

1. Air is approximately 79% nitrogen and 21% oxygen by volume. How many moles of oxygen are present in 6.0 L of air at 25 °C and a pressure of 1.00 atm?

- a) 0.25 mol
- b) 0.0024 mol
- c) 0.052 mol
- d) 0.00051 mol
- e) 0.19 mol

Questions 2 and 3 refer to the following experiment. 0.080 M aluminium nitrate solution (50 mL) is added to 0.060 M potassium phosphate solution (100 mL).

2. What amount (in mol) of AlPO_4 precipitates?

- a) 0.0060
- b) 0.0060
- c) 0.0040
- d) 0.0020
- e) 0.040

3. What is the final concentration of $\text{PO}_4^{3-}(\text{aq})$ ions remaining in solution after the reaction?

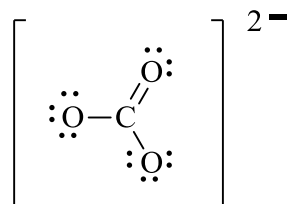
- a) 0.020 M
- b) 0.013 M
- c) 0.040 M
- d) 0.060 M
- e) 0.010 M

4. How many non-bonding electron pairs (lone pairs) are around the Cl atom in HCl?

- a) 0
- b) 1
- c) 2
- d) 3
- e) 4

5. One resonance structure of the carbonate ion is shown below. What is the bond order of the carbon–oxygen bond in CO_3^{2-} ?

- a) 1.0
- b) 1.33
- c) 1.5
- d) 1.66
- e) 2.0



6. What is the molecular geometry of the NO_3^- ion?
- trigonal planar
 - tetrahedral
 - trigonal pyramidal
 - T-shaped
 - square planar
7. What is the molecular geometry of the XeO_4 molecule?
- trigonal planar
 - tetrahedral
 - trigonal bipyramidal
 - octahedral
 - T-shaped
8. Which one of the following molecules has a permanent dipole moment?
- a) CO_2 b) N_2 c) SF_4 d) CH_4 e) SiCl_4
9. What is the ground state electronic configuration of K?
- $1s^2 2s^8 3s^8 4s^1$
 - $1s^2 2s^2 2p^6 2d^{10}$
 - $1s^2 2s^2 2p^8 3s^2 3p^5$
 - $1s^2 2s^2 2p^6 3s^2 3p^6 3d^1$
 - $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$
10. What amount of heat is required to raise the temperature of a 364 g piece of aluminium from 37°C to 59°C ? The heat capacity of aluminium is $24 \text{ J K}^{-1} \text{ mol}^{-1}$.
- 7.1 kJ
 - 9.0 kJ
 - 11 kJ
 - 190 kJ
 - 530 kJ

Correct answers: 1C, 2C, 3B, 4D, 5B, 6A, 7B, 8C, 9E, 10A

1. Air is approximately 79% nitrogen and 21% oxygen by volume. How many moles of nitrogen are present in 26.0 L of air at 55 °C and a pressure of 173 kPa?

- a) 130 mol
- b) 35 mol
- c) 1.6 mol
- d) 1.3 mol
- e) 0.35 mol

Questions 2 and 3 refer to the following experiment. 0.050 M zinc nitrate solution (100 mL) is added to 0.040 M potassium carbonate solution (80 mL).

2. What amount (in mol) of ZnCO_3 precipitates?

- a) 0.0016
- b) 0.0032
- c) 0.0040
- d) 0.0050
- e) 0.0082

3. What is the final concentration of $\text{Zn}^{2+}(\text{aq})$ ions remaining in solution after the reaction?

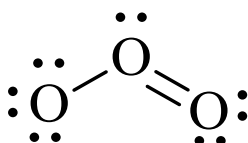
- a) 0.0018 M
- b) 0.0180 M
- c) 0.18 M
- d) 0.0010 M
- e) 0.010 M

4. How many non-bonding electron pairs (lone pairs) are around the B atom in BCl_3 ?

- a) 0
- b) 1
- c) 2
- d) 3
- e) 4

5. One resonance structure of ozone is shown below. What is the bond order of the oxygen–oxygen bond in O_3 ?

- a) 1.0
- b) 1.33
- c) 1.5
- d) 1.66
- e) 2.0



6. What is the molecular geometry of the NH_3 molecule?
- a) trigonal planar
 - b) tetrahedral
 - c) trigonal pyramidal
 - d) T-shaped
 - e) square planar
7. What is the molecular geometry of the SO_3 molecule?
- a) trigonal planar
 - b) tetrahedral
 - c) trigonal bipyramidal
 - d) octahedral
 - e) T-shaped
8. Which one of the following molecules has a permanent dipole moment?
- a) XeF_2 b) H_2 c) CF_4 d) PF_5 e) ClF_5
9. What is the ground state electronic configuration of Se?
- a) $1s^2 2s^2 2p^6 3s^2 3p^5$
 - b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$
 - c) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4p^4$
 - d) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^0 3d^{10} 4p^6$
 - e) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^{46}$
10. What amount of heat is required to raise the temperature of a 155 g piece of scandium from $32\text{ }^\circ\text{C}$ to $92\text{ }^\circ\text{C}$? The heat capacity of scandium is $26\text{ J K}^{-1}\text{ mol}^{-1}$.
- a) 3.0 kJ
 - b) 5.4 kJ
 - c) 7.9 kJ
 - d) 16 kJ
 - e) 242 kJ

Correct answers: 1D, 2B, 3E, 4A, 5C, 6C, 7A, 8E, 9B, 10B