



# General Chemistry II

## Chem 102

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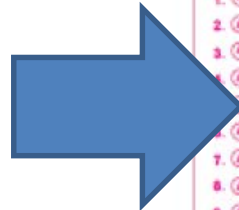



*Final Revision*

Ahmad Alakraa

40 MCQ=60  
mark

Answer  
Here



**Cairo University**  **Faculty of Science**

**MARKING INSTRUCTIONS**

- Use pencil or blue or black pen.
- Do not fill more than one circle.
- To change your answer use the eraser.

• DO NOT use the CORRECTOR.  
• For true&False questions, Mark (T) for true & (F) for false.

CORRECT: ● INCORRECT: ○

Student Name \ \_\_\_\_\_ Date \ \_\_\_\_\_  
Student ID \ \_\_\_\_\_  
Academic Year \ ① ② ③ ④  
Subject Name \ \_\_\_\_\_ subject code \ \_\_\_\_\_  
Examination Form \ (A) (B) (C) (D)  
Exam type \  Quiz 1  Quiz 2  Midterm  Final

Student ID

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**MCQ**

1. (A) (B) (C) (D)	11. (A) (B) (C) (D)	21. (A) (B) (C) (D)	31. (A) (B) (C) (D)	41. (A) (B) (C) (D)
2. (A) (B) (C) (D)	12. (A) (B) (C) (D)	22. (A) (B) (C) (D)	32. (A) (B) (C) (D)	42. (A) (B) (C) (D)
3. (A) (B) (C) (D)	13. (A) (B) (C) (D)	23. (A) (B) (C) (D)	33. (A) (B) (C) (D)	43. (A) (B) (C) (D)
4. (A) (B) (C) (D)	14. (A) (B) (C) (D)	24. (A) (B) (C) (D)	34. (A) (B) (C) (D)	44. (A) (B) (C) (D)
5. (A) (B) (C) (D)	15. (A) (B) (C) (D)	25. (A) (B) (C) (D)	35. (A) (B) (C) (D)	45. (A) (B) (C) (D)
6. (A) (B) (C) (D)	16. (A) (B) (C) (D)	26. (A) (B) (C) (D)	36. (A) (B) (C) (D)	46. (A) (B) (C) (D)
7. (A) (B) (C) (D)	17. (A) (B) (C) (D)	27. (A) (B) (C) (D)	37. (A) (B) (C) (D)	47. (A) (B) (C) (D)
8. (A) (B) (C) (D)	18. (A) (B) (C) (D)	28. (A) (B) (C) (D)	38. (A) (B) (C) (D)	48. (A) (B) (C) (D)
9. (A) (B) (C) (D)	19. (A) (B) (C) (D)	29. (A) (B) (C) (D)	39. (A) (B) (C) (D)	49. (A) (B) (C) (D)
10. (A) (B) (C) (D)	20. (A) (B) (C) (D)	30. (A) (B) (C) (D)	40. (A) (B) (C) (D)	50. (A) (B) (C) (D)

**TRUE OR FALSE**

1. (T) (F)	11. (T) (F)	21. (T) (F)	31. (T) (F)	41. (T) (F)
2. (T) (F)	12. (T) (F)	22. (T) (F)	32. (T) (F)	42. (T) (F)
3. (T) (F)	13. (T) (F)	23. (T) (F)	33. (T) (F)	43. (T) (F)
4. (T) (F)	14. (T) (F)	24. (T) (F)	34. (T) (F)	44. (T) (F)
5. (T) (F)	15. (T) (F)	25. (T) (F)	35. (T) (F)	45. (T) (F)
6. (T) (F)	16. (T) (F)	26. (T) (F)	36. (T) (F)	46. (T) (F)
7. (T) (F)	17. (T) (F)	27. (T) (F)	37. (T) (F)	47. (T) (F)
8. (T) (F)	18. (T) (F)	28. (T) (F)	38. (T) (F)	48. (T) (F)
9. (T) (F)	19. (T) (F)	29. (T) (F)	39. (T) (F)	49. (T) (F)
10. (T) (F)	20. (T) (F)	30. (T) (F)	40. (T) (F)	50. (T) (F)

**MATCHING**

1. (A) (B) (C) (D) (E) (F) (G) (H) (I) (J)	11. (A) (B) (C) (D) (E) (F) (G) (H) (I) (J)
2. (A) (B) (C) (D) (E) (F) (G) (H) (I) (J)	12. (A) (B) (C) (D) (E) (F) (G) (H) (I) (J)
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اختتم  
الامتحان

Subjective Item Score

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

رقم اللجنة : \_\_\_\_\_  
توقيع الملاحظ : \_\_\_\_\_

# Question

✚ “If a change is imposed on a system at equilibrium, the position of the equilibrium will shift in a direction that tends to reduce that change” is a statement of -----.

