Engineering Daily 26 [Home Practice] EV

Environmental Chemistry

Total Marks: 50 **Negative Marks:** 0.25 **Time:** 1 Hour

MCQ 50 marks

1. At STP, in how many litres of ammonia gas are there 1.50575×10^{23} molecules?

(A) 5.6 L (B) 22.4 L (C) 11.2 L (D) 2.8 L

2. How many moles of He are in a 2.5 L balloon at 37°C and 0.95 atm?

(A) 0.0982 mol (B) 0.0933 mol
(C) 0.7818 mol (D) 0.1116 mol

3. The pressure of N_2 gas in a 20.0 dm^3 cylinder at 17°C is 12.0 atm. What is the mass of N_2 in the cylinder?

(A) 282.2 g (B) 141.1 g
(C) 322.6 g (D) 4814.8 g

4. The pressure of a gas in a closed metal vessel at −18°C is 1.70 atm. When the vessel is taken to a higher temperature the pressure becomes 1.92 atm. What is the temperature difference between the two states?

(A) 18°C (B) 30°C (C) 15°C (D) 33°C

5. What is the density of SO_2 gas (in g L^{-1}) at 27°C and 2.0 atm?

(A) 2.857 (B) 5.197 (C) 57.743 (D) 2.598

6. How many molecules are present in 1.25 L of gas at 380 mmHg and −23°C?

(A) 3.361×10^{22} (B) 1.834×10^{19}
(C) 3.668×10^{22} (D) 1.834×10^{22}

7. How many molecules are in a gas bubble of volume 1.0×10^{-9} L at 27°C and 1 atm?

(A) 2.689×10^{13} (B) 2.445×10^{13}
(C) 2.445×10^{16} (D) 2.445×10^{10}

8. A balloon is filled with 4 m^3 of gas at 1.2 atm, which is $\frac{2}{3}$ of its maximum expansion capacity. If the gas pressure in the balloon decreases by 0.5 mmHg per metre of height gained and the temperature stays constant, at what height will the balloon burst?

(A) 1824 m (B) 304 m
(C) 730 m (D) 608 m

9. 420 mL of a gas at 47°C and 740 mmHg has a mass of 0.84 g. What is the density of the gas at standard temperature and pressure?

(A) 2.000 gL^{-1} (B) 2.408 gL^{-1}
(C) 1.661 gL^{-1} (D) 1.204 gL^{-1}

10. 0.42 g of helium at 7°C and a certain pressure occupies the same volume as 5.6 g of another gas at 77°C and the same pressure. What is the molar mass of that gas?

(A) 66.67 (B) 53.33 (C) 42.67 (D) 586.67

11. The density of a gas at temperature T and pressure P is d. If the absolute temperature is halved and the pressure is tripled, what will the density be?

(A) $\frac{d}{6}$ (B) $\frac{3d}{2}$ (C) $\frac{2d}{3}$ (D) 6d

12. A tank holds some gas at 150 atm and 7°C. Some gas is removed which occupies 90 m^3 at 27°C and 2 atm, and the tank pressure falls to 147.5 atm. If the tank temperature is unchanged, what is the volume of the tank?

(A) 36.0 m^3 (B) 38.6 m^3
(C) 67.2 m^3 (D) 72.0 m^3

13. Under the same conditions the density of gas A is 9 times that of gas B. What is the ratio of their diffusion rates $r_A : r_B$?

(A) 1 : 9 (B) 1 : 3 (C) 3 : 1 (D) 9 : 1

14. At the same temperature and pressure the effusion rates of gases X and Y through the same orifice are 0.420 and 0.297 respectively. If the vapour density of X is 16, which gas is Y?

(A) O_2 (B) Cl_2 (C) SO_2 (D) CO_2

15. At the same temperature and pressure, an equal volume of an unknown gas takes 75% more time than methane to effuse through an orifice. What is the molar mass of the unknown gas?

(A) 9.14 (B) 28 (C) 36 (D) 49

16. At a fixed temperature and pressure, the rate of diffusion of SO_2 through an orifice is 24 cm^3/s. What volume of methane will flow through the same orifice in 8 s?

(A) 96 cm^3 (B) 384 cm^3
(C) 768 cm^3 (D) 192 cm^3

17. The relative densities of air and chlorine are 14.4 and 35.5 respectively. If 150 cm^3 of chlorine flows through an orifice in 18 s, how long will 250 cm^3 of air take to flow through the same orifice under the same conditions?

