Multiple Choice

1) How many moles of NH_3 are there in 77.5 g of NH_3?

A) 0.22 mol B) 4.55 mol C) 14.0 mol D) 1.31×10^{3} mol

2) What is the mass of one copper atom?

A) 1.055×10^{-22}g B) 63.55 g C) 1 amu D) 1.66×10^{-24}g

3) How many sulfur atoms are there in 21.0 g of Al_2S_3?

A) 8.42×10^{22} B) 2.53×10^{23} C) 2.14×10^{23} D) 6.02×10^{23}

4) A 0.8715 g sample of sorbic acid is burned completely in oxygen to give 2.053 g of carbon dioxide (CO_2) and 0.5601 g water (H_2O). The empirical formula of sorbic acid is:

A) CH_2O B) C_3H_4O C) CH_4O_3 D) $C_3H_4O_2$

5) 0.500 mole of ammonia (NH_3) occupies a 1.20 L flask at 150°C. Calculate the pressure (in atm) of the ammonia inside the flask.

A) 4.88 B) 5.13 C) 12.12 D) 14.47

6) A small bubble rises from the bottom of a lake, where the temperature and pressure are 4°C and 3.0 atm, to the water's surface, where the temperature is 25°C and the pressure is 0.95 atm. Calculate the final volume (in mL) of the bubble if its volume was 2.1 mL.

A) 7.1 B) 6.2 C) 5.8 D) 4.2

7) What volume of CO_2 gas (in L) at 645 torr and 800 K could be produced by the reaction of 45 g of $CaCO_3$ according to the equation.

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$

A) 0.449 B) 22.4 C) 25.0 D) 34.8

8) Two moles of chlorine gas at 20°C are heated to 350°C while the volume is kept constant. The density of the gas:

A) increases B) decreases C) remains the same
D) Not enough information is given to correctly answer the question

9) A mixture of three gases has a total pressure of 1380 mmHg at 298 K. The mixture is analyzed and is found to contain 1.27 mol CO_2, 3.04 mol CO and 1.50 mol Ar. What is the partial pressure of Ar (in mmHg)?

A) 301 B) 327 C) 345 D) 356

10) When 0.560 g of Na(s) reacts with excess F_2(g) to form NaF(s), 13.8 kJ of heat is evolved at standard-state conditions. What is the standard enthalpy of formation (ΔH_f^o) in kJ/mol of NaF(s)?

A) 24.8 B) -566.5 C) -24.8 D) 566.5

11) Calcium oxide and water react in an exothermic reaction:

$CaO(s) + H_2O(\ell) \rightarrow Ca(OH)_2(s)$ $\Delta H^o_{rxn} = -64.8$ kJ

How much heat would be liberated when 7.15 g CaO(s) is dropped into a beaker containing 152 g H_2O?

A) 8.26 kJ B) 9.16 kJ C) 15.4 kJ D) 7.15 kJ

12) A gas is compressed in a cylinder from a volume of 20.0 L to 2.0 L by a constant pressure of 10.0 atm. Calculate the amount of work done. (1 L atm = 101.3 J)

A) 1.01×10^4 J B) -1.01×10^4 J C) -1.82×10^4 J D) 1.82×10^4 J

13) What is the molarity of an aqueous solution that is 26.0% by mass phosphoric acid (H_3PO_4) and that has a density of 1.155 g/mL

A) 4.86 M B) 4.05 M C) 3.06 M D) 2.78 M

14) An aqueous solution of glucose boils at 100.45°C. What will be the freezing point of this solution (in °C) ($K_f = 1.86$ °C/m, $K_b = 0.52$ °C/m)

A) -1.6 B) -0.45 C) -1.1 D) -1.4

15) At 10°C one volume of water dissolves 3.10 volume of chlorine gas, Cl_2, at 1.0 atm pressure. What is the Henry's law constant in mol/L.atm of this gas?

