135. The vapor pressure of the solvent decreased by 10 mm Hg, when a non-volatile solute was added to the solvent. The mole fraction of the solute in the solution is 0.2. What should be the mole fraction of the solvent, if the decrease in vapor pressure of the solvent is required to be 20 mm Hg?**

- (A) 0.2
  - (B) 0.1
  - (C) 0.4
  - (D) 0.6
- Answer: Option D

**136. Colligative properties of a dilute solution are those, which depend entirely upon the**

- (A) Chemical composition of the solute
- (B) Constitution of the solute

(C) Number of solute molecules contained in a given volume of the solvent

(D) None of these

Answer: Option B

**137.  $C_p - C_v$  for an ideal gas is equal to**

(A)  $R$

(B)  $R/2$

(C)  $2R$

(D)  $3R$

Answer: Option A

**138. Which of the following is not a unit of pressure?**

(A) Parsec

(B) Kilo-Pascal

(C) Bar

(D) Newton/metre<sup>2</sup>

Answer: Option A

**139. Real gases approach ideal behaviour at**

(A) High pressure & high temperature

(B) Low pressure & high temperature

(C) High pressure & low temperature

(D) Low pressure & low temperature

Answer: Option B

**140. If the pH value of a solution changes by one unit, it implies that hydrogen ion concentration in the solution will change \_\_\_\_\_ times.**

(A) 10

(B) 20

(C) 70

(D) 100

Answer: Option A

**141. In the reaction, represented by  $\text{Na}_2\text{CO}_3 + \text{HCl} \rightarrow \text{NaHCO}_3 + \text{NaCl}$ , the equivalent weight of  $\text{Na}_2\text{CO}_3$  is**

(A) 53

(B) 5.3

(C) 106

(D) 10.6

Answer: Option C

**142. pH value of an alkaline solution is**

(A) 7

(B)  $> 7$

(C)  $< 7$

(D) Constant over a wide range

Answer: Option B

**143. The unit of  $C_p$  in S.I. units is**

(A)  $\text{W/m}^2 \cdot ^\circ\text{K}$

(B)  $\text{J/kg} \cdot ^\circ\text{K}$

(C)  $\text{W/m} \cdot ^\circ\text{K}$

(D)  $\text{J/m}^3 \cdot ^\circ\text{K}$

Answer: Option B

**144. Which of the following is not used for computing latent heat of vaporisation?**

(A) Clausius-Clapeyron equation

(B) Reference substance plots based on Dühring & Othmer plots

(C) Kistyakowsky's equation

(D) Hess's law of constant heat summation

Answer: Option D

**145. Simultaneous doubling of the absolute temperature of a gas and reduction of its pressure to half will result in \_\_\_\_\_ in the volume of the gas.**

(A) No change

- (B) Doubling
  - (C) 1/4th reduction
  - (D) Fourfold increase
- Answer: Option B

**146. \_\_\_\_\_ equation relates latent heat and boiling point.**

- (A) Antoine
  - (B) Kistyakowsky
  - (C) Kopp's
  - (D) Trouton's
- Answer: Option D

**147. The heat of vaporisation \_\_\_\_\_ with increase in pressure.**

- (A) Increases
  - (B) Decreases
  - (C) Becomes zero at critical pressure
  - (D) Both (B) and (C)
- Answer: Option D

**148. Refluxing of part of the distillate in a fractionating column is a 'recycling operation', aimed primarily at**

- (A) Heat conservation
  - (B) Yield enhancement
  - (C) Product enrichment
  - (D) None of these
- Answer: Option C

**149.  $C_p/C_v$  for monatomic gases is**

- (A) 1.44
- (B) 1.66
- (C) 1.99
- (D) 1

Answer: Option B

**150. The rate of material \_\_\_\_\_ is zero in case of a steady state system.**

- (A) Accumulation
  - (B) Production
  - (C) Input
  - (D) Generation
- Answer: Option A

**151. Volume percent for gases is equal to the**

- (A) Weight percent
- (B) Mole percent
- (C) Weight percent only for ideal gases
- (D) Mole percent only for ideal gases

Answer: Option D

**152. Pick out the wrong unit conversion of heat transfer co-efficient.**

- (A)  $1 \text{ kcal/m}^2 \cdot \text{hr} \cdot ^\circ\text{C} = 0.2048 \text{ BTU/ft}^2 \cdot \text{hr} \cdot ^\circ\text{F} = 1.163 \text{ W/m}^2 \cdot ^\circ\text{K}$
- (B)  $1 \text{ kcal/m}^2 \cdot \text{hr} \cdot ^\circ\text{K} = 1.163 \text{ W/m}^2 \cdot ^\circ\text{C}$
- (C)  $1 \text{ W/m}^2 \cdot ^\circ\text{C} = 0.1761 \text{ BTU/ft}^2 \cdot \text{hr} \cdot ^\circ\text{F}$ .
- (D)  $1 \text{ BTU/ft}^2 \cdot \text{hr} \cdot ^\circ\text{F} = 4.88 \text{ kcal/m}^2 \cdot \text{hr} \cdot ^\circ\text{C} = 20.44 \text{ kJ/m}^2 \cdot \text{hr} \cdot ^\circ\text{C} = 5.678 \text{ W/m}^2 \cdot ^\circ\text{C}$

Answer: Option B

**153. One micron is equal to**

- (A)  $10^{-4} \text{ mm}$
- (B)  $10^{-4} \text{ cm}$
- (C)  $10^{-6} \text{ m}$
- (D) Both (B) & (C)

Answer: Option D

**154. Viscosity of atmospheric air may be about \_\_\_\_\_ centipoise.**

- (A) 0.015
- (B) 1.5



- (C) 15
- (D) 150

Answer: Option A

**155. 1 centipoise is equivalent to**

- (A) 1 gm/cm.second
- (B) 1 centistoke
- (C) 2.42 lb/ft.hr
- (D) 2.42 lb/ft.second

Answer: Option C

**156. Kopp's rule is concerned with the calculation of**

- (A) Thermal conductivity
- (B) Heat capacity
- (C) Viscosity
- (D) Surface tension

Answer: Option B

**157. The net heat evolved or absorbed in a chemical process, i.e. total change in the enthalpy of the system is independent of the**

- (A) Temperature & pressure
- (B) Number of intermediate chemical reactions involved
- (C) State of aggregation & the state of combination at the beginning & the end of the reaction
- (D) None of these

Answer: Option B

**158. Validity of the relationship, inputs = outputs, holds good for the system at steady state**

- (A) With chemical reaction
- (B) Without chemical reaction
- (C) Without chemical reaction & losses
- (D) None of these

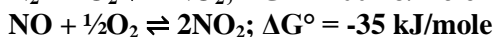
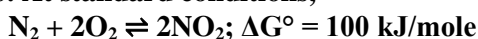
Answer: Option C

**159. With rise in pressure, the solubility of gases in solvent, at a fixed temperature**

- (A) Increases
- (B) Decreases
- (C) Remains unchanged
- (D) Decreases linearly

Answer: Option A

**160. At standard conditions,**



**The standard free energy of formation of NO in kJ/mole is**

- (A) 15
- (B) 30
- (C) 85
- (D) 170

Answer: Option C

**161. NaOH contains \_\_\_\_\_ percent oxygen.**

- (A) 1
- (B) 10
- (C) 16
- (D) 40

Answer: Option D

**162. Pick out the wrong unit conversion of calorific value.**

- (A) 1 kcal/kg = 1.8 BTU/lb = 4.186 kJ/kg
- (B) 1 BTU/ft<sup>3</sup> = 8.9 kcal/m<sup>3</sup> = 0.038 MJ/m<sup>3</sup>
- (C) 1 BTU/lb = 2.3 kcal/kg
- (D) 1 kcal/m<sup>3</sup> = 0.1124 BTU/ft<sup>3</sup>

Answer: Option C

**163. Pick out the wrong statement.**

- (A) One kg-mole of an ideal gas occupies  $22.4 \text{ m}^3$  at N.T.P.
- (B) One lb-mole of an ideal gas occupies  $359 \text{ ft}^3$  at N.T.P.
- (C) One gm-mole of an ideal gas occupies 22.4 litres (i.e., 22400 c.c) at N.T.P.
- (D) Density of dry air at N.T.P. is 1 gm/litre

Answer: Option D

**164. A bypass stream in a chemical process is useful, because it**

- (A) Facilitates better control of the process
- (B) Improves the conversion
- (C) Increases the yield of products
- (D) None of these

Answer: Option A

**165.  $1 \text{ kgf/cm}^2$  is not equal to**

- (A) 1 torr
- (B) 1 bar
- (C) 10000 mm wc
- (D)  $100 \text{ KPa} = 100\,000 \text{ N/m}^2$

