Problems based on mixing

Calculate the change in entropy when 21g of nitrogen are mixed with 22g of CO_2 and 24g of oxygen at 25°C. [At. wt. N = 14, O = 16, C = 12].

Calcualate the change in entropy with 2 moles of nitrogen gas are mixed with 8 gm chlorine gas at 25°C.

[Atomic wts. N = 14, Cl = 35.5]

Calculate the change in entropy when 6 g of N_2 are mixed with (5 g O_2 at 2O°C [At. wts. N = 14 O = 16].

Evaluate ΔS_{mix} when 4 gm helium, 30 gm neon and 36 gm argon are mixed at 25°C. [At. Wt. He = 4, Ne = 20, Ar = 40]

Calculate the entropy change of mixing when 16 gram of 'NO' and 32 gram of 'O_3' at 200K.

[Given Atomic Weight : N = 14, O = 16].

Calculate the change in entropy when 21 gm of nitrogen are mixed with 22 gm of Co_2 and 24 gm of oxygen at 25°c.

[Given Atomic weight : N=14, O =16, C =12]

Calculate $\Delta S, \Delta G$ and ΔH when 20g of methane is mixed with 30g of ethane considering both of them to be ideal at 30°c. comment on your answer.

Work done , reversible irreversible , adiabatic problems

89 of N_2 is expanded reversibly from 1 lit to 10 lit at 300 K. Calculate ΔS, ΔH and ΔG (At. mass N = 14).

Three moles of hydrogen are compressed isothermally and reversibly from 60 dm^3 to 20 dm^3 and 8.22 KJ of work is done on it. Assuming ideal behaviour, calculate the temperature of the gas.

Calculate the work done during adiabatic reversible expansion of 0.02m ar at 25°c expanded from 0.5 L to 1.0 L.

[Given : Cv_1m of Ar = 12.48J K^{-1} mol^{-1}]

Problems based on Colligative properties

By how much the freezing point of benzene 5.53°C, be reduced if 10g hexane added to 100 g benzene?

(ΔHf for benzene = 9.836 kJ mol^{-1}).

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(ΔH_f for benzene = 9.836 KJ $mole^{-1}$)

[At.wt. C = 12

H = 1].

When 5.25 g of a substance is dissolved in 565 g of benzene at 25°C, the boiling point is raised by 0.625°C. Evaluate the molecular weight of the substance. [K_b = 2.53 K Kg mol^{-1}].

Problems based on partial molar quantities

Estimate the molar solubility of oxygen in water at 25°C and partial pressure of 160 torr. (Henry's constant K = 3.3×10^7 torr).

A water alcohol mixture is 40% in alcohol by mass, the density of water is 1 gram/cc and density of alcohol is 0.785 gram/cc. Find the total volume of 1 kg mixture [Given : Partial molar volume of water = 17.5 cc $mole^{-1}$, and partial molar volume of ethanol = 55.0 cc $mole^{-1}$].

At 25°c the density of 50% by mass of ethanol-water mixture is 914 kg/m^3. Find the Partial molar volume of ethanol.

[Partial Molar volume of water=17.4 cm^3 $mole^{-1}$]

Problems based on Photoelectric effect

When lithium is irradiated with light of wavelength 300 nm electrons having kinetic energy 2.935×10^{-19}J are ejected. Calculate the threshold frequency and work function of Lithium.

The velocity of electrons ejected from a metal surface when irradiated with 215 nm light is 0.70 Mms^{-1}. Estimate the work function of the metal in electron volts.

The work function of barium is 2.48eV. If light of 400nm is incident on a barium cathode. What is the maximum velocity of ejected electrons in eV?

Calculate the kinetic energy of an electrons emitted from a potassium surface ($\phi = 564nm$). The irradiation wavelength is 410nm.

The energy required for the ionisation of a certain atom is 3.44×10^{-18}J. The absorption of a photon of unknown wavelength ionises the atom and eject an electron with velocity $1.03 \times 10^{6} ms^{-1}$. Calculate the wavelength of incident radiation.

Calculate the velocity of ejected electrons from Barium Surface $\phi = 2.48\ ev$. When light of 400 nm is irradiated on Barium cathode.

Calculate the velocity of an electron ejected from a sodium surface ($\phi = 1.82\,eV$) when light having frequency 1.13×10^{15} Hz is incident on it.

Problems based on debroglie hypothesis

An electron travels 2000 km in a ms. Calculate its de Broglie wavelength.

Calculate the de-Broglie wavelength of an oxygen molecule at 25°C.

Calculate the de Broglie Wavelength of an electron moving at $\frac{1}{179}^{th}$ the speed of light.

