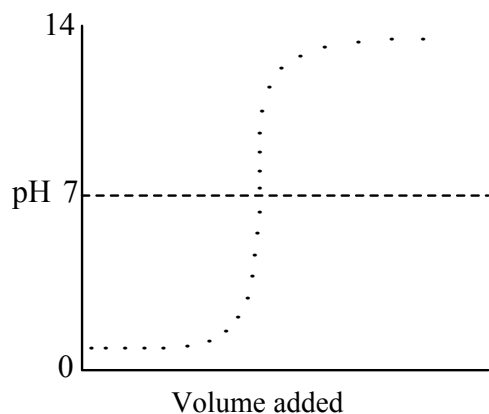


- What is the pH of a 0.20 M solution of boric acid? The pK_a of boric acid is 9.24.
a) 0.70 b) 2.73 c) 4.97 d) 5.12 e) 5.87
- What is the pH of a 0.045 M solution of KOBr? The pK_a of HOBr is 8.63.
a) 4.74 b) 4.99 c) 8.25 d) 9.01 e) 10.64
- A buffered solution is 0.0500 M $\text{CH}_3\text{CO}_2\text{H}$ and 0.0400 M NaCH_3CO_2 . If 0.0100 mol of gaseous HCl is added to 1.00 L of the buffered solution, what is the final pH of the solution? For acetic acid, $pK_a = 4.76$ (*Hint: Use the Henderson-Hasselbalch Equation*)
a) 4.76 b) 4.46 c) 4.66 d) 4.86 e) 4.54

4. In each of the following titrations, the first solution is in the burette and the second solution is in the titration flask. For which titration would the curve illustrated be typical?



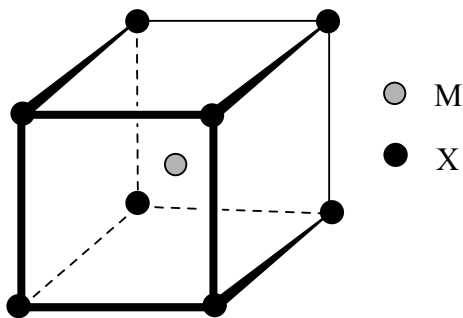
- Na_2CO_3 (0.05 M) / HCl (0.1 M)
 - NaOH (0.1 M) / HI (0.1 M)
 - NaOH (0.1 M) / CH_3COOH (0.1 M)
 - NH_3 (0.1 M) / CH_3COOH (0.1 M)
 - NH_3 (0.1 M) / HCl (0.1 M)
- In which of the following are the atoms arranged in order of INCREASING first ionisation energy?
a) Ne, F, O, C
b) Te, Se, S, O
c) Ca, K, Cl, Ar
d) He, Ne, Ar, Kr
e) N, P, K, Rb

6. A sulfide of lithium has a crystal structure based on a cubic close packed array of sulfide anions with lithium cations in all of the tetrahedral holes. What is the formula of the sulfide?

- a) Li_2S
- b) LiS
- c) Li_2S_3
- d) LiS_2
- e) LiS_3

7. The unit cell below has anions (X) at the corners and cations (M) in the centre of the cell. What is the formula of the compound?

- a) MX
- b) MX_2
- c) M_2X_3
- d) M_2X
- e) MX_3



8. What is the solubility of $\text{Cd}(\text{OH})_2$ in mol L^{-1} ? The K_{sp} for $\text{Cd}(\text{OH})_2$ is 5.9×10^{-15} at 25°C .

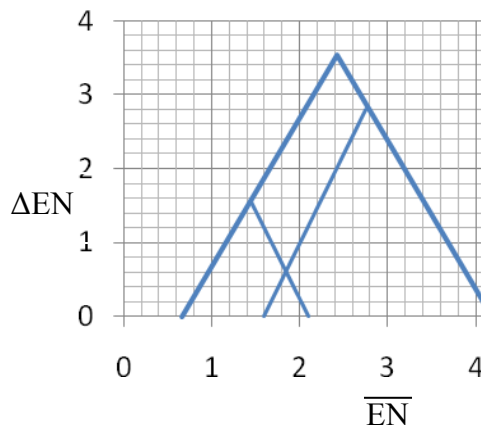
- a) 7.7×10^{-8}
- b) 5.4×10^{-8}
- c) 1.1×10^{-5}
- d) 5.9×10^{-15}
- e) 1.8×10^{-5}

9. Alongside H_2O , what are the major species present in a 1.0 M solution of HCl ?

- a) $\text{HCl}(\text{aq})$, $\text{H}_3\text{O}^+(\text{aq})$ and $\text{Cl}^-(\text{aq})$
- b) $\text{H}_3\text{O}^+(\text{aq})$ and $\text{Cl}^-(\text{aq})$
- c) $\text{HCl}(\text{aq})$
- d) $\text{HCl}(\text{aq})$, $\text{H}_3\text{O}^+(\text{aq})$, $\text{OH}^-(\text{aq})$ and $\text{Cl}(\text{aq})$
- e) $\text{H}_3\text{O}^+(\text{aq})$, $\text{OH}^-(\text{aq})$ and $\text{Cl}^-(\text{aq})$

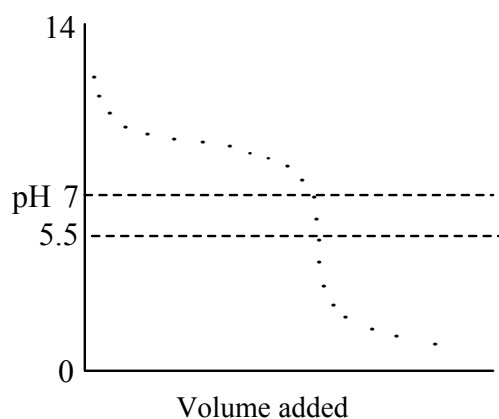
10. The electronegativities (EN) of elements X and Y are 1.80 and 2.01 respectively. What bonding type would be present in the elements X and Y and in a compound formed between X and Y? A bond type diagram is provided to assist you.