Answer: Option A

**166. Which of the following expressions defines the Baume gravity scale for liquids heavier than water?**

- (A)  $(141.5/G) - 131.5$
- (B)  $145 - (145/G)$
- (C)  $200(G-1)$
- (D)  $(400/G) - 400$

Answer: Option B

**167. Ideal solution is formed, when its components have zero**

- (A) Heat of mixing
- (B) Volume change
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option C

**168. The weight fraction of methanol in an aqueous solution is 0.64. The mole fraction of methanol  $X_M$  satisfies**

- (A)  $X_M < 0.5$
- (B)  $X_M = 0.5$
- (C)  $0.5 < X_M < 0.64$
- (D)  $X_M \geq 0.64$

Answer: Option D

**169. Compressibility factor of a real gas is the ratio of the actual volume to that predicted by ideal gas law. As the pressure of the gas approaches zero, the compressibility factor approaches**

- (A)  $\infty$
- (B) 0
- (C) 1
- (D) 0.24

Answer: Option C

**170. The effect of pressure on the heat capacity of the gases \_\_\_\_\_ is negligible.**

- (A) At pressure below one atmosphere
- (B) Below the critical temperature
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option C

**171.  $\text{CaCO}_3$  contains \_\_\_\_\_ percent of Ca by weight.**

- (A) 40
- (B) 48
- (C) 96
- (D) 12

Answer: Option A

172. The osmotic pressure of a solution increases, if its \_\_\_\_\_ is decreased.

- (A) Volume
- (B) Solute concentration
- (C) Temperature
- (D) None of these

Answer: Option D

173. One kg of saturated steam at 100°C and 1.01325 bar is contained in a rigid walled vessel. It has a volume of 1.673 m<sup>3</sup>. It cools to 98°C; the saturation pressure is 0.943 bar; one kg of water vapour under these conditions has a volume of 1.789 m<sup>3</sup>. The amount of water vapour condensed (in kg) is

- (A) 0.0
- (B) 0.065
- (C) 0.1
- (D) 1.0

Answer: Option B

174. A metal oxide is reduced by heating it in a stream of hydrogen. After complete reduction, it is found that 3.15 gm of the oxide has yielded 1.05 gm of the metal. It may be inferred that the

- (A) Atomic weight of the metal is 4
- (B) Equivalent weight of the metal is 4
- (C) Atomic weight of the metal is 2
- (D) Equivalent weight of the metal is 8

Answer: Option B

175. The boiling points for pure water and pure toluene are 100°C and 110.6°C respectively. Toluene and water are completely immiscible in each other. A well agitated equimolar mixture of toluene and water are prepared. If, at a total pressure of one standard atm. exerted by the vapours of water and toluene, the mole fraction of water  $X_w$  in the vapour phase satisfies

- (A)  $0 < X_w < 0.5$
- (B)  $X_w = 0.5$
- (C)  $0.5 < X_w < 1.0$
- (D)  $X_w = 1.0$

Answer: Option C

176. Diffusion is that property by virtue of which a perfume bottle when opened up in a room, makes the whole room fragrant with its smell. If a perfume 'X' diffuses twice as fast as another perfume 'Y'; what is the molecular weight of 'Y', if the vapor density of gas 'X' is 2? Molecular weight of gas 'X' is to be assumed to be 2.

- (A) 2
- (B) 4
- (C) 8
- (D) 16

Answer: Option D

177. Gases diffuse faster compared to liquids because of the reason that the liquid molecules

- (A) Are held together by stronger inter-molecular forces
- (B) Move faster
- (C) Have no definite shape
- (D) Are heavier

Answer: Option A

178. The number of atoms of oxygen present in 11.2 litres of ozone (O<sub>3</sub>) at N.T.P. are

- (A)  $3.01 \times 10^{22}$
- (B)  $6.02 \times 10^{23}$
- (C)  $9.03 \times 10^{24}$
- (D)  $1.20 \times 10^{24}$

Answer: Option C

179. Enthalpy of formation of NH<sub>3</sub> is - 46 kJ/kg mole. The enthalpy change for the gaseous reaction,  $2\text{NH}_3 \rightarrow \text{N}_2 + 3\text{H}_2$ , is equal to \_\_\_\_\_ kJ/kg. mole.

- (A) 46
- (B) 92
- (C) -23
- (D) -92

Answer: Option B

**180.  $N_2$  content in a urea sample was found to be only 42%. What is the actual urea content of the sample? (Molecular weight of urea = 60)**

- (A) 80%
- (B) 90%
- (C) 95%
- (D) 98%

Answer: Option B

**181. A rigid vessel containing three moles of nitrogen gas at  $30^\circ\text{C}$  is heated to  $250^\circ\text{C}$ . Assume the average capacities of nitrogen to be  $C_p = 29.1 \text{ J/mole}\cdot^\circ\text{C}$  and,  $C_v = 20.8 \text{ J/mole}\cdot^\circ\text{C}$ . The heat required, neglecting the heat capacity of the vessel, is**

- (A) 13728 J
- (B) 19206 J
- (C) 4576 J
- (D) 12712 J

Answer: Option B

**182. Which of the following ratios defines the recycle ratio in a chemical process?**

- (A) Gross feed stream/recycle feed stream
- (B) Recycle stream/fresh feed stream
- (C) Recycle stream/gross feed stream
- (D) None of these

Answer: Option B

**183. Increasing the temperature of an aqueous solution will cause decrease in its**

- (A) Molality
- (B) Mole fraction
- (C) Weight percent
- (D) Molarity

Answer: Option D

**184.  $C_p$  equals  $C_v$  at**

- (A)  $0^\circ\text{C}$
- (B)  $0^\circ\text{K}$
- (C)  $0^\circ\text{F}$
- (D)  $0^\circ\text{R}$

Answer: Option B

**185.  $C_p$  is expressed in S.I. unit as**

- (A)  $\text{J/kg}\cdot^\circ\text{K}$
- (B)  $0^\circ\text{K}$
- (C)  $\text{W/m}^2\cdot^\circ\text{C}$
- (D)  $\text{W/m}\cdot^\circ\text{K}$

Answer: Option A

**186. On addition of 1 c.c. of dilute hydrochloric acid (1% concentration) to 80 c.c. of a buffer solution of  $\text{pH} = 4$ , the  $\text{pH}$  of the solution becomes**

- (A) 1
- (B) 8
- (C) 4
- (D) 2

Answer: Option C

**187. In osmosis through a semi-permeable membrane, diffusion of the**

- (A) Solvent is from low concentration to high concentration region
- (B) Solvent is from high concentration to low concentration region
- (C) Solute takes place
- (D) None of these

Answer: Option A

**188. One kg of saturated steam at  $100^\circ\text{C}$  and 1.01325 bar is contained in a rigid walled vessel. It has a volume of  $1.673 \text{ m}^3$ . It cools to  $98^\circ\text{C}$ ; the saturation pressure is 0.943 bar ; one kg of water vapour under these conditions has a volume of  $1.789 \text{ m}^3$ . The latent heat of condensation**

(kJ/kg<sup>-1</sup>) under these conditions is

- (A) 40732
- (B) 2676
- (C) 2263
- (D) 540

Answer: Option C

**189. Solutions which distil without change in composition are called**

- (A) Ideal
- (B) Saturated
- (C) Supersaturated
- (D) Azeotropic

Answer: Option D

**190. Raoult's law is obeyed by a \_\_\_\_\_ solution.**

- (A) Saturated
- (B) Molar
- (C) Normal
- (D) None of these

Answer: Option D

**191. The equilibria relations in a multi-component and multiphase system cannot be calculated with the help of the**

- (A) Phase rule
- (B) Experimental data
- (C) Empirical equations
- (D) Theoretical equations

Answer: Option A

**192. The heat change for the reaction,  $C(s) + 2S(s) \rightarrow CS_2(l)$ , is 104.2 kJ. It represents the heat of**

- (A) Formation
- (B) Solution
- (C) Combustion
- (D) Fusion

Answer: Option A

**193. Pick out the wrong conversion formula for the conversion of weight units:**

- (A) 1 tonne = 1000 kg = 22.046 lbs
- (B) 1 U.S. ton = 907 kg = 0.907 tonne = 0.893 ton
- (C) 1 ton = 2240 lbs = 1016 kg = 1.016 tonnes = 1.12 U.S. tons
- (D) None of these

Answer: Option D

**194. Which of the following holds good for a solution obeying Raoult's law (i.e., an ideal solution) (where,  $\Delta H$  = heat of mixing, and  $\Delta V$  = volume change on mixing)?**