(A) 11.46 s (B) 12.17 s
(C) 19.11 s (D) 47.10 s

18. At 30°C and 99.99 kPa, 25 dm^3 of H_2S escapes through a fine orifice of a vessel in 6 minutes. What volume of NH_3 will escape through the same orifice in 9 minutes under the same conditions?

(A) 75.00 dm^3 (B) 26.52 dm^3
(C) 35.36 dm^3 (D) 53.03 dm^3

19. At the same temperature and pressure, CH_4 gas diffuses $\sqrt{4.25}$ times faster than a hydrocarbon of molecular formula C_nH_{2n-2}. What is the value of n?

(A) 6 (B) 5 (C) 3 (D) 4

20. N_2, O_2 and He gases are kept in a closed vessel at P atm in the mole ratio 1 : 2 : 3. If all the O_2 is removed from the vessel at constant temperature, what will be the pressure of the gas in the vessel?

Ⓐ $\frac{P}{3}$ Ⓑ P Ⓒ $\frac{2P}{3}$ Ⓓ $\frac{P}{2}$

21. 7 g of nitrogen and 1 g of hydrogen are kept in an evacuated 12 dm^3 cylinder at 47°C. What is the total pressure inside the vessel?

Ⓐ 1.642 atm Ⓑ 1.095 atm

Ⓒ 0.241 atm Ⓓ 0.547 atm

22. At 27°C, vessel A contains 400 cm^3 of N_2 at 120 kPa and vessel B contains 300 cm^3 of O_2 at 1.8 atm. Both gases are transferred to an evacuated 1.5 L vessel C kept at 57°C. What is the pressure of the mixture in vessel C?

Ⓐ 161.41 kPa Ⓑ 75.32 kPa

Ⓒ 68.48 kPa Ⓓ 35.60 kPa

23. A vessel of fixed volume contains 1.2046×10^{23} He atoms and 3.0115×10^{23} N_2 molecules. If the total pressure is 1.4 atm, what is the partial pressure of He?

Ⓐ 0.56 atm Ⓑ 1.00 atm

Ⓒ 0.40 atm Ⓓ 0.28 atm

24. A 2 dm^3 flask contains hydrogen at 60 kPa at a certain temperature. What volume (in cm^3) of nitrogen, measured at 150 kPa and the same temperature, must be introduced into the flask so that the total pressure of the mixture is 105 kPa?

Ⓐ 800 cm^3 Ⓑ 600 cm^3

Ⓒ 300 cm^3 Ⓓ 1400 cm^3

25. 2.00 L of oxygen is collected over water at 25°C and 1.00 atm. If the volume of the dry oxygen at STP is 1.778 L, what is the vapour pressure of water at 25°C?

Ⓐ 84.4 mmHg Ⓑ 737.5 mmHg

Ⓒ 22.5 mmHg Ⓓ 3.0 mmHg

26. What is the ratio of the average kinetic energies of H_2 and O_2 molecules at the same temperature?

Ⓐ 16 : 1 Ⓑ 1 : 16

Ⓒ 1 : 4 Ⓓ 1 : 1

27. If the root mean square speed of nitrogen at 77°C is 558.4 m s^{-1}, what is the root mean square speed of helium at 7°C?

Ⓐ 1477.3 ms^{-1} Ⓑ 445.4 ms^{-1}

Ⓒ 1321.3 ms^{-1} Ⓓ 3126.9 ms^{-1}

28. At the same temperature, what is the ratio of the root mean square speed to the most probable speed of the molecules of a gas?

Ⓐ 1 : 1.225 Ⓑ 1.225 : 1

Ⓒ 1.128 : 1 Ⓓ 1.086 : 1

29. If the total kinetic energy of the molecules of an argon sample at −73°C is 997.7 J, what is the mass of the sample? [Ar = 40]

Ⓐ 24 g Ⓑ 6.4 g Ⓒ 40 g Ⓓ 16 g

30. If the root mean square speed of oxygen is 2 times that of helium, which of the following is correct?

Ⓐ $T_{O_2} = 32\,T_{He}$ Ⓑ $T_{O_2} = 8\,T_{He}$

Ⓒ $T_{O_2} = 16\,T_{He}$ Ⓓ $T_{O_2} = 4\,T_{He}$

31. What is the average kinetic energy of a gas molecule at 127°C in erg?

Ⓐ 8.28×10^{-14} erg Ⓑ 2.63×10^{-14} erg

Ⓒ 5.52×10^{-14} erg Ⓓ 8.28×10^{-21} erg

32. At 27°C, the root mean square speed of the molecules of which of the following gases is greater than 500 m s^{-1}?

Ⓐ O_2 Ⓑ N_2 Ⓒ Cl_2 Ⓓ CO_2

33. At the same temperature the total kinetic energies of 1 mol of He and 1 mol of Xe are E_1 and E_2, and the root mean square speeds of their molecules are C_1 and C_2 respectively. The values of $\frac{E_1}{E_2}$ and $\frac{C_1}{C_2}$ are respectively— [Xe = 131.3]

Ⓐ 1 and 32.83 Ⓑ 5.73 and 1

Ⓒ 1 and 5.73 Ⓓ 5.73 and 5.73

34. For 1 mol of an ideal gas with total kinetic energy E and molar mass M, which expression gives the average speed $\bar{c}$ of the molecules?