A) 0.13 B) 0.15 C) 0.17 D) 0.19

16) When equal masses of the three non-electrolytes solutes, urea, $(NH_2)_2CO$, glucose, $C_6H_{12}O_6$ and sucrose, $C_{12}H_{22}O_{11}$, are dissolved separately each in exactly the same volume of water. Therefore:

A) The urea solution will have the lowest osmotic pressure.
B) The glucose solution will have the lowest osmotic pressure.
C) The sucrose solution will have the lowest osmotic pressure.
D) The three solutions will have exactly the same osmotic pressure.

17) The reaction A + 2B → products, was found to follow the rate law:

$$\text{rate} = k[A]^2[B]$$

Predict by what factor the rate of the reaction will increases when the concentration of A is doubled and the concentration of B is tripled and the temperature remains constant.

A) 36 B) 24 C) 18 D) 12

18) The isomerization of cyclopropane follows first order kinetics. The rate constant at 700 K is 6.2×10^{-4} min^{-1}, and the half life at 760 K is 29.0 min. Calculate (in kJ/mol) the activation energy for this reaction.

A) 269.2 B) 250.6 C) 240.8 D) 283.4

19) The unit for a third order reaction rate constant is:

A) s^{-1} B) $mol^{-2}\ L^{2}\ s^{-1}$ C) $mol^{2}\ L^{-2}\ s^{-1}$ D) $mol^{3}\ L^{-3}\ s^{-1}$

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20) 4.21 moles of S_2Cl_4 gas are introduced in 2.0 L vessel. The reaction

$$S_2Cl_4(g) \rightleftharpoons 2SCl_2(g)$$

Comes to equilibrium and 1.25 moles of S_2Cl_4 are found in the reaction vessel. Calculate K_c for the reaction.

A) 14.0 B) 17.0 C) 19.5 D) 21.5

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21) At 700 K, the reaction

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

has an equilibrium constant $K_c = 4.3\times10^{6}$, and the following concentrations are present: $[SO_2]$ 0.01 M; $[SO_3]$ = 10.0 M and $[O_2]$ = 0.10 M
Therefore:

A) The reaction mixture is at equilibrium.
B) The reaction must proceed to the right to reach equilibrium.
C) The reaction must proceed to the left to reach equilibrium.
D) There is not enough information to answer.

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22) What is the pH of 1.0 L buffer solution that is 0.12 M lactic acid, $HC_3H_5O_3$, and 0.10 M sodium lactate, $NaC_3H_5O_3$, after the addition of 0.01 mole of gaseous HCl (assuming that this will not change the volume of the solution)? For lactic acid: $K_a = 1.4\times10^{-4}$.

A) 3.3 B) 3.5 C) 3.7 D) 3.9

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23) Which of the following systems could be used to prepare a buffer solution of pH = 10?
1) CH_3COOH/CH_3COONa ($K_a = 1.8\times10^{-5}$)
2) NH_3/NH_4Cl ($K_b = 1.8\times10^{-5}$)
3) HCOOH/HCOONa ($K_a = 1.7\times10^{-4}$)
4) HCN/NaCN ($K_a = 4.9\times10^{-10}$)

A) 1, 2 B) 2, 4 C) 1, 3 D) 4 only

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24) The conjugated acid of NH_2^- is:

A) HNO_3 B) HNO_2 C) NH_4^+ D) NH_3

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25) The pOH of 2.5×10^{-3} M $Ba(OH)_2$ solution is:

A) 5.0 B) 2.5 C) 2.3 D) 2.1

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26) The pH of 100 ml of 0.002 M HCl solution is:

A) 0.27 B) 2.0 C) 0.2 D) 2.7

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27) The pH of 1.6 M KOH solution is:

A) 13.8 B) 14.2 C) 12.4 D) 1.6

28) The pH of a coffee drink is 5.0. How many times greater is $[H^+]$ in coffee than in neutral water?

A) 200 B) 100 C) 10 D) 2

29) The pH of 0.05 M acetic acid ($K_a = 1.8\times10^{-5}$) solution is:

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

30) The pH of 0.1 M ammonia ($K_b = 1.8\times10^{-5}$) solution is:

A) 2.87 B) 11.13 C) 8.94 D) 12.56