- (A)  $\Delta H = 1$  (+ve) and  $\Delta V = -ve$
- (B)  $\Delta H = 0$
- (C)  $\Delta V = 0$
- (D) Both (B) and (C)

Answer: Option D

**195. If pH value of an acidic solution is decreased from 5 to 2, then the increase in its hydrogen ion concentration is \_\_\_\_\_ times.**

- (A) 10
- (B) 100
- (C) 1000
- (D) 10000

Answer: Option C

**196. 40 gms each of the methane and oxygen are mixed in an empty container maintained at 40°C. The fraction of the total pressure exerted by oxygen is**

- (A) 1/2
- (B) 1/3
- (C) 1/4
- (D) 2/3

Answer: Option B

**197. 1 gm mole of methane (CH<sub>4</sub>) contains**

- (A)  $6.02 \times 10^{23}$  atoms of hydrogen
- (B) 4 gm atoms of hydrogen
- (C)  $3.01 \times 10^{23}$  molecules of methane
- (D) 3 gms of carbon

Answer: Option B

**198. Pick out the wrong statement.**

- (A) 'Reduced temperature' of a substance is the ratio of its existing temperature to its critical temperature, both expressed on Celsius scale
- (B) 'Reduced pressure' is the ratio of the existing pressure of a substance to its critical pressure
- (C) 'Reduced volume' is the ratio of the existing molal volume of a substance to its critical molal volume
- (D) None of these

Answer: Option A

**199. Pick out the wrong statement.**

- (A) The evaporation of aqueous solution of glucose causes its molarity to increase
- (B) Both the freezing point as well as boiling point of sea water is more than that of distilled water
- (C) The solution containing equal masses of two liquids 'X' and 'Y' has the same mole fraction of 'X' and 'Y'
- (D) Both (B) and (C)

Answer: Option D

**200. For estimation of heat capacity of a solid compound, one can use**

- (A) Clapeyron's equation
- (B) Gibb's equation
- (C) Kopp's rule
- (D) Trouton's rule

Answer: Option C

**201. In case of an unsaturated vapor-gas mixture, the humid volume increases with increase in the**

- (A) Total pressure
- (B) Absolute humidity at a given temperature
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option C

**202. The hydroxyl ion (OH<sup>-</sup>) concentration in a solution having pH value 3 will be**

- (A)  $10^{-11}$
- (B)  $10^{-10}$
- (C)  $10^{-3}$
- (D)  $10^{-4}$

Answer: Option A

**203. The pH value of a solution is 5.9. If the hydrogen ion concentration is decreased hundred times, the solution will be**

- (A) Basic
- (B) More acidic
- (C) Neutral
- (D) Of the same acidity

Answer: Option A

**204. Pick out the wrong statement.**

- (A) Heat capacity of a diatomic gas is higher than that of a monatomic gas
- (B) Equal volumes of Argon and Krypton contain equal number of atoms
- (C) Total number of molecules contained in 22.4 litres of hydrogen at NTP is  $6.023 \times 10^{23}$
- (D) The binary mixture of a particular composition in both vapor and liquid state is known as an azeotropic mixture

Answer: Option B

**205. According to Raoult's law, "The vapor pressure exerted by component in a solution is proportional to the mole fraction of that component." Raoult's law is not applicable under the following assumption/condition.**

- (A) No component is concentrated at the surface of the solution
- (B) The component molecules are non polar and are of almost equal size
- (C) In the formation of solution, chemical combination/molecular association between unlike molecules takes place
- (D) The attractive forces between like and unlike molecules are almost equal

Answer: Option C

**206. 1 kg/cm<sup>2</sup> is equal to**

- (A) 760 torr
- (B) 1 KPa
- (C) 10 metres of water column
- (D) 1 metre of water column

Answer: Option C

**207. Gases having same reduced temperatures and reduced pressures**

- (A) Deviate from ideal gas behaviour to the same degree
- (B) Have nearly the same compressibility factor
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option C

**208. For a reaction,  $X \rightarrow Y$ , if the concentration of 'X' is tripled; the rate becomes nine times. The order of reaction is**

- (A) 0
- (B) 1
- (C) 2
- (D) 3

Answer: Option C

**209. 'Giga' stands for**

- (A)  $10^9$
- (B)  $10^{-12}$
- (C)  $10^{12}$
- (D)  $10^{15}$

Answer: Option A

**210. A sample of well water contains 140 gm/m<sup>3</sup> Ca<sup>2+</sup> ions and 345 gm/m<sup>3</sup> Na<sup>+</sup> ions. The hardness of the sample of water, expressed in terms of equivalent CaCO<sub>3</sub> in gm/m<sup>3</sup> is (assuming atomic masses of Ca :40, Na : 23, C : 12, O : 16)**

- (A) 350
- (B) 485
- (C) 140
- (D) 345

Answer: Option A

**211. N.T.P. corresponds to**

- (A) 1 atm absolute pressure & 0°C
- (B) 760 mm Hg gauge pressure & 0°C
- (C) 760 torr & 15°C
- (D) 101.325 KPa gauge pressure & 0°C

Answer: Option A

**212. Which equation is not an equation of state?**

- (A)  $PV = RT + B/V + y/V^2 + \dots$
- (B)  $(P + a/V^2)(V-b) = RT$
- (C)  $\log_e (p/p_0) = (\lambda/R) (1/T_0 - 1/T)$
- (D)  $p = [RT/(V - b)] - (a/TV^2)$

Answer: Option C

**213. Pick out the wrong statement.**

- (A) The effect of pressure on heat capacity of gases at pressure above one atmosphere and above the critical temperature is negligible

- (B) The value of  $C_p$  of gases increases with increase in pressure, above atmospheric pressure  
(C) The value of  $C_p$  at critical temperature and pressure reaches infinity  
(D) All (A), (B), and (C)  
Answer: Option A

**214. Avogadro number is the number of molecules in one \_\_\_\_\_ of a gas.**  
(A) gram  
(B) Kilogram  
(C) gm.mole  
(D) Litre  
Answer: Option C

**215. A chemical process is said to occur under unsteady state, if the**  
(A) Inventory changes do not take place  
(B) Ratio of streams entering/leaving are independent of time  
(C) Flow rates & composition both are time dependent  
(D) None of these  
Answer: Option C

**216. A solution is made by dissolving 1 kilo mole of solute in 2000 kg of solvent. The molality of the solution is**  
(A) 2  
(B) 1  
(C) 0.5  
(D) 0.05  
Answer: Option C

**217. The vapor pressure of liquids of similar chemical nature at any particular temperature \_\_\_\_\_ with increase in the molecular weight.**  
(A) Increases  
(B) Decreases  
(C) Remains unchanged  
(D) Either (A) or (B); depends on the liquid  
Answer: Option B

**218. 1 BTU/ft<sup>3</sup> is approximately equal to \_\_\_\_\_ kcal/m<sup>3</sup>.**  
(A) 1  
(B) 9  
(C) 4  
(D) 252  
Answer: Option B

**219. Heat of solution in a system in which both solute and solvent are liquids is termed as**  
(A) Heat of solvation  
(B) Heat of hydration  
(C) Standard integral heat of solution  
(D) Heat of mixing  
Answer: Option D

**220. The heat of adsorption of a gas caused by Van der Waals forces of attraction and capillarity is equal to the heat of**  
(A) Normal condensation  
(B) Wetting  
(C) Sum of (A) and (B)  
(D) Difference of (A) and (B)  
Answer: Option C

**221. Pick out the wrong unit conversion of mass transfer co-efficient.**  
(A)  $1 \text{ lb/hr.ft}^3 \cdot \text{atm.} = 4.8182 \text{ kg/hr.m}^2 \cdot \text{bar}$   
(B)  $1 \text{ kg/hr.m}^2 \cdot \text{atm} = 0.98687 \text{ kg/hr. m} \cdot \text{bar}$   
(C)  $1 \text{ lb/hr.ft}^2 = 4.8823 \text{ kg/hr.m}^2$   
(D)  $1 \text{ kg/hr.m}^2 = 4.8823 \text{ lb/hr.ft}^2$   
Answer: Option D

**222. Which of the following is not a unit of pressure?**



- (A) Torr
  - (B) Newton/m<sup>2</sup>
  - (C) Parsec
  - (D) Ata, bar or Pascal
- Answer: Option C