Ⓐ $\sqrt{\frac{4E}{3M}}$ Ⓑ $\sqrt{\frac{2E}{M}}$

Ⓒ $\sqrt{\frac{8E}{\pi M}}$ Ⓓ $\sqrt{\frac{16E}{3\pi M}}$

35. What is the unit of the constant 'a' in the van der Waals equation?

Ⓐ atm L mol^{-1} Ⓑ $L^2mol^{-2}atm^{-1}$

Ⓒ atm L^2mol^{-2} Ⓓ L mol^{-1}

36. 4.4 g of CO_2 gas occupies 2.0 dm^3 at 47°C. The pressure from the van der Waals equation is what percentage of the pressure from the ideal gas equation? [a = 3.59 atm dm^6 mol^{-2}, b = 0.0427 dm^3 mol^{-1}]

Ⓐ 100.47% Ⓑ 99.53%

Ⓒ 0.47% Ⓓ 100.21%

37. 2 mol of NH_3 is kept in a 4 L vessel and exerts a pressure of 11.5 atm at 27°C. If the volume correction constant is b = 0.0371 L mol^{-1}, what is the value of the van der Waals constant a?

Ⓐ 4.19 atm L^2mol^{-2} Ⓑ 16.76 atm L^2mol^{-2}

Ⓒ 3.26 atm L^2mol^{-2} Ⓓ 1.05 atm L^2mol^{-2}

38. For which of the following gases is the van der Waals constant a the lowest?

Ⓐ Cl_2 Ⓑ N_2 Ⓒ He Ⓓ CO_2

39. At what temperature (in °C) will the compressibility factor of 0.5 mol of methane in a 2.0 dm^3 vessel at 600 kPa be 0.95?

(A) 30.9°C (B) 15.7°C

(C) 1.2°C (D) 303.9°C

40. What is the conjugate base of NH_4^+?

(A) H_3O^+ (B) OH^- (C) NH_2^- (D) NH_3

41. Which of the following is NOT a Lewis base?

(A) BH_3 (B) H_2O (C) NH_3 (D) CN^-

42. Which of the following oxides is amphoteric?

(A) CaO (B) Na_2O (C) SO_3 (D) ZnO

43. How does boric acid $B(OH)_3$ behave in aqueous solution?

(A) Lewis acid (B) Brønsted base

(C) Strong Brønsted acid (D) Arrhenius base

44. Which of the following is the correct increasing order of base strength?

(A) $Cl^- < CH_3COO^- < H_2O < NH_3$

(B) $Cl^- < H_2O < CH_3COO^- < NH_3$

(C) $NH_3 < CH_3COO^- < H_2O < Cl^-$

(D) $H_2O < Cl^- < NH_3 < CH_3COO^-$

45. Which secondary pollutant is formed in the presence of sunlight in photochemical smog?

(A) SO_2 (B) CH_4 (C) CO (D) O_3

46. During lightning, which compound is formed first from the reaction of atmospheric N_2 and O_2?

(A) NO_2 (B) HNO_3 (C) NO (D) N_2O

47. Which of the following is NOT a heavy metal pollutant of water?

(A) Na (B) Hg (C) Pb (D) Cd

48. The BOD of water increases—
i. when the amount of organic pollutants increases
ii. when the amount of dissolved oxygen increases
iii. when the activity of microorganisms decomposing organic matter increases
Which of the following is correct?

(A) i, ii and iii (B) i and ii

(C) i and iii (D) ii and iii

49. To completely precipitate Ca^{2+} ions as $CaCO_3$ in a 250 mL water sample, 7.5 mL of 0.02 M Na_2CO_3 solution is required. What is the hardness of the water in ppm?

(A) 30 ppm (B) 75 ppm

(C) 15 ppm (D) 60 ppm

50. If the BOD of the water of a water body is 10 mg L^{-1}, the condition of the water is—

(A) Poor pollution level

(B) WHO permitted pollution level

(C) Very good

(D) Fairly good