Amount of Substance for KS5 Chemistry - Worksheet

1. Write an equation, including units, for density.

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2. What is the mass of 10cm^3 of dilute HCl solutions? The density of the solution is 1gcm^{-3}.

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3. How many moles of ethanol are there in 0.2dm^3. Density of ethanol is 0.789gcm^{-3}.

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4. Convert the following concentrations into gdm^{-3}
   a. 0.1$moldm^{-3}$ of NaOH

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   b. 0.5 $moldm^{-3}$ of HNO_3

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   c. 0.25 $moldm^{-3}$ of HCl

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5. What mass of K_2CO_3 would be required to make up 100cm^3 of a 0.2$moldm^{-3}$ solution.

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6. 3.9875g of $CuSO_4$ were weighed out using an analytical balance. It was dissolved in water and made up to 250cm^3 in a volumetric flask. What is the concentration of this solution?

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7. $10cm^3$ of water is added to a $40cm^3$ of a $0.1moldm^{-3}$ solution of HCl. What is the new concentration of the solution?

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8. $20cm^3$ of a $1moldm^{-3}$ solution of H_2SO_4 is diluted to a concentration of $0.5moldm^{-3}$, what volume of water is added?

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9. Write an expression for the ideal gas equation

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10. What volume, in cm^3, would 2g of Hydrogen gas occupy at 100°C and 100KPa. ($R = 8.314JK^{-1}mol^{-1}$)

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11. What would be the pressure of 2 moles of $200cm^3$ of Oxygen at a temperature of 50°C?($R = 8.314JK^{-1}mol^{-1}$)

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12. How many moles are there in $2400cm^3$ of Nitrogen at 100KPa of pressure and a temperature of 20°C?($R = 8.314JK^{-1}mol^{-1}$)

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Amount of Substance for KS5 Chemistry - Worksheet (Answers)

1. Write an equation, including units, for density.

   density (gcm^{-3}) = mass (g) /volume (cm^3)

2. What is the mass of $10cm^3$ of dilute HCl solutions? The density of the solution is $1gcm^{-3}$.

   mass = density x volume = 1 x 10 = 10g

3. How many moles of ethanol are there in $0.2dm^3$. Density of ethanol is $0.789gcm^{-3}$.

   moles = mass/Mr mass = density x volume Mr of ethanol = 46

   mass = 0.789 x (0.2x1000) = 157.8g moles = 157.8/46 = 3.43

4. Convert the following concentrations into gdm^{-3}
   a. $0.1moldm^{-3}$ of NaOH

      Mr of NaOH = 40 Conc (gdm^{-3}) = 0.1 x 40 = $4gdm^{-3}$

   b. $0.5\ moldm^{-3}$ of HNO_3

      Mr of HNO_3 = 63 Conc (gdm^{-3}) = 0.5 x 63 = $31.5gdm^{-3}$

   c. $0.25\ moldm^{-3}$ of HCl

      Mr of HCl = 36.5 Conc (gdm^{-3}) = 0.25 x 36.5 = $9.125gdm^{-3}$

5. What mass of K_2CO_3 would be required to make up $100cm^3$ of a $0.2moldm^{-3}$ solution.

   moles of K_2CO_3 = $\frac{\text{vol x conc}}{1000}$ = $\frac{100 \times 0.2}{1000}$ = 0.02

   Mr of K_2CO_3= 138

   mass = moles x Mr = 0.02 x 138 = 2.76g

6. 3.9875g of $CuSO_4$ were weighed out using an analytical balance. It was dissolved in water and made up to $250cm^3$ in a volumetric flask. What is the concentration of this solution?

   Mr of $CuSO_4$ = 159.5

   moles = mass/mr = 3.9875/159.5 = 0.025

   Conc = $\frac{\text{moles x 1000}}{\text{volume}}$ = $\frac{0.025 \times 1000}{250}$ = $0.1moldm^{-3}$

7. $10cm^3$ of water is added to a $40cm^3$ of a $0.1moldm^{-3}$ solution of HCl. What is the new concentration of the solution?

   moles (in original solution) = $\frac{\text{vol x conc}}{1000} = \frac{40 \times 0.1}{1000} = 4x10^{-3}$ = moles (in new solution)

   conc (new solution) = $\frac{\text{moles x 1000}}{\text{vol}} = \frac{4x10^{-3} \times 1000}{(10 + 40)} = 0.08moldm^{-3}$

8. $20cm^3$ of a $1moldm^{-3}$ solution of H_2SO_4 is diluted to a concentration of $0.5moldm^{-3}$, what volume of water is added?

   moles (in original solution) = $\frac{20 \times 1}{1000} = 0.02$ = moles (in new solution)

   vol (total volume of new solution) = $\frac{\text{moles x 1000}}{\text{conc}} = \frac{0.02 \times 1000}{0.5} = 40cm^3$

   volume of water added = 40-20 = $20cm^3$

   ...this makes sense, doubling the volume, halves the concentration.

9. Write an expression for the ideal gas equation

   PV=nRT

10. What volume, in cm^3, would 2g of Hydrogen gas occupy at 100°C and 100KPa

    $V = \frac{nRT}{P}$ R = 8.314, n=mass/Mr=2/2=1, T= 100+273 = 373K, P= 100000Pa

    $V = \frac{1x8.314x373}{100000} = 0.031m^3$ or $31011cm^3$

11. What would be the pressure of 2 moles of $200cm^3$ of Oxygen at a temperature of 50°C?($R = 8.314JK^{-1}mol^{-1}$)

    $P = \frac{nRT}{V}$ R = 8.314, n=2, T= 50+273 = 323K, V= $200/1000000=2x10^{-4}m$

    $P = \frac{2x8.314x323}{2x10^{-4}} = 2.7x10^7Pa$

12. How many moles are there in $2400cm^3$ of Nitrogen at 100KPa of pressure and a temperature of 20°C?

    $n=\frac{PV}{RT}$ P= 100000Pa, V= $2.4x10^{-3}m$, R = 8.314, T= 293K

    $n= \frac{100000 \times 2.4x10^{-3}}{8.314 \times 293} = 0.0985$