**223. 1 Pascal (unit of pressure) is equal to \_\_\_\_\_ N/m<sup>2</sup>.**

- (A) 10
- (B) 1
- (C) 0.1
- (D) 1000

Answer: Option B

**224. Pick out the wrong statement:**

- (A) A vapor is termed as a saturated vapor, if its partial pressure equals its equilibrium vapor pressure
- (B) A vapor whose partial pressure is less than its equilibrium vapor pressure, is termed as a 'superheated vapor'
- (C) The temperature at which a vapor is saturated is termed as the boiling point
- (D) The difference between the existing temperature of a vapor and its saturation temperature (i.e. dew point) is called its 'degree of superheat'

Answer: Option C

**225. Assuming that CO<sub>2</sub> obeys perfect gas law, calculate the density of CO<sub>2</sub> (in kg/m<sup>3</sup>) at 263°C and 2 atm.**

- (A) 1
- (B) 2
- (C) 3
- (D) 4

Answer: Option B

**226. Mass number of an atom is the sum of the numbers of**

- (A) Neutrons and protons
- (B) Protons and electrons
- (C) Neutrons and electrons
- (D) Both (A) & (B)

Answer: Option D

**227. Number of gm moles of solute dissolved in 1 kg of solvent is called its**

- (A) Normality
- (B) Molarity
- (C) Molality
- (D) Formality

Answer: Option C

**228. Solution made by dissolving equimolar amounts of different solutes in the same amount of a given solvent will have the**

- (A) Same elevation in boiling point
- (B) Different elevation in boiling point
- (C) Elevation in boiling point in the ratio of their molecular weights
- (D) None of these

Answer: Option A

**229. Boiling point of a solution as compared to that of the corresponding solvent is**

- (A) Less
- (B) More
- (C) Same
- (D) Either more or less; depends upon the solvent

Answer: Option B

**230. Kopp's rule is helpful in finding the**

- (A) Heat capacities of solids
- (B) Heat capacities of gases
- (C) Molal heat capacities of gases
- (D) Activation energy

Answer: Option A

**231. 6 gms of magnesium (atomic weight = 24), reacts with excess of an acid, the amount of  $H_2$  produced will be \_\_\_\_\_ gm.**

- (A) 0.5
- (B) 1
- (C) 3
- (D) 5

Answer: Option A

**232. Number of gram equivalent of solute dissolved in one litre of solution is called its**

- (A) Normally
- (B) Molarity
- (C) Molality
- (D) Formality

Answer: Option A

**233. With increase in the temperature of pure (distilled) water, its**

- (A) pOH decreases and pH increases
- (B) pOH and pH both decreases
- (C) pH and pOH both increases
- (D) pH decreases and pOH increases

Answer: Option B

**234. Which of the following is an exothermic reaction?**

- (A) Conversion of graphite to diamond
- (B) Decomposition of water
- (C) Dehydrogenation of ethane to ethylene
- (D) None of these

Answer: Option D

**235. Under conditions of equal reduced pressure and equal reduced temperature, substances are said to be in the 'corresponding states'. At equal reduced conditions i.e., at the corresponding state, the \_\_\_\_\_ of different gases are nearly the same.**

- (A) Compressibility
- (B) Molecular weight
- (C) Humidity
- (D) None of these

Answer: Option A

**236. Addition of a non-volatile solute to a solvent produces a \_\_\_\_\_ in its solvent.**

- (A) Freezing point elevation
- (B) Boiling point depression
- (C) Vapor pressure lowering
- (D) All (A), (B) & (C)

Answer: Option C

**237. The evaporation of aqueous solution of sugar causes its molarity to**

- (A) Decrease
- (B) Increase
- (C) Remain unchanged
- (D) Either (A) or (B); depends on the concentration of the solution

Answer: Option C

**238. 1 kg of calcium carbide ( $CaC_2$ ) produces about 0.41 kg of acetylene gas on treatment with water. How many hours of service can be derived from 1 kg of calcium carbide in an acetylene lamp burning 35 litres of gas at NTP per hour?**

- (A) 5
- (B) 10
- (C) 15
- (D) 20

Answer: Option B

239. What is the total pressure exerted by a mixture of 0.45 kg mole of benzene, 0.44 kg mole of toluene and 0.23 kg mole of o-xylene at 100°C, if their vapor pressures at 100°C are 1340, 560 and 210 mmHg respectively ?

- (A) 756.2
- (B) 780.5
- (C) 801.5
- (D) 880.5

Answer: Option C

240. Heat capacity of air can be approximately expressed as,  $C_p = 26.693 + 7.365 \times 10^{-3} T$ , where,  $C_p$  is in J/mole.K and  $T$  is in K. The heat given off by 1 mole of air when cooled at atmospheric pressure from 500°C to - 100°C is

- (A) 10.73 kJ
- (B) 16.15 kJ
- (C) 18.11 kJ
- (D) 18.33 kJ

Answer: Option C

241. The elevation in boiling point of a solution is proportional to the \_\_\_\_\_ of the solution.

- (A) Molal concentration
- (B) Reciprocal of the molal concentration
- (C) Normality
- (D) Molarity

Answer: Option A

242. Size range of the colloids particles is

- (A) 5 - 200 milli-microns
- (B) 50 - 200 microns
- (C) 500 - 1000 microns
- (D) 10 - 50 Angstrom

Answer: Option A

243. In case of a ternary system involving two liquid components and a solute, the ratio of the concentration of the solute in the two phases at equilibrium is called the distribution co-efficient. The distribution co-efficient depends upon the

- (A) Solute concentration
- (B) Temperature
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option C

244. Pure aniline is evaporating through a stagnant air film of 1 mm thickness at 300 K and a total pressure of 100 KPa. The vapor pressure of aniline at 300 K is 0.1 KPa. The total molar concentration under these conditions is 40.1 mole/m<sup>3</sup>. The diffusivity of aniline in air is 0.74 × 10<sup>-5</sup> m<sup>2</sup>/s. The numerical value of mass transfer co-efficient is 7.4 × 10<sup>-3</sup>. The rate of evaporation of aniline is 2.97 × 10<sup>-4</sup>. Its units are

- (A) mole/s
- (B) mole/cm<sup>2</sup>.s
- (C) mole/m<sup>2</sup>.s
- (D) k.mole/m<sup>2</sup>.s

Answer: Option D

245. \_\_\_\_\_ kg of CaCO<sub>3</sub> on heating will give 56 kg of CaO.

- (A) 56
- (B) 100
- (C) 144
- (D) 1000

Answer: Option B

246. The activity co-efficient of a solution, which accounts for the departure of liquid phase from ideal solution behaviour

- (A) Measures the elevation in boiling point
- (B) Is not dependent on the temperature
- (C) Is a function of the liquid phase composition

(D) Measures the depression in freezing point

Answer: Option C

**247. In a binary liquid solution of components 'A' and 'B', if component 'A' exhibits positive deviation from Raoult's law, then component 'B'**

(A) Exhibits positive deviation from Raoult's law

(B) Exhibits negative deviation from Raoult's law

(C) Obeys Raoult's law

(D) May exhibit either positive or negative deviation from Raoult's law

Answer: Option A

**248. Percentage saturation of a vapor bearing gas is always \_\_\_\_\_ the relative saturation.**

(A) Higher than

(B) Smaller than

(C) Equal to

(D) Either (A) or (B); depends on the system

Answer: Option B

**249. One Newton is equal to \_\_\_\_\_ dynes.**

(A)  $10^2$

(B)  $10^3$

(C)  $10^4$

(D)  $10^5$

Answer: Option D

**250. The temperature at which the second Virial co-efficient of a real gas is zero is called the**

(A) Eutectic point

(B) Boyle temperature

(C) Boiling point

(D) Critical temperature

Answer: Option A

**251. For a given mass of a gas at constant temperature, if the volume 'V' becomes three times, then the pressure 'P' will become**

(A)  $P/3$

(B)  $3P$

(C)  $9P^2$

(D)  $9P$

Answer: Option A

**252. Atoms of the same element, but of different masses are called**

(A) Isobars

(B) Isotones

(C) Isotopes

(D) None of these

Answer: Option C

**253. The pressure of 'V' litres of a dry gas is increased from 1 to 2 kgf/cm<sup>2</sup> at a constant temperature. The new volume will become**

(A)  $V/2$

(B)  $2V$

(C)  $V/4$

(D)  $V^2$

Answer: Option A

**254. The latent heat of vaporisation**

(A) Decreases with increased temperature

(B) Decreases as pressure increases

(C) Becomes zero at the critical point

(D) All (A), (B) & (C)

Answer: Option D

**255. Osmotic pressure of a dilute solution of a non volatile solute in a solvent obeying Raoult's law is proportional to the**

(A) Temperature

- (B) Volume of solution
  - (C) Moles of non-volatile solute
  - (D) None of these
- Answer: Option A