(A) Hess's law

(C) Dalton's law

(B) Raoult's law

(D) Le Châtelier's principle

# Answer

**(D) Le Châtelier's principle**

# Question

✚ “The following factor(s) can certainly affect the solubility of a given solute in a certain solvent -----.

- (A) temperature      (C) nature of the solute & solvent  
(B) pressure          (D) all of them

# Answer

**(D) all of them**

# Question

✚ “A solution containing more solutes than the equilibrium amount that tends to move to saturation under proper conditions” is called the ----- solution.

(A) saturated

(C) supersaturated

(B) unsaturated

(D) missing info.

# Answer

**(C) supersaturated**

# Question

✚ “Which of the following exhibits dipole-dipole attraction between molecules?”



# Answer



# Question

Which of the following exhibits only London dispersion forces?



# Answer



# Question

- ✚ The rate of vaporization of a liquid increases when the ...
- (A) temperature increases
  - (B) The surface area of the liquid increases
  - (C) the intermolecular forces between liquid molecules are weakened
  - (D) all of the above

# Answer

**(D) all of the above**

# Question

✚ The number of atom(s) per unit cell in a certain metal in the body-centered cubic lattice is .....

(A) 1

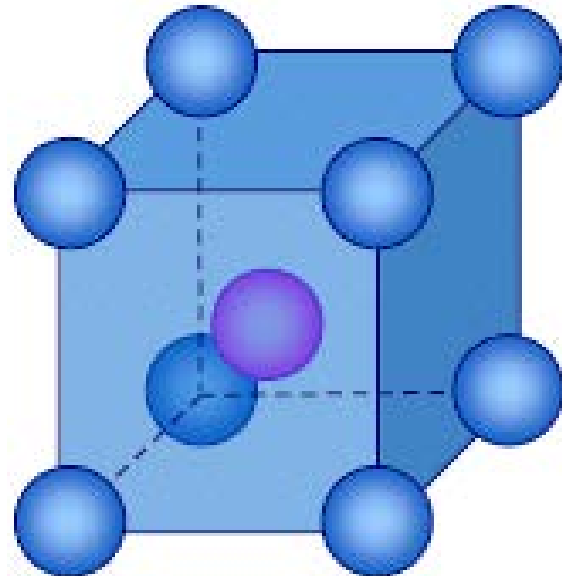
(C) 3

(B) 2

(D) 4

# Answer

**(B) 2**



# Question

✚ The general equation for non-ideal gases is represented mathematically by -----.

(A)  $PV = nRT$

(C)  $P_{\text{obs}} = \frac{nRT}{V-nb} + a \left[ \frac{n}{V} \right]^2$

(B)  $P_i = \chi_i P_T$

(D) None of these

# Answer

**(D) None of these**

# Question

✚ The vaporization of water at room temperature is an -----  
---- process with a -----  $\Delta H$ .

(A) endothermic & -ve

(C) exothermic & -ve

(B) endothermic & +ve

(D) exothermic & +ve

# Answer

**(B) endothermic & +ve**

# Question

✚ “Real gases behavior is most likely sustained at-----.

- (A) high T, low P & low n    (C) low T, high P & high n  
(B) low T, high P & low n    (D) high T, low P & high n

# Answer

**(C) low T, high P & high n**

# Question

✚ “Boyl’s law is valid at -----.

- (A) high T, low P & low n    (C) low T, high P & high n  
(B) low T, high P & low n    (D) high T, low P & high n

# Answer

**(A) high T, low P & low n**

# Question

✚ “Which of the following solution inspires the smallest depression in the freezing point of water?

