

1. A 1.0 L flask contains a mixture of hydrogen (8.0 atm), oxygen (4.0 atm) and neon (2.0 atm) at the stated partial pressures at a temperature of 40 °C. What is the total pressure inside the flask at 40 °C after the mixture is ignited. Ignore the vapour pressure of water.
a) 14.0 atm b) 10.0 atm c) 6.0 atm d) 2.0 atm e) 0.0 atm
2. Assuming ideal behaviour, what is the boiling point of a solution of sodium hydroxide (150.0 g) in water (900.0 g)? The boiling point elevation constant, K_b , for water is 0.51 K kg mol⁻¹.
a) 106.4 °C b) 104.3 °C c) 102.1 °C d) 97.9 °C e) 95.8 °C
3. Which one of the following is **not** an example of a conjugate acid-base pair?
a) NH₄⁺, NH₃
b) HI, I⁻
c) CH₃CH₂OH₂⁺, CH₃CH₂O⁻
d) HSO₃⁻, SO₃²⁻
e) H₂O, OH⁻
4. Which one of the following sets of 0.1 M solutions is arranged in order of increasing boiling point?
a) glucose < NaCl < NH₃ < Na₂SO₄
b) glucose < HBr < Na₃PO₄ < Na₂SO₄
c) Na₂SO₄ < Na₃PO₄ < HBr < glucose
d) glucose < HBr < Na₂SO₄ < Na₃PO₄
e) HBr < Na₂SO₄ < Na₃PO₄ < glucose
5. 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

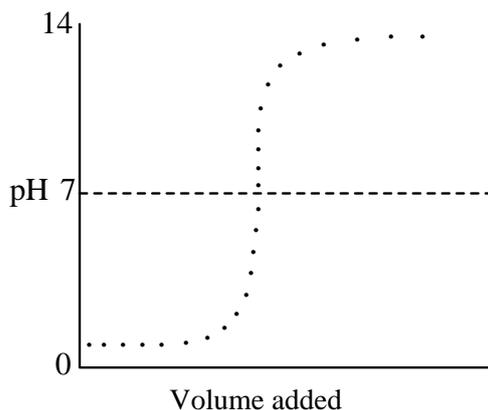
6. What is the pH of a 0.045 M solution of KBr? The pK_a of HOBr is 8.63.

- a) 4.74 b) 4.99 c) 8.25 d) 9.01 e) 10.64

7. A buffered solution is 0.0500 M CH_3COOH 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, $pK_a = 4.76$

- a) 4.76 b) 4.46 c) 4.66 d) 4.86 e) 4.54

8. 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?



- a) Na_2CO_3 (0.05 M) / HCl (0.1 M)
 b) NaOH (0.1 M) / HI (0.1 M)
 c) NaOH (0.1 M) / CH_3COOH (0.1 M)
 d) NH_3 (0.1 M) / CH_3COOH (0.1 M)
 e) NH_3 (0.1 M) / HCl (0.1 M)

9. Given the initial rate data below, what is the rate law for the following reaction?



$[ClO_2]$ (mol L ⁻¹)	$[OH^-]$ (mol L ⁻¹)	Initial rate (mol L ⁻¹ s ⁻¹)
0.100	0.100	0.23
0.200	0.050	0.46
0.200	0.100	0.92

- a) rate = $k[ClO_2][OH^-]^2$ b) rate = $k[ClO_2]^2[OH^-]$ c) rate = $k[ClO_2]^2[OH^-]^2$
 d) rate = $k[ClO_2][OH^-]$ e) rate = $k[ClO_2]^3$

10. How long does it take for the activity a sample of ^{131}I to drop to 95% of its initial value? The half-life of ^{131}I is 8.02 days.