**256. Atomic \_\_\_\_\_ of an element is a whole number.**

- (A) Weight
- (B) Number
- (C) Volume
- (D) Radius

Answer: Option B

**257. Isotonic solutions must have the same**

- (A) Viscosity
- (B) Molar concentration
- (C) Normality
- (D) Critical temperature

Answer: Option B

**258. A very dilute solution is prepared by dissolving ' $x_1$ ' mole of solute in ' $x_2$ ' mole of a solvent. The mole fraction of solute is approximately equal to**

- (A)  $x_1/x_2$
- (B)  $x_2/x_1$
- (C)  $1 - (x_1/x_2)$
- (D)  $1/x_2$

Answer: Option A

**259. Internal energy of a substance comprises of the \_\_\_\_\_ energy.**

- (A) Vibrational
- (B) Rotational
- (C) Translational
- (D) All (A), (B) & (C)

Answer: Option D

**260. Pick out the wrong statement.**

- (A) Raoult's law holds good for the solubility of polar gases in non-polar liquids
- (B) Molecules with symmetrical arrangement (e.g.,  $\text{CH}_4$  and  $\text{CCl}_4$ ) are non-polar
- (C) Most of the hydrocarbons are non-polar
- (D) Generally, non-polar compounds are chemically inactive, conduct electricity poorly and do not ionise

Answer: Option A

**261. Specific gravity on API scale is given by the relation (where,  $G$  = specific gravity at  $15.5^\circ\text{C}$ ).**

- (A)  $^\circ\text{API} = 200(G - 1)$
- (B)  $^\circ\text{API} = (141.5/G) - 131.5$
- (C)  $^\circ\text{API} = (140/G) - 130$
- (D)  $^\circ\text{API} = 145 - (145/G)$

Answer: Option B

**262. Vapor pressure of water at  $100^\circ\text{C}$  is about \_\_\_\_\_ bar.**

- (A) 0.1013
- (B) 1.013
- (C) 10.13
- (D) 101.3

Answer: Option B

**263. A vapor whose partial pressure is less than its equilibrium vapor pressure is called the \_\_\_\_\_ vapor.**

- (A) Saturated
- (B) Superheated
- (C) Unsaturated
- (D) Dry gaseous

Answer: Option B

**264. With increase in temperature, the surface tension of water**

- (A) Increases
  - (B) Decreases
  - (C) Remain constant
  - (D) Increases linearly
- Answer: Option B

**265. An Azeotropic solution of two liquids has boiling point lower than either of them, when it**

- (A) Is saturated
- (B) Is unsaturated
- (C) Shows negative deviation from Raoult's law
- (D) Shows positive deviation from Raoult's law

Answer: Option D

**266. An ideal gas can be liquefied, because**

- (A) Its molecular size is very small
- (B) Its critical temperature is more than 0°C
- (C) Forces operative between its molecules are negligible
- (D) It gets solidified directly without becoming liquid

Answer: Option C

**267. For an ideal gas, the compressibility factor**

- (A) Decreases with pressure rise
- (B) Is unity at all temperature
- (C) Is unity at Boyle's temperature
- (D) Zero

Answer: Option B

**268. What fraction of the total pressure is exerted by oxygen, if equal weights of oxygen and methane are mixed in an empty vessel at 25°C?**

- (A) 2/3
- (B) 1/3
- (C) 1/2
- (D)  $1/3 \times (298/273)$

Answer: Option B

**269. Assume that benzene is insoluble in water. The normal boiling points of benzene and water are 80.1 and 100°C respectively. At a pressure of 1 atm, the boiling point of a mixture of benzene and water is**

- (A) 80.1°C
- (B) Less than 80.1°C
- (C) 100°C
- (D) Greater than 80.1°C but less than 100°C

Answer: Option D

**270. Average molecular weight of air is about**

- (A) 21
- (B) 29
- (C) 23
- (D) 79

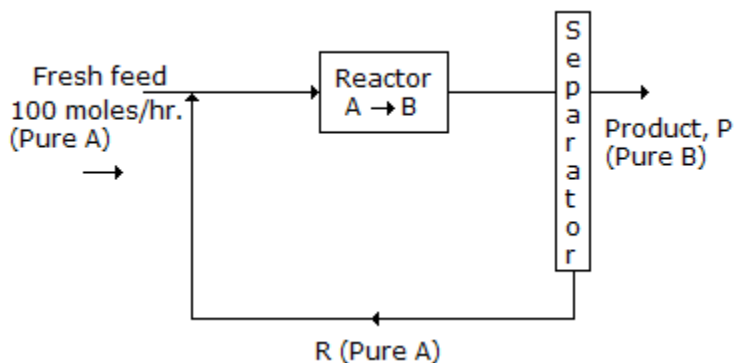
Answer: Option B

**271. The boiling points for pure water and pure toluene are 100°C and 110.6°C respectively. Toluene and water are completely immiscible in each other. A well agitated equimolar mixture of toluene and water are prepared. The temperature at which the above mixture will exert a pressure of one standard atm. is**

- (A) Less than 100°C
- (B) 100°C
- (C) Between 100 and 110°C
- (D) 110.6°C

Answer: Option C

**272. A flowsheet is given in the following figure: If the single pass once through conversion of A to B is 20%, then the rate of recycle R (molds/hr) is**



- (A) 300
- (B) 400
- (C) 500
- (D) 600

Answer: Option C

**273. At 100°C, water and methylcyclohexane both have vapour pressures of 1 atm. Also at 100°C, the latent heats of vaporisation of these compounds are 40.63 kJ/mole for water and 31.55 kJ/mole for methylcyclohexane. The vapour pressure of water at 150°C is 4.69 atm. At 150°C, the vapour pressure of methylcyclohexane would be expected to be**

- (A) Significantly less than 4.69 atm
- (B) Nearly equal to 4.69 atm
- (C) Significantly more than 4.69 atm
- (D) Indeterminate due to lack of data

Answer: Option C

**274. If pH value of a solution is 8, then its pOH value will be**

- (A) 6
- (B) 1
- (C) 7
- (D) 10

Answer: Option A

**275. In case of a solution (not of a solid in a liquid), whose total volume is less than the sum of the volumes of its components in their pure states, solubility is**

- (A) Independent of temperature
- (B) Increases with rise in pressure
- (C) Increased with decrease in pressure
- (D) Unchanged with pressure changes

Answer: Option B

**276. The equilibrium data of component A in the two phases B and C are given below. The estimate of Y for X = 4 by fitting a quadratic expression of a form  $Y = mX^2$  for the above data is**

<i>X (moles of A/moles of B)</i>	<i>Y (moles of A/moles of C)</i>
1	0.5
2	4.125

- (A) 15.5
- (B) 16
- (C) 16.5
- (D) 17

Answer: Option C

**277. 1 ata is equivalent to**

- (A) 1 atm
- (B) 10 torr
- (C) 0.98 Pascal
- (D) 1 kgf/cm<sup>2</sup>

Answer: Option D

**278. S.T.P. corresponds to**

- (A) 1 atm. absolute pressure & 15.5°C

- (B) 760 mm Hg gauge pressure & 15.5°C
  - (C) 760 torr & 0°C
  - (D) 101.325 kPa gauge pressure & 15.5°C
- Answer: Option A

**279. In a binary liquid system, the composition expressed as \_\_\_\_\_ is independent of the temperature & pressure.**

- (A) Kg of solute/kg of solvent
- (B) Kg-mole of solute/kg-mole of solvent
- (C) Kg-mole of solute/1000 kg of solvent
- (D) All (A), (B) & (C)

Answer: Option D

**280. In general, the specific heats of aqueous solutions \_\_\_\_\_ with increase in the concentration of the solute.**

- (A) Increase
- (B) Decrease
- (C) Remain unchanged
- (D) None of these

Answer: Option B

**281. The value of gas constant 'R' is \_\_\_\_\_ kcal/kg.mole.°C.**

- (A) 2.79
- (B) 1.987
- (C) 3.99
- (D) None of these

Answer: Option D

**282. The chemical nature of an element is independent of**

- (A) Its atomic number
- (B) The number of protons or electrons present in it
- (C) The number of neutrons present in it
- (D) None of these

Answer: Option C

**283. Vapor pressure of a solution is proportional to (where,  $S_v$  and  $S_t$  are mole fraction of solvent and solute respectively).**

- (A)  $S_v$
- (B)  $1/S_t$
- (C)  $S_t$
- (D)  $1/S_v$

Answer: Option A

**284. For most salts, the solubility increases with rise in temperature, but the solubility of \_\_\_\_\_ is nearly independent of temperature rise.**