(A) 1 m glucose

(C) 1 m  $\text{FeSO}_4$

(B) 1 m NaCl

(D) 1 m  $\text{KNO}_3$

# Answer

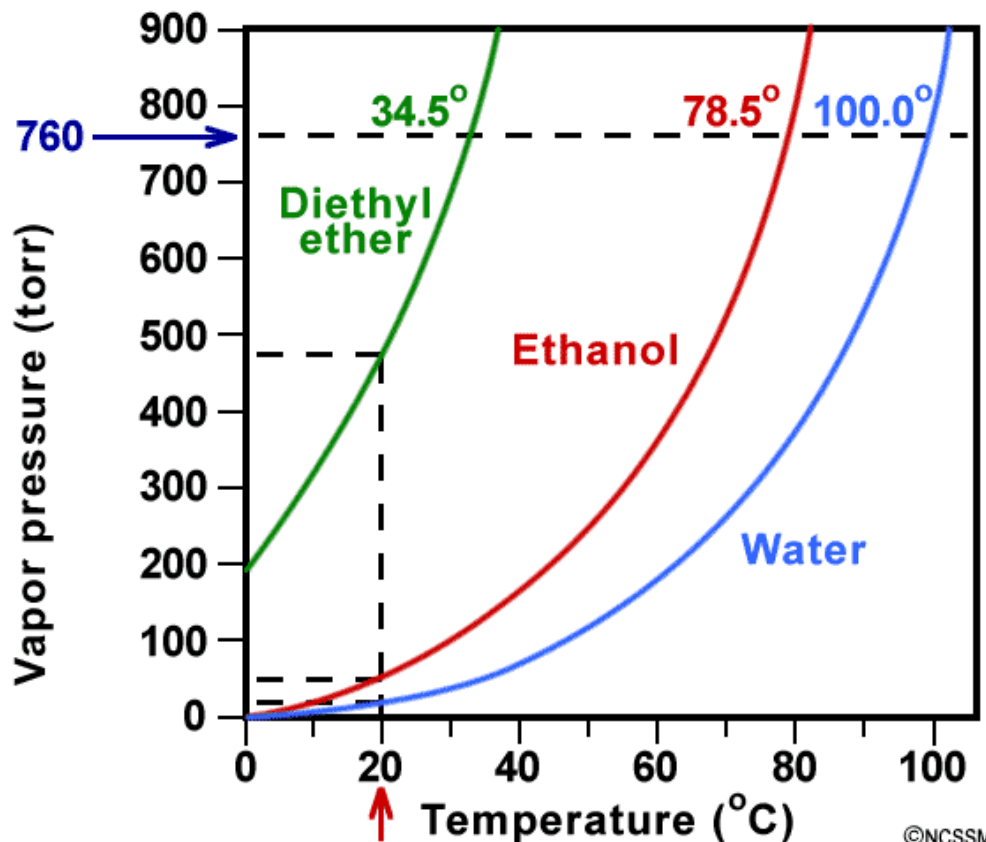
**(A) 1 m glucose**

- ▶ Colligative properties are independent of the **type** of the salt added but on its **concentration**.
- ▶ The one having the smallest **Van't Hoff factor**,  $i$ , will have the smallest  $\Delta T_f$

# Question

The following figure depicts the P-T plots for three materials. Which one of them is more volatile at 20°C?

- (A) Diethyl ether
- (B) Ethanol
- (C) Water
- (D) can't tell



# Answer

**(A) Diethyl ether**

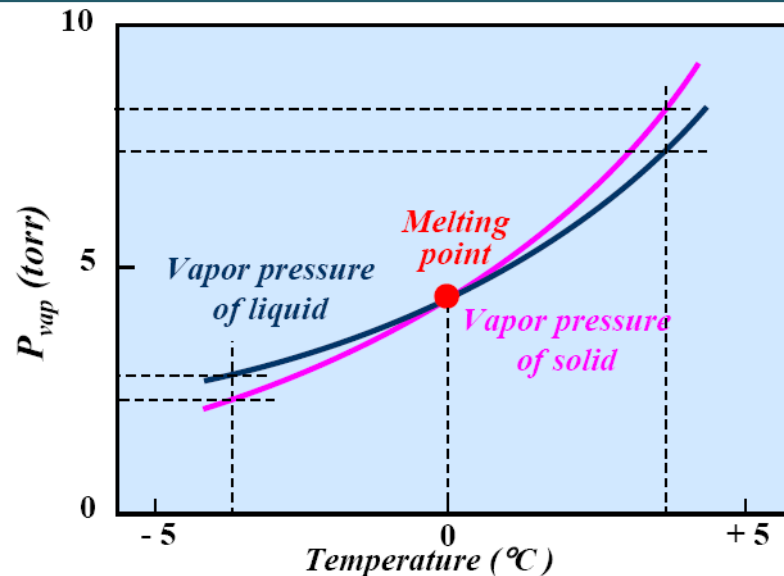
# Question

✚ Ice floats on water at room temperature as a consequence of being .....