	element X	element Y	compound of X and Y
a)	metallic	covalent	ionic
b)	semi-metallic	semi-metallic	ionic
c)	semi-metallic	metallic	covalent
d)	semi-metallic	covalent	covalent
e)	semi-metallic	semi-metallic	semi-metallic



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

- What is the pH of a 0.40 M solution of hydrazoic acid, HN_3 ? The $\text{p}K_a$ of HN_3 is 4.65.
a) 0.13 b) 0.40 c) 2.52 d) 3.67 e) 5.05
- What is the pH of a 0.24 M solution of sodium fluoride? The $\text{p}K_a$ of HF is 3.17.
a) 5.72 b) 8.28 c) 9.26 d) 11.45 e) 13.38
- A buffered solution is 0.450 M $\text{CH}_3\text{CO}_2\text{H}$ and 0.450 M NaCH_3CO_2 . If 0.0800 mol of solid NaOH is added to 1.00 L of the buffered solution, what is the final pH of the solution? For acetic acid, $\text{p}K_a = 4.76$ (*Hint: Use the Henderson-Hasselbalch Equation*)
a) 4.58 b) 4.60 c) 4.76 d) 4.90 e) 4.92
- In each of the following titrations, the first solution is in the titration flask and the second solution is in the burette. For which titration would the curve illustrated be typical?



- Na_2CO_3 (0.05 M) / HCl (0.1 M)
- NaOH (0.1 M) / HI (0.1 M)
- NaOH (0.1 M) / CH_3COOH (0.1 M)
- NH_3 (0.1 M) / CH_3COOH (0.1 M)
- NH_3 (0.1 M) / HCl (0.1 M)

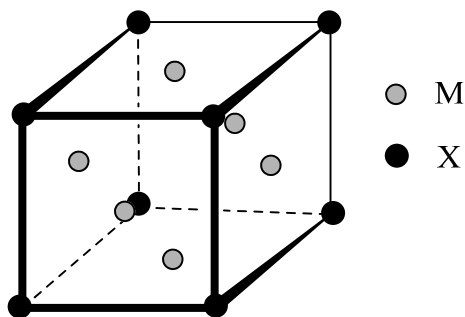
- In which of the following are the ions arranged in order of DECREASING ionic radius?
a) Sn^{4+} , In^{3+} , Sr^{2+} , Rb^+
b) Na^+ , Mg^{2+} , O^{2-} , F^-
c) I^- , Cl^- , Br^- , F^-
d) Cs^+ , Ba^{2+} , Tl^{3+} , Pb^{4+}
e) Mg^{2+} , Al^{3+} , S^{2-} , Cl^-

6. An iodide of silver has a crystal structure based on an hexagonal close packed array of iodide anions with silver cations in half of the tetrahedral holes. What is the formula of the iodide?

- a) Ag₂I
- b) AgI
- c) Ag₂I₃
- d) AgI₂
- e) AgI₃

7. The unit cell below has anions (X) at the corners and cations (M) in the centre of each face. What is the formula of the compound?

- a) MX
- b) MX₂
- c) M₃X
- d) M₂X
- e) M₂X₃



8. What is the solubility of Fe₃(PO₄)₂ in mol L⁻¹? The *K*_{sp} for Fe₃(PO₄)₂(s) is 1.0 × 10⁻³⁶ at 25 °C.

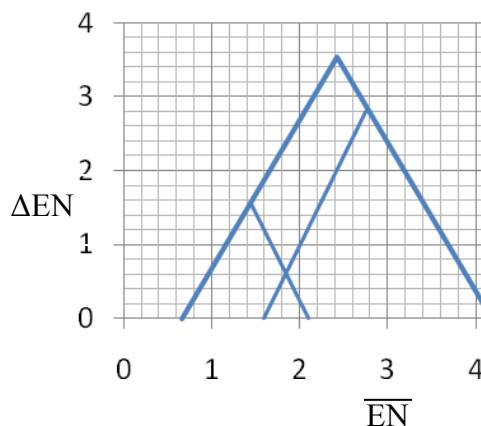
- a) 2.5 × 10⁻⁸
- b) 3.1 × 10⁻⁸
- c) 6.3 × 10⁻⁸
- d) 1.0 × 10⁻⁷
- e) 4.0 × 10⁻⁷

9. Alongside H₂O, what are the major species present in a 1.0 M solution of NaCN?

- a) NaCN(aq)
- b) HCN(aq), Na⁺(aq) and CN⁻(aq)
- c) HCN(aq), OH⁻(aq), Na⁺(aq) and CN⁻(aq)
- d) Na⁺(aq) and CN⁻(aq)
- e) CN⁻(aq), H₃O⁺(aq), OH⁻(aq) and Na⁺(aq)

10. The electronegativities (EN) of elements X and Y are 3.44 and 1.00 respectively. What bonding type would be present in the elements X and Y and in a compound formed between X and Y? A bond type diagram is provided to assist you.

	element X	element Y	compound of X and Y
a)	metallic	covalent	ionic
b)	covalent	metallic	ionic
c)	semi-metallic	metallic	covalent
d)	metallic	covalent	covalent
e)	semi-metallic	metallic	metallic



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