- (A) Sodium chloride
- (B) Sodium carbonate monohydrate
- (C) Anhydrous sodium sulphate
- (D) Hypo

Answer: Option A

**285. "The heat capacity of a solid compound is approximately equal to the sum of the heat capacities of the constituent elements." This is the statement of**

- (A) Law of Petit and Dulong
- (B) Kopp's rule
- (C) Nernst heat theorem
- (D) Trouton's rule

Answer: Option B

**286. At room temperature, the product  $[H^+][OH^-]$  in a solution is  $10^{-14}$  moles/litre. If,  $[OH^-] = 10^{-6}$  moles/litre, then the pH of the solution will be**

- (A) 6
- (B) 8
- (C) 10
- (D) 12



Answer: Option B

**287. A gaseous mixture contains 14 kg of N<sub>2</sub>, 16 kg of O<sub>2</sub> and 17 kg of NH<sub>3</sub>. The mole fraction of oxygen is**

- (A) 0.16
- (B) 0.33
- (C) 0.66
- (D) 0.47

Answer: Option B

**288. The percentage ratio of the partial pressure of the vapor to the vapor pressure of the liquid at the existing temperature is**

- (A) Termed as relative saturation
- (B) Not a function of the composition of gas mixture
- (C) Called percentage saturation
- (D) Not a function of the nature of vapor

Answer: Option A

**289. Number of gm moles of solute dissolved in one litre of a solution is called its**

- (A) Equivalent weight
- (B) Molarity
- (C) Molality
- (D) Normality

Answer: Option B

**290. Molar heat capacity of water in equilibrium with ice at constant pressure is**

- (A) 0
- (B)  $\infty$
- (C) 1
- (D) None of these

Answer: Option B

**291. In a neutral solution**

- (A) H<sup>+</sup> ions are absent
- (B) OH<sup>-</sup> ions are absent
- (C) Both H<sup>+</sup> and OH<sup>-</sup> ions are present in very small but equal concentration
- (D) None of these

Answer: Option C

**292. The ratio of existing moles of vapor per mole of vapor free gas to the moles of vapor that would be present per mole of vapor free gas, if the mixture were saturated at the existing temperature & pressure, is termed as the**

- (A) Relative humidity
- (B) Relative saturation
- (C) Percentage saturation
- (D) None of these

Answer: Option C

**293. Hess's law of constant heat summation is based on conservation of mass. It deals with**

- (A) Equilibrium constant
- (B) Reaction rate
- (C) Changes in heat of reaction
- (D) None of these

Answer: Option C

**294. Density of carbon dioxide is \_\_\_\_\_ kg/Nm<sup>3</sup>.**

- (A) 44/22400
- (B) 44/22.4
- (C) 22.4/44
- (D) None of these

Answer: Option B

**295. A gas mixture contains 6 moles of H<sub>2</sub> and 2 moles of N<sub>2</sub>. If the total pressure of the gaseous mixture is 4 kgf/cm<sup>2</sup>; then the partial pressure of N<sub>2</sub> in the mixture will be \_\_\_\_\_ kgf/cm<sup>2</sup>.**

- (A) 1

- (B) 2
- (C) 4
- (D) 8

Answer: Option A

**296. No cooling occurs, when an ideal gas undergoes unrestrained expansion, because the molecules**

- (A) Collide without loss of energy
- (B) Do work equal to loss in kinetic energy
- (C) Are above the inversion temperature
- (D) Exert no attractive force on each other

Answer: Option C

**297. The temperature of a gas in a closed container is 27° C. If the temperature of the gas is increased to 300° C, then the pressure exerted is**

- (A) Doubled
- (B) Halved
- (C) Trebled
- (D) Unpredictable

Answer: Option D

**298. Equal masses of CH<sub>4</sub> and H<sub>2</sub> are mixed in an empty container. The partial pressure of hydrogen in this container expressed as the fraction of total pressure is**

- (A) 1/9
- (B) 8/9
- (C) 1/2
- (D) 5/9

Answer: Option B

**299. Pick out the correct statement.**

- (A) A substance existing above its critical temperature is called a saturated vapor
- (B) A mixture of vapor gas is called saturated, if the equilibrium vapor pressure of the liquid is more than the partial pressure of the vapor at the same temperature
- (C) Heat added to or given up by a substance at constant temperature is called the sensible heat
- (D) The end points of a vapor-pressure vs. temperature curve are critical and triple points

Answer: Option D

**300. pH value of a solution containing 1 gm of hydrogen ion per litre will be**

- (A) 0
- (B) 1
- (C) 7
- (D) 10

Answer: Option A

**301. Total energy at a point comprises of \_\_\_\_\_ energy.**

- (A) Potential & kinetic
- (B) Pressure
- (C) Internal
- (D) All (A), (B) & (C)

Answer: Option D

**302. Which of the following is not a colligative property?**

- (A) Osmotic pressure
- (B) Depression of freezing point
- (C) Lowering of vapor pressure
- (D) None of these

Answer: Option D

**303. A sugar solution containing \_\_\_\_\_ percent sugar is equivalent to 1 Brix.**

- (A) 0.01
- (B) 0.1
- (C) 1
- (D) 10

Answer: Option C

**304. Unrestrained expansion of an ideal gas does not result in its cooling due to the reason that the gas molecules**

- (A) Do not lose energy on collision
- (B) Are above the inversion temperature
- (C) Do not exert attractive force on each other
- (D) Do work equal to loss in kinetic energy

Answer: Option C

**305. The vapor pressures of benzene and toluene are 3 and 4/3 atmospheres respectively. A liquid feed of 0.4 moles of benzene and 0.6 moles of toluene is vaporised. Assuming that the products are in equilibrium, the vapor phase mole fraction of benzene is**

- (A) 0.4
- (B) 0.6
- (C) 0.8
- (D) 0.2

Answer: Option B

**306. The quantity of heat required to evaporate 1 kg of a saturated liquid is called**

- (A) Specific heat
- (B) 1 Kcal
- (C) Sensible heat
- (D) Latent heat

Answer: Option D

**307. The heat capacity of most substances is greater for the \_\_\_\_\_ state.**

- (A) Solid
- (B) Liquid
- (C) Gaseous
- (D) None of these

Answer: Option B

**308. 1 torr is equal to \_\_\_\_\_ mm Hg column.**

- (A) 1
- (B) 0.1
- (C) 10
- (D) 1000

Answer: Option A

**309. Isotopes are atoms having the same**

- (A) Mass number
- (B) Number of neutrons
- (C) Atomic mass
- (D) None of these

Answer: Option D

**310. Saturated solution of benzene in water is in equilibrium with a mixture of air and vapours of benzene and water at room temperature and pressure. Mole fraction of benzene in liquid is  $x_B$  and the vapour pressures of benzene and water at these conditions are  $p_v^B$  and  $p_v^w$  respectively. The partial pressure of benzene in air-vapour mixture is**

- (A)  $P_v^B$
- (B)  $x_B \cdot P_v^B$
- (C)  $(P_{atm} - P_v^w) x_B$
- (D)  $x_B \cdot P_{atm}$

Answer: Option B

**311. Which of the following is not a unit of kinematic viscosity?**

- (A) Poise
- (B) Stoke
- (C)  $\text{cm}^2/\text{second}$
- (D) None of these

Answer: Option A

**312. If the partial pressure of the solvent in the vapor phase is equal to the vapor pressure of the solvent at that temperature, then the system is said to be at its**

- (A) Bubble point

- (B) Saturation temperature
  - (C) Dew point
  - (D) Both (B) and (C)
- Answer: Option D

**313. Osmotic pressure exerted by a solution prepared by dissolving one gram mole of a solute in 22.4 litres of a solvent at 0°C will be \_\_\_\_\_ atmosphere.**

- (A) 0.5
- (B) 1
- (C) 1.5
- (D) 2

Answer: Option B

**314. Addition of a non-volatile solute to a pure solvent**

- (A) Increases its freezing point
- (B) Increases its boiling point
- (C) Decreases its freezing point
- (D) Both (B) and (C)

Answer: Option D

**315. With increase in the solute concentration, the specific heat of aqueous solutions**

- (A) Increases
- (B) Decreases
- (C) Remains unchanged
- (D) Either (A) or (B); depends on the type of solution

Answer: Option B

**316. \_\_\_\_\_ equation gives the effect of temperature on heat of reaction.**

- (A) Kirchoff's
- (B) Maxwell's
- (C) Antoine
- (D) Kistyakowsky

Answer: Option A

**317. In which of the following case of mixing of a strong acid with strong base (each of 1N concentration), temperature increase will be the highest?**