- (A) Ice has a lower vapor pressure than liquid water
- (B) Ice and liquid water have the same density
- (C) Ice is denser than liquid water
- (D) Ice is less dense than liquid water

# Answer

**(D) Ice is less dense than liquid water**



# Question

✚ The average kinetic energy of  $O_2$  molecules in a closed container increases with increasing the container's -----  
-----.

(A) volume

(B) temperature

(C) pressure

(D) missing info

# Answer

**(B) temperature**

# Question

Which one of the following can shift the following equilibrium in the direction of the decomposition of  $\text{CaCO}_3(\text{s})$ ?



- (A) adding  $\text{CO}_2$                       (B) increasing T                      (C) adding Ar  
(D) decreasing the container's volume

# Answer

**(B) increasing T**

# Question

✚ The change in internal energy of a system is certainly positive when heat flows into the ..... and work is done by the -----, RESPECTIVELY.

- (A) system & system
- (B) surrounding & surrounding
- (C) surrounding & system
- (D) system & surrounding

# Answer

**(D) system & surrounding**

# Question

✚ A device to measure atmospheric pressure is called -----  
-----.

(A) calorimeter

(C) thermometer

(B) barometer

(D) viscometer

# Answer

**(B) barometer**

# Question

✚ The SI dimension of pressure is -----.

(A)  $\text{N m}^2$

(B)  $\text{kg m}^{-1} \text{s}^{-2}$

(C)  $\text{kg m s}^{-2}$

(D)  $\text{kg m}^2 \text{s}^{-2}$

# Answer

**(B)  $\text{kg m}^{-1} \text{s}^{-2}$**

# Question

✚ Gas A and gas B are mixed together in a container at a certain temperature. The partial pressure of gas B will be -----.

(A)  $P_B = X_B P_{\text{total}}$

(C)  $P_B = \frac{n_B}{P_{\text{total}}}$

(B)  $P_B = X_B P_A$

(D)  $P_B = n_B P_{\text{total}}$

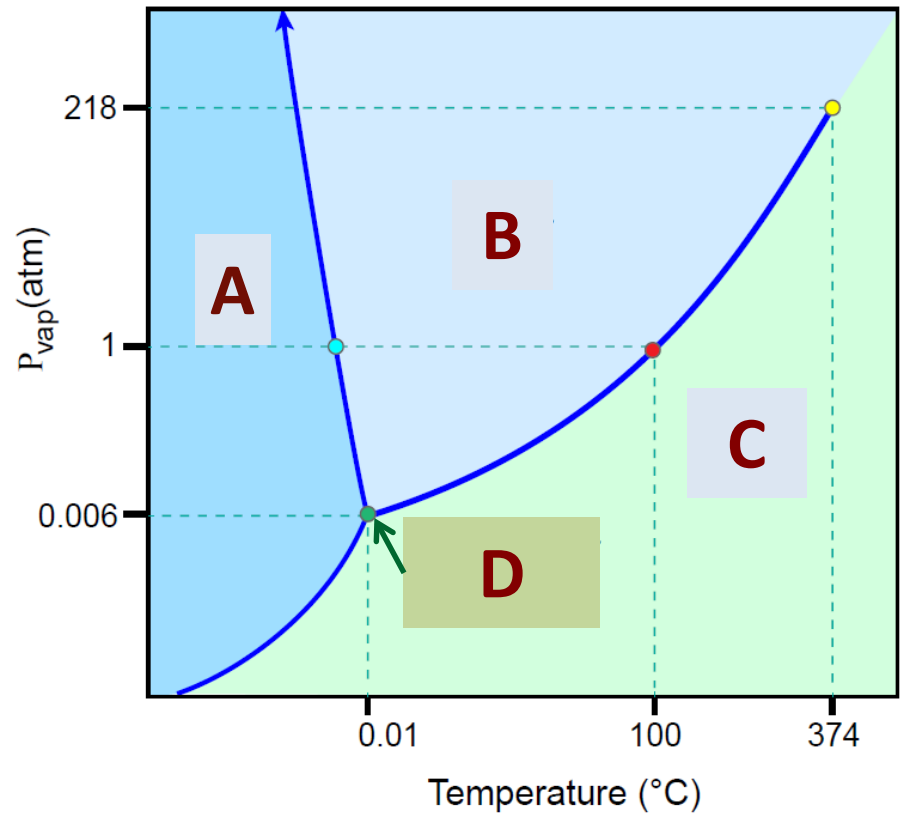
# Answer

**(A)  $P_B = X_B P_{\text{total}}$**

# Question

In the following phase diagram, the phase change from Phase C to phase A is known as -----.

