Cairo University-Faculty of Science - Chemistry Department

Physical Chemistry (Chem 102) for 1st Year Students

Questions for Final Exam. *JUNE* 2021 Time allowed: 90 min

- Choose the most correct answer and Write it down in the answer sheet (2 Marks for each point)

(Atomic masses, g/mol: H = 1, He = 4, C = 12, O = 16, Cu = 63.546, N = 14, , Cl = 35),

(R = 0.082 L atm mol^{-1} K^{-1}, R = 8.314 J mol^{-1} K^{-1}) R = 0.082 L.atm/mol K = 8.314 J/mol K = 2 cal/mol K, Avogadro's number = 6.022×10^{23})

1- The direct conversion from a solid state to a gaseous state without passing by the liquid state is known as --------

(a) melting (b) fusion (c) condensation (d) sublimation

2- Temperature at which the vapor pressure of the liquid equals 1 atm is describing the liquid's --------- point

(a) boiling (b) normal boiling (c)Vaporization (d) normal freezing

3- 1204080 contains -------- captive zeros and have ------ significant figures

(a) 3 & 7 (b) 3 & 6 (c) 2 & 6 (d) 2 & 7

4- If 34 g of ammonia is reacted with 300 g copper (II) oxide according to the following reaction, the mass of evolved nitrogen (N_2) gas will be ------ g

$$NH_3\,(g) + CuO\,(s) \rightarrow N_2\,(g) + Cu\,(s) + H_2O\,(g)$$

(a) 14 (b) 28 (c) 56 (d) None of these

5- A gas's pressure is 190 torr. On the atmospheric scale, it should read -------- atm.

(a) 0.25 (b) 0.5 (c) 4 (d) None of them

6- The volume of a certain gas increases with…

(a) increase of pressure (b) increase of Temperature (c) decrease of average kinetic energy (d) can't tell

7- The temperature of an ideal gas (in a 5.00 L container originally at 1 atm pressure and 25°C) is lowered to 220 K. Calculate the new pressure of the gas

(a) 0.738 atm (b) 1.0 atm (c) 8.8 atm (d) 1.35 atm

8- At the same temperature, oxygen gas molecules diffuse faster than ……

(a) hydrogen gas (b) CO_2 gas (c) CO gas (d) Helium gas

9- Calculate the density, in g/L, of chlorine (Cl_2) gas at STP.
(a) 46.9 g/L (b) 1.58 g/L (c) 3.16 g/L (d) 0.316 kg/L

10- A sample of natural gas contains 8.24 moles of CH_4, 0.421 moles of C_2H_6, and 0.116 moles of C_3H_8. If the total pressure of the gases is 1.37 atm, what is the partial pressure of methane (CH_4)?
(a) 1.28 atm (b) 1.37 atm (c) 1 atm (d) can't tell

11-The intermolecular force that bind molecules by one another is:
(a) Cohesive force (b) Adhesive force (c) Binding energy

(d) None of the above

12-The observed osmotic pressure for a 0.1 M solution of NaCl at 25ºC is …….that of 0.1 M glucose.

a- Equal to b- larger than c- less than d- none

13-A human hormone weighing 0.546 gm was dissolved in 15 gm benzene and the freezing point depression was 0.24 ºC. The molar mass of the hormone is ……g/mol (knowing that K_f = 5.12 C^o Kg/mol)/

a-776 b- 0.776 c- 800 d-none

14-Ethylene glycol is added to the water in the car cooling system in order to……..of the water
a- lower the freezing point b- elevate the boiling point
c- decrease the vapor pressure d-all

15-A 2.5 g sample of groundwater was found to contain 5.4 microgram of $Zn^{+2.}$ the concentration of Zn^{+2} in ppm is …….

a- 2.16×10^6 b- 2.16×10^{-4} c- 2.16 d- none

16-Which one of the following processes is exothermic?

a) freezing b) melting c) sublimation d) boiling

17-To which one of the following reactions occurring at 25 ˚C does the symbol $\Delta H^{\circ}_f[H_2SO_{4(l)}]$ refer?

a) $2H_{(g)}+S_{(g)}+4O_{(g)} \rightarrow H_2SO_{4(l)}$ b) $H_{2(g)}+S_{(g)}+2O_{2(g)} \rightarrow H_2SO_{4(l)}$

c) $H_2SO_{4(l)} \rightarrow H_{2(g)}+S_{(s)}+2O_{2(g)}$ d) $H_{2(g)}+S_{(s)}+2O_{2(g)} \rightarrow H_2SO_{4(l)}$

18-How much heat is evolved when 248 g of white phosphorus ($P_{4(s)}$) burn in air?

$P_{4(s)} + 5O_{2(g)} \longrightarrow P_4O_{10(s)}$, ΔH= -3013 kJ (Atomic weight of P is 31.0 g/mol)

a) -6026 kJ bz) -24104 kJ c) -12.15 kJ d) -1506.5 kJ

19-The fundamental equation representing the first law of thermodynamic for a closed system is …….

a) $\Delta E = q+w$ b) $\Delta H = q+w$ c) $\Delta E = q+\Delta H$ d) $\Delta E = q$

20- ΔE of the system for a process in which the system releases 140 J of heat to the surroundings and does 85 J of work on the surroundings is…….

a) 225 J b) -225 J c) 55 J d) -55 J

21-The equilibrium constant K_C for the following reaction

2 NO (g) + Cl_2 (g) = 2 NOCl (g) is: (the answer is a)

a. $\frac{[NOCl]^2}{[NO]^2[Cl2]}$ c. $\frac{[NOCl]}{[NO][Cl2]}$

b. $\frac{[NO]^2[Cl2]}{[NOCl]^2}$ d. $\frac{[NOCl]^2}{[NO]^2[Cl]^2}$

22- For the reaction: CO (g) + H_2O (g) = CO_2 (g) + H_2 (g), K_C =1 at 1100 K, the calculated reaction quotient (Q)= 4. This indicates that ..

a. Products are excess and the system should shift to right to attain equilibrium.
b. Products are excess and the system should shift to left to attain equilibrium.
c. Reactants are excess and the system should shift to right to attain equilibrium.
d. Reactants are excess and the system should shift to left to attain equilibrium

23- If K_C for the forward reaction: N_2 (g) + O_2 (g) → 2 NO (g) is 3, then the value of K_C for the backward reaction is …..

a. -3 b. 0.33 c. -0.33 d. 3

24- If the forward reaction is endothermic, then K_C increases with **……**

a. Increasing temperature c. Increasing time
b. Decreasing temperature d. Decreasing time

25-Acid is an

a - electron acceptor . b - electron donor .

c - proton acceptor . d - proton donor .

26-Half neutralization the acid and its salt is called

a - turbid solution . b - buffer solution .

c - green solution . d - none of the above .

27-…..is the particle that remains when an acid has donated a hydrogen ion .

a - conjugate acid . b - conjugate base .

c - ion pair . d - none of the above .

28- What is the concentration of OH^- ions in a HCL solution whose Hydrogen ion concentration is 1.3 M ?

a - 7.7×10^{-15} M . b - 7.7×10^{-13} M .

c - 7.7×10^{-11} M . d - 7.7×10^{-9} M .

29-The OH^- ion concentration of a blood sample is 2.5×10^{-Y} M . What is the pH of the blood ?

a - 6.6 . b – 7.4 .

c - 14 . d - 5 .

30-The pH of a 0.050 M weak acid is 2.00 . What is the percentage ionization?

a - 20% . b - 70% .

c - 50% . d - 30% .