- (A) 30 c.c acid and 30 c.c base
- (B) 20 c.c acid and 25 c.c base
- (C) 15 c.c acid and 35 c.c base
- (D) 35 c.c acid and 15 c.c base

Answer: Option A

**318. "The equilibrium value of the mole fraction of the gas dissolved in a liquid is directly proportional to the partial pressure of that gas above the liquid surface". This statement pertaining to the solubility of gases in liquid is the \_\_\_\_\_ law.**

- (A) Raoult's
- (B) Henry's
- (C) Amagat's
- (D) None of these

Answer: Option B

**319. Which of the following terms of Vander Walls equation of state for a non-ideal gas accounts for intermolecular forces?**

- (A)  $RT$
- (B)  $P + (a/V^2)$
- (C)  $(V - b)$
- (D)  $1/RT$

Answer: Option A

**320. A perfectly insulated container of volume V is divided into two equal halves by a partition. One side is under vacuum, while the other side has one mole of an ideal gas (with constant heat capacity) at 298 K. If the partition is broken, the final temperature of the gas in the container**

- (A) Will be greater than 298 K
- (B) Will be 298 K
- (C) Will be less than 298 K

(D) Cannot be determined  
Answer: Option C

**321. At higher temperatures, molal heat capacities for most of the gases (at constant pressure) \_\_\_\_\_ with increase in temperature.**

- (A) Varies linearly
  - (B) Increases
  - (C) Decreases
  - (D) Does not vary
- Answer: Option B

**322. As per Kirchoff's equation, the heat of reaction is affected by the**

- (A) Pressure
  - (B) Volume
  - (C) Temperature
  - (D) Molecularity
- Answer: Option C

**323. The depression in freezing point of a solution is**

- (A) Inversely proportional to the mass of solvent
  - (B) Directly proportional to the mole of solute
  - (C) Both (A) and (B)
  - (D) Neither (A) nor (B)
- Answer: Option C

**324. The total number of atoms in 8.5 gm of  $\text{NH}_3$  is \_\_\_\_\_  $\times 10^{23}$ .**

- (A) 9.03
  - (B) 3.01
  - (C) 1.204
  - (D) 6.02
- Answer: Option A

**325. Normality of a solution does not change with the increase in the**

- (A) Pressure
  - (B) Temperature
  - (C) Solute concentration
  - (D) Dilution of the solution
- Answer: Option A

**326. The heat capacity of a substance is**

- (A) Greater for liquid state than for solid state
  - (B) Lower for liquid state than for gaseous state
  - (C) Higher for solid state than for liquid state
  - (D) Equal for solid and liquid states below melting point
- Answer: Option A

**327. Which of the following has the smallest least effect on the solubility of a solute into the solvent?**

- (A) Nature of the solute
  - (B) Nature of the solvent
  - (C) Temperature
  - (D) Pressure
- Answer: Option D

**328. If  $1 \text{ Nm}^3$  of  $\text{O}_2$  contains 'N' number of molecules, then number of molecules in  $2 \text{ Nm}^3$  of  $\text{SO}_2$  will be**

- (A)  $N$
  - (B)  $N/2$
  - (C)  $2N$
  - (D)  $4N$
- Answer: Option C

**329. Pick out the wrong statement:**

- (A) The integral heat of solution of either component cannot be calculated from heat of mixing data

- (B) The average value of heat of neutralisation of dilute solutions of weak acids and bases is much less compared to that for strong acids and bases
- (C) The standard heat of solution of the hydrate of a substance is the difference between the heat of solution of the anhydrous substance and its heat of hydration
- (D) The accompanying enthalpy change, when a solute is dissolved in solvent, depends upon the nature & amount of the solute & the solvent, on the temperature & on the initial & final concentrations of the solution

Answer: Option A

**330. Which of the following gases will have the- highest kinetic energy per mole at the same pressure & temperature?**

- (A) Chlorine
- (B) Nitrogen
- (C) Ethane
- (D) All the gases will have the same KE

Answer: Option D

**331. What is the simplest formula of a compound containing 50% of element A (atomic weight = 10) and 50% of element B (atomic weight = 20)?**

- (A) AB<sub>3</sub>
- (B) A<sub>2</sub>B<sub>3</sub>
- (C) A<sub>2</sub>B
- (D) AB<sub>2</sub>

Answer: Option A

**332. In a chemical process, the recycle stream is purged for**

- (A) Increasing the product yield
- (B) Enriching the product
- (C) Limiting the inerts
- (D) Heat conservation

Answer: Option C

**333. How much O<sub>2</sub> can be obtained from 90 kg of water?**

- (A) 32 kg
- (B) 80 kg
- (C) 64 kg
- (D) 90 kg

Answer: Option B

**334. pH value of a solution containing equal concentration of hydroxyl and hydrogen ions will be**

- (A) 0
- (B) 10
- (C) 7
- (D) 14

Answer: Option C

**335. Pure oxygen is mixed with air to produce an enriched air containing 50 volume % of oxygen. The ratio of moles of air to oxygen used is**

- (A) 1.72
- (B) 0.58
- (C) 0.5
- (D) 0.2

Answer: Option B

**336. The heat of solution depends upon the**

- (A) Nature of solvent
- (B) Concentration of solution
- (C) Nature of solute
- (D) All (A), (B) & (C)

Answer: Option D

**337. One 'Therm' is equivalent to**

- (A) 10<sup>5</sup> BTU
- (B) 10<sup>5</sup> kcal

- (C)  $10^9$  BTU  
(D)  $10^9$  kcal  
Answer: Option A

**338. Enthalpy change resulting, when unit mass of solid is wetted with sufficient liquid, so that further addition of liquid produces no additional thermal effect, is called the heat of**

- (A) Mixing  
(B) Adsorption  
(C) Wetting  
(D) Complete wetting  
Answer: Option D

**339. The value of  $(C_p - C_v)$  for a real gas obeying Vander Wall's equation is**

- (A)  $R$   
(B)  $> R$   
(C)  $< R$   
(D)  $0.5 R$   
Answer: Option B

**340. Assuming applicability of ideal gas law, the pure component volume of the vapor in a saturated gas can be calculated from theoretical relationship. The volumetric composition of a vapor saturated gas is independent of the**

- (A) Nature of the liquid  
(B) Nature of the gas  
(C) Temperature of the liquid  
(D) Total pressure  
Answer: Option B

**341. In \_\_\_\_\_ process, ions of salts react with water to produce acidity or alkalinity.**

- (A) Hydration  
(B) Hydrolysis  
(C) Electrolysis  
(D) Dialysis  
Answer: Option B

**342. If a solution of eutectic composition is cooled, \_\_\_\_\_ reaching the eutectic temperature?**

- (A) The solvent begins to freeze out even before  
(B) It will undergo no change until  
(C) It will not solidify even on  
(D) None of these  
Answer: Option B

**343. For the gaseous phase reaction,  $N_2 + O_2 \rightleftharpoons 2NO$ ,  $\Delta H = + 80$  kJ/kg. mole; the decomposition of NO is favoured by**

- (A) Increasing the concentration of  $N_2$   
(B) Decrease in temperature  
(C) Increase in pressure  
(D) Decrease in pressure  
Answer: Option B

**344. The atomic weight of helium is 4 times that of hydrogen. Its diffusion rate as compared to hydrogen will be \_\_\_\_\_ times.**

- (A)  $1/2$   
(B) 4  
(C)  $\sqrt{2}$   
(D)  $1/4$   
Answer: Option C

**345. 1 Kcal/kg. °C is equivalent to \_\_\_\_\_ BTU/lb. °F.**

- (A) 1  
(B) 2.42  
(C) 4.97  
(D) None of these  
Answer: Option A

**346. The molar composition of a gas is 10% H<sub>2</sub>, 10% O<sub>2</sub>, 30% CO<sub>2</sub> and balance H<sub>2</sub>O. If 50% H<sub>2</sub>O condenses, the final mole percent of H<sub>2</sub> in the gas on a dry basis will be**

- (A) 10%
- (B) 5%
- (C) 18.18%
- (D) 20%

Answer: Option D

**347. A fluid gas produced on burning furnace oil contains 0.15 gm mole of CO<sub>2</sub>, 0.05 gm mole of oxygen and 0.80 gm mole of N<sub>2</sub>. What is its molecular weight?**

- (A) 28.6
- (B) 30.0
- (C) 30.6
- (D) 32.6

Answer: Option C

**348. \_\_\_\_\_ chart is a graph related to Antoine equation.**

- (A) Ostwald
- (B) Cox
- (C) Mollier's
- (D) Enthalpy-concentration

Answer: Option B

**349. Pick out the wrong unit conversion.**

- (A) 1 kgf = 9.8 Newton
- (B) 1 stoke = 1 m<sup>2</sup>/second
- (C) 1 Pascal second = 10 poise
- (D) 1 ppm = 1 ml/m<sup>3</sup> = 1 mg/kg