- (A) deposition
- (B) sublimation
- (C) condensation
- (D) liquefaction



# Answer

**(A) deposition**

# Question

✚ To the correct number of significant figures, calculate  $(1.8 + 0.020) \times 0.3315 =$

(A) 0.5967

(B) 0.60

(C) 0.597

(D)  $5.97 \times 10^{-1}$

# Answer

**(B) 0.60**

$$(1.820) \times 0.3315 = (1.8) \times 0.3315 \\ = 0.5967 = 0.60$$

# Question

✚ The number of captive zeros in 5800 is -----.

(A) 0

(C) 2

(B) 1

(D) missing info.

# Answer

**(A) 0**

# Question

A sample of  $\text{N}_2$  gas (2.0 mmole) effused through a pinhole in 5.5 s. It should take ----- s for the same amount of  $\text{CH}_4$  to effuse under the same conditions.

(A) 0.14

(C) 4.16

(B) 7.27

(D) missing info.

# Answer

**(C) 4.16**

$$\frac{\text{Rate of effusion for gas 1}}{\text{Rate of effusion for gas 2}} = \frac{u_{\text{rms for gas 1}}}{u_{\text{rms for gas 2}}} = \frac{\sqrt{M_2}}{\sqrt{M_1}}$$

$$\frac{u_{\text{rms for gas 1}}}{u_{\text{rms for gas 2}}} = \frac{t_2}{t_1} = \frac{\sqrt{M_2}}{\sqrt{M_1}} \Rightarrow t_2 = \frac{t_1 \sqrt{M_2}}{\sqrt{M_1}} = \frac{5.5\text{s} \sqrt{16}}{\sqrt{28}} = 4.16 \text{ s}$$

# Question

At 25°C & a nitrogen gas pressure of 522 mmHg, the solubility of nitrogen gas is  $4.7 \times 10^{-4}$  mol/L. This corresponds to Henry's constant of ----- mol/L.atm.

(A)  $9.0 \times 10^{-7}$

(C)  $6.8 \times 10^{-4}$

(B) 0.68

(D) missing info.

# Answer

**(C)  $6.8 \times 10^{-4}$**

$$4.7 \times 10^{-4} \frac{\text{mol}}{\text{L}} = k \left( 522 \text{ mmHg} \times \frac{1 \text{ atm}}{760 \text{ mmHg}} \right)$$

$S_g = k P_g$



$$k = 6.8 \times 10^{-4} \frac{\text{mol}}{\text{L} \cdot \text{atm}}$$

# Question

✚ The average kinetic energy and density of CO<sub>2</sub> gas at 100°C and 10.0 atm are ----- kJ mol<sup>-1</sup> and ----- g L<sup>-1</sup>, respectively.

(A) 45.88 & 0.14

(C) 1.2 & 53.66

(B) 4.65 & 14.39

(D) None of these

# Answer

**(B) 4.65 & 14.39**

$$(\text{KE})_{\text{avg}} = \frac{3}{2} RT = \frac{3 (8.314 \text{ J K}^{-1} \text{ mol}^{-1}) 373 \text{ K}}{2} = 4.65 \text{ kJ mol}^{-1}$$



$$d = \frac{PM}{RT} = \frac{(10 \text{ atm})(44 \text{ g mol}^{-1})}{(0.082 \text{ L atm K}^{-1} \text{ mol}^{-1})(373 \text{ K})} = 14.39 \text{ g L}^{-1}$$

# Question

✚ The freezing point of a solution prepared by dissolving 10.0 g  $\text{Ca}(\text{NO}_3)_2$  (164 g/mol) in 100 g of water is -----  $^\circ\text{C}$ . The molal fb depression constant of water is  $1.86^\circ\text{C}/\text{m}$ ?