- a) 0.59 days b) 0.26 days c) 1.37 days d) 0.41 days e) 5.2 days

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

1. A 1.0 L flask contains a mixture of hydrogen (8.0 atm), oxygen (4.0 atm) and neon (2.0 atm) at the stated partial pressures at a temperature of 200 °C. What is the total pressure inside the flask at 200 °C after the mixture is ignited.
a) 14.0 atm b) 10.0 atm c) 8.0 atm d) 4.0 atm e) 2.0 atm
2. Assuming ideal behaviour, what is the freezing point of a solution of sodium hydroxide (95.0 g) in water (600.0 g)? The freezing point depression constant, K_f , for water is 1.86 K kg mol⁻¹.
a) -14.7 °C b) -7.36 °C c) 0 °C d) 7.36 °C e) 14.7 °C
3. Which of the following is **not** an example of a conjugate acid-base pair?
a) O, OH⁻
b) HSO₃⁻, SO₃²⁻
c) HCN, CN⁻
d) H₃PO₄, H₂PO₄⁻
e) H₃O⁺, H₂O
4. Which one of the following sets of 0.1 M solutions is arranged in order of increasing boiling point?
a) sucrose < NaCl < CH₃COOH < Na₂SO₄
b) sucrose < HCl < Na₃PO₄ < K₂SO₄
c) sucrose < CH₃COOH < MgCl₂ < K₃PO₄
d) HBr < Na₂SO₄ < Na₃PO₄ < sucrose
e) Na₂SO₄ < K₃PO₄ < HBr < sucrose
5. What is the pH of a 2.00 M solution of hydrazoic acid, HN₃? The pK_a of HN₃ is 4.65.
a) -0.30 b) 0.48 c) 2.00 d) 2.17 e) 4.35

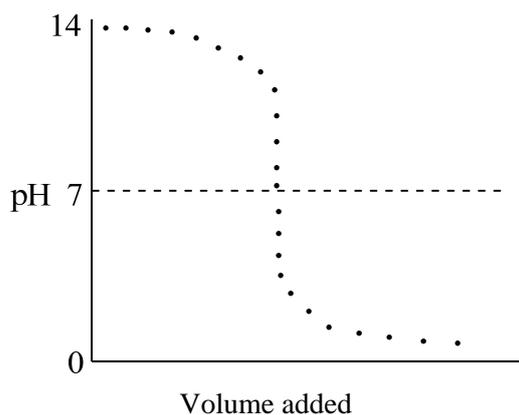
6. What is the pH of a 0.42 M solution of sodium azide, NaN_3 ? The $\text{p}K_a$ of HN_3 is 4.65.

- a) 4.74 b) 8.25 c) 9.14 d) 9.73 e) 13.62

7. A buffered solution is 0.0600 M CH_3COOH and 0.0300 M NaCH_3CO_2 . If 0.0200 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, $\text{p}K_a = 4.76$

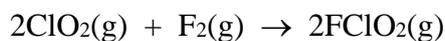
- a) 4.76 b) 4.46 c) 4.66 d) 4.86 e) 4.54

8. 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?



- a) HCl (0.1 M) / Na_2CO_3 (0.05 M)
 b) HCl (0.1 M) / NH_3 (0.1 M)
 c) CH_3COOH / NaOH (0.1 M) (0.1 M)
 d) CH_3COOH (0.1 M) / NH_3 (0.1 M)
 e) HI (0.1 M) / NaOH (0.1 M)

9. Given the initial rate data below, what is the rate law for the following reaction?



$[\text{ClO}_2]$ (mol L^{-1})	$[\text{F}_2]$ (mol L^{-1})	Initial rate ($\text{mol L}^{-1} \text{s}^{-1}$)
0.010	0.10	1.2×10^{-3}
0.040	0.10	4.8×10^{-3}
0.010	0.20	2.4×10^{-3}

- a) $\text{rate} = k[\text{ClO}_2][\text{F}_2]^2$ b) $\text{rate} = k[\text{ClO}_2]^2[\text{F}_2]$ c) $\text{rate} = k[\text{ClO}_2]^2[\text{F}_2]^2$
 d) $\text{rate} = k[\text{ClO}_2][\text{F}_2]$ e) $\text{rate} = k[\text{ClO}_2]^2$

10. How long does it take for the activity a sample of ^{14}C to drop to 55% of its initial value? The half-life of ^{14}C is 5730 years.

- a) 2100 years b) 11000 years c) 3400 years d) 4900 years e) 8800 years

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