Answer: Option B

**350. The viscosity of water at room temperature may be around one**

- (A) Centipoise
- (B) Poise
- (C) Stoke
- (D) Both (B) & (C)

Answer: Option A

**351. Pick out the correct statement.**

- (A) Heat of solution is always positive
- (B) At equilibrium,  $\Delta G$  is zero
- (C) For the reaction,  $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$ ,  $\Delta G$  is less than  $\Delta E$
- (D) The heating of water in a beaker is an example of an isolated system

Answer: Option B

**352. 80 kg of Na<sub>2</sub>SO<sub>4</sub> (molecular weight = 142) is present in 330 kg of an aqueous solution. The solution is cooled such that 80 kg of Na<sub>2</sub>SO<sub>4</sub> · 10H<sub>2</sub>O crystals separate out. The weight fraction of Na<sub>2</sub>SO<sub>4</sub> in the remaining solution is**

- (A) 0.00
- (B) 0.18
- (C) 0.24
- (D) 1.00

Answer: Option B

**353. A gas at 0°C was subjected to constant pressure cooling until its volume became half the original volume. The temperature of the gas at this stage will be**

- (A) 0°C
- (B) 0°K
- (C) -136.5°C
- (D) -136.5°K

Answer: Option C

**354. Clausius Clapeyron equation applies to the \_\_\_\_\_ process.**

- (A) Sublimation
- (B) Melting



- (C) Vaporisation  
(D) All (A), (B) & (C)  
Answer: Option D

**355. 500 c.c. each of hydrogen at 700 mm Hg pressure and oxygen at 600 mm Hg pressure are put together in a vessel of 1 litre capacity. The final pressure of the gas mixture will be \_\_\_\_\_ mm Hg.**

- (A) 650  
(B) 700  
(C) 600  
(D) 375

Answer: Option A

**356. Air at a temperature of 20°C and 750 mm Hg pressure has a relative humidity of 80%. What is its percentage humidity? Vapour pressure of water at 20°C is 17.5 mm Hg.**

- (A) 80.38  
(B) 80  
(C) 79.62  
(D) 78.51

Answer: Option C

**357. Pick out the wrong unit conversion.**

- (A) 1 Joule = 4.186 calorie  
(B) 1 kcal = 3.968 BTU = 0.00116 kWh = 0.00156 hp  
(C) 1 ton of TNT (tri-nitro-toluene) = 4.2 GJ (1G = 10<sup>9</sup>)  
(D) 1 ft.lbf = 0.3238 calorie = 0.1383 kg.m = 1.356 J = 1.356 N.m

Answer: Option A

**358. The density of a gas 'X' is twice that of another gas 'Y'. If the molecular weight of gas 'Y' is 'M'; then the molecular weight of the gas 'X' will be**

- (A) 2M  
(B) M/2  
(C) M  
(D) M/4

Answer: Option A

**359. A car tyre of volume 0.057 m<sup>3</sup> is inflated to 300 kPa at 300 K. After the car is driven for 10 hours, the pressure in the tyre increases to 330 kPa. Assume air is an ideal gas and C<sub>v</sub> for air is 21 J/mole.K. The change in the internal energy of air in the tyre in J/mole is**

- (A) 380  
(B) 630  
(C) 760  
(D) 880

Answer: Option B

**360. Atmospheric pressure corresponds to a hydrostatic head of**

- (A) 13.6 cms of Hg  
(B) 34 ft of H<sub>2</sub>O  
(C) 1 metre of H<sub>2</sub>O  
(D) 13.6 metres of Hg

Answer: Option B

**361. Sodium \_\_\_\_\_ has inverted solubility curve i.e. its solubility increases with the lowering of temperature.**

- (A) Carbonate (monohydrate)  
(B) Chloride  
(C) Thiosulphate  
(D) Bisulphite

Answer: Option A

**362. On mixing 56 gm of CaO with 63 gm of HNO<sub>3</sub>, the amount of Ca(NO<sub>3</sub>)<sub>2</sub> formed is \_\_\_\_\_ gm.**

- (A) 82  
(B) 164  
(C) 41

(D) 8.2

Answer: Option A

**363. The accumulation in a steady state combustion process, burning 1 kg mole of carbon with 1 kg mole of oxygen thereby producing 1 kg mole of carbon dioxide, is \_\_\_\_\_ kg mole.**

(A) 1

(B) 0

(C) 16

(D) 44

Answer: Option B

**364. At a temperature of 0°K, the molecules of a gas have only \_\_\_\_\_ energy.**

(A) Rotational

(B) Vibrational

(C) Translational

(D) None of these

Answer: Option C

**365. According to the kinetic theory, the thermal conductivity of a monatomic gas is proportional to**

(A) T

(B)  $T^{0.5}$

(C)  $T^{1.5}$

(D)  $T^2$

Answer: Option B

**366.  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$  crystals are formed by cooling 100 Kg of 30% by weight aqueous solution of  $\text{Na}_2\text{SO}_4$ . The final concentration of the solute in the solution is 10%. The weight of crystals is**

(A) 20

(B) 32.2

(C) 45.35

(D) 58.65

Answer: Option D

**367. Which of the following has the least (almost negligible) effect on the solubility of a solute in a solvent?**

(A) Temperature

(B) Nature of solute

(C) Pressure

(D) Nature of solvent

Answer: Option C

**368. The molecules of a liquid which is in equilibrium with its vapor at its boiling point on an average have equal \_\_\_\_\_ in the two phases.**

(A) Potential energy

(B) Intermolecular forces

(C) Kinetic energy

(D) Total energy

Answer: Option C

**369. Volume occupied by one gm mole of a gas at S.T.P. is**

(A) 22.4 litres

(B) 22400 litres

(C) 22.4 c.c

(D) 359 litres

Answer: Option A

**370. A butane isomerisation process produces 70 kmole/hr of pure iso-butane. A purge stream removed continuously, contains 85% n-butane and 15% impurity (mole%). The feed stream is n-butane containing 1% impurity (mole%). The flow rate of the purge stream will be**

(A) 3 kmole/hr

(B) 4 kmole/hr

(C) 5 kmole/hr

(D) 6 kmole/hr

Answer: Option C

**371. In a mixture of benzene vapor and nitrogen gas at a total pressure of 900 mm Hg, if the absolute humidity of benzene is 0.2 kg benzene/kg nitrogen, the partial pressure of benzene in mm Hg is**

- (A) 180
- (B) 60.3
- (C) 720
- (D) 200

Answer: Option B

**372. One mole of methane undergoes complete combustion in a stoichiometric amount of air. The reaction proceeds as  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ . Both the reactants and products are in gas phase.  $\Delta H^\circ_{298} = -730$  kJ/mole of methane. If the average specific heat of all the gases/vapour is 40 J/mole.K, the maximum temperature rise of the exhaust gases in °C would be approximately equal to**

- (A) 1225
- (B) 1335
- (C) 1525
- (D) 1735

Answer: Option D

**373. The vapour pressure of water is given by, in  $P_{\text{sat}} = A - (5000/T)$ , where A is a constant,  $P_{\text{sat}}$  is the vapour pressure in atm. and T is the temperature in K. The vapor pressure of water in atm. at 50°C is approximately**

- (A) 0.07
- (B) 0.09
- (C) 0.11
- (D) 0.13

Answer: Option D

**374. The most convenient way of expressing solution concentration is in terms of**

- (A) Mole fraction
- (B) Normality
- (C) Molality
- (D) Molarity

Answer: Option D

**375. Disappearance of snow in subzero weather exemplifies the process of**

- (A) Evaporation
- (B) Sublimation
- (C) Vaporisation
- (D) Melting

Answer: Option B

**376. Elements in a periodic table are arranged in order of their**

- (A) Atomic number
- (B) Mass number
- (C) Atomic weight
- (D) Metallic characteristics

Answer: Option A

**377. Pick out the wrong unit conversion.**

- (A) 1 atm. = 760 mm Hg = 29.92 inch Hg = 14.7 psi = 1.013 bar = 1.013 kgf/cm<sup>2</sup>
- (B) 1 kPa = 100 bar
- (C) 1 mm Hg = 1 torr = 133.3 Pa
- (D) None of these

Answer: Option B

**378. Unit of mass velocity is**

- (A) kg/m.hr
- (B) kg/m<sup>2</sup>.hr
- (C) kg/hr
- (D) kg/m<sup>2</sup>

Answer: Option B