(A) 3.4

(C) 0

(B)  $-3.4$

(D) None of these

# Answer

**(B)  $-3.4$**

$$m = \frac{W_{\text{solute}}}{M_{\text{wt}}_{\text{solute}}} \times \frac{1000}{W_{\text{solvent}} (\text{g})} = \frac{(10 \text{ g}) 1000}{(164 \text{ g mol}^{-1})(100 \text{ g})} = 0.61 \text{ m}$$

$$\Delta T_f = i K_f m_{\text{solute}} = 3 \times 1.86^\circ\text{C}/\text{m} \times 0.61 \text{ m} = 3.4^\circ\text{C}$$



$$\text{FB} = 0 - 3.4 = -3.4^\circ\text{C}$$

# Question

✚ The heat of formation (kCal) of  $\text{Hg}_2\text{Cl}_2 = +63.01$ ,  $\text{KOH}_{(\text{aq})} = +114.85$ ,  $\text{KCl}_{(\text{aq})} = +99.88$ ,  $\text{Hg}_2\text{O} = +21.5$  and  $\text{H}_2\text{O} = +68.4$ .  $\Delta H$  for the reaction  $\text{Hg}_2\text{Cl}_2 + 2\text{KOH} \rightarrow 2\text{KCl} + \text{Hg}_2\text{O} + \text{H}_2\text{O}$  should equal to ----- kCal.

(A) 3.05

(C) 0

(B) -3.05

(D) None of these

# Answer

**(B) -3.05**



$$\Delta H = (2)99.88 + (1)21.5 + (1)68.4$$

$$-(1)63.01 - (2)114.85 = -3.05 \text{ kCal}$$

# Question

✚ A sample of  $N_2$  gas has a volume of 1.75 L at STP. How many molecules of  $N_2$  are present?

(A) 0.08

(C) 0

(B)  $1.3 \times 10^{-25}$

(D)  $4.7 \times 10^{22}$

# Answer

**(D)  $4.7 \times 10^{22}$**

$$PV = nRT \quad \rightarrow \quad (1 \text{ atm})(1.75) = n \left( \frac{0.082 \text{ L atm}}{\text{K mol}} \right) (273 \text{ K})$$
$$n = 0.0782 \text{ mol}$$
$$\text{no. of molecules} = (0.0782 \text{ mol}) \left( \frac{6.023 \times 10^{23}}{\text{mol}} \text{ molecule} \right)$$
$$= 4.7 \times 10^{22} \text{ molecule}$$

# Question

The normal boiling of liquid ammonia is  $-33.4^{\circ}\text{C}$  and it has a heat of vaporization of  $23.5 \text{ kJ/mol}$ . Its vapor pressure at  $-50.0^{\circ}\text{C}$  should be ----- torr.

(A) 240

(C) 316

(B) 87

(D) None of them

# Answer

**(C) 316**

$$\ln P = -\frac{\Delta H_{\text{vap}}}{RT} + C$$

$$\ln \frac{P_1}{P_2} = \frac{\Delta H_{\text{vap}}}{R} \left( \frac{1}{T_2} - \frac{1}{T_1} \right)$$

$$\ln \frac{760}{P_2} = \frac{23.5 \times 1000}{8.314} \left( \frac{1}{-50 + 273} - \frac{1}{-33.4 + 273} \right) = 0.876$$



$$P_2 = 316 \text{ torr}$$

# Question

✚ The concentration of NaOH in a certain aqueous sample is 1.0 M. How many milliliters of the sample contains 4 g of NaOH?

(A) 50

(C) 100

(B) 70

(D) 120

# Answer

**(C) 100**

$$w_{\text{solute}}(\text{g}) = \frac{M(\text{mol/L}) \times \text{Mwt}_{\text{solute}}(\text{g/mol}) \times V(\text{mL})}{1000}$$

$$V(\text{mL}) = \frac{1000 w_{\text{solute}}(\text{g})}{M(\text{mol/L}) \times \text{Mwt}_{\text{solute}}(\text{g/mol})} = \frac{1000 \times 4}{1.0 \times 40}$$



$$V = 100 \text{ mL}$$

# Question

✚ Phosphoric acid can be prepared by reaction of sulfuric acid with “phosphate rock” according to the equation:  $\text{Ca}_3(\text{PO}_4)_2 + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{H}_3\text{PO}_4$ . How many oxygen atoms are there in 1.55 ng of  $\text{Ca}_3(\text{PO}_4)_2$ ?

(A)  $2.49 \times 10^{11}$

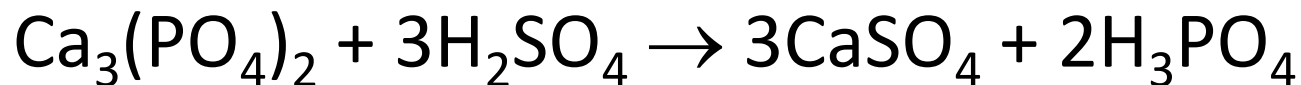
(C)  $2.49 \times 10^{13}$

(B)  $5.64 \times 10^{12}$

(D) None of them

# Answer

## Balance



# Molar mass

$$\text{Phosphate rock} = (3 \times 40) + 2(31 + 4(16)) = 310 \text{ g/mol}$$

# Moles

$$\text{Moles Ca}_3(\text{PO}_4)_2 = (1.55 \times 10^{-9}) / 310 = 5 \times 10^{-12} \text{ mol}$$

Every 1 mol of  $\text{Ca}_3(\text{PO}_4)_2$  contains 8 mol of oxygen atoms

$$\text{No of O atoms} = 5 \times 10^{-12} \times 8 \times 6.23 \times 10^{23} = 249.2 \times 10^{11} \text{ atom}$$

$$\text{(C) } 2.49 \times 10^{13}$$

# Question

Phosphoric acid can be prepared by reaction of sulfuric acid with “phosphate rock” according to the equation:  $\text{Ca}_3(\text{PO}_4)_2 + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{H}_3\text{PO}_4$ . Suppose the reaction is carried out starting with 103 g of  $\text{Ca}_3(\text{PO}_4)_2$  and 75.0 g of  $\text{H}_2\text{SO}_4$ . Which substance is the limiting reactant?

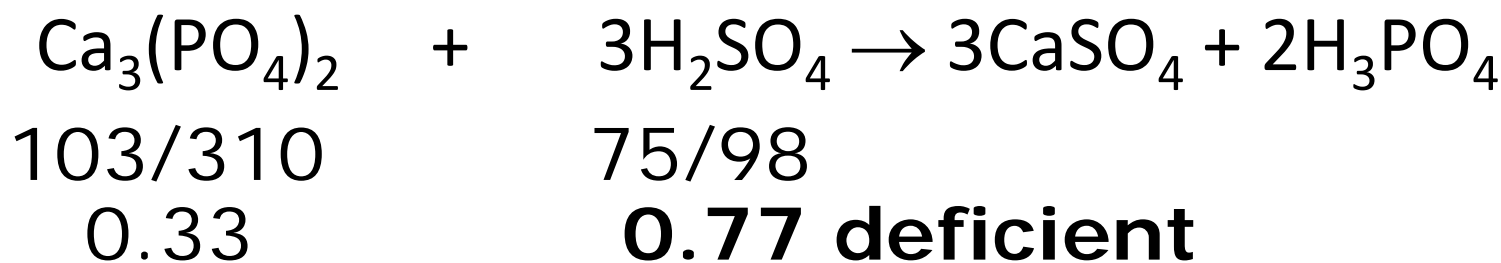
- (A)  $\text{Ca}_3(\text{PO}_4)_2$       (B)  $\text{H}_2\text{SO}_4$       (C)  $\text{CaSO}_4$       (D)  $\text{H}_3\text{PO}_4$

## Answer

## Balance



## (B) $\text{H}_2\text{SO}_4$



# Question

✚ For the reaction  $2\text{NOCl}(\text{g}) \rightleftharpoons 2\text{NO}(\text{g}) + \text{Cl}_2(\text{g})$ ,  $K_c=8.0$  at a certain temperature, Calculate the concentration of NOCl in mol/L that must be put into empty 4.00 L reaction vessel in order that the equilibrium concentration of NOCl be 1.00 M?

(A) 1.24

(C) 3.52

(B) 6.23

(D) None of them

# Answer

**(C) 3.52**

$$K = \frac{[\text{NO}]^2 [\text{Cl}_2]}{[\text{NOCl}]^2} = 8.0 = \frac{(2x)^2 (x)}{(1.0)}$$

$$x = 1.26$$



**Initial NOCl concentration**  $= 1 + 2x = 1 + 2(1.26) = \mathbf{3.52}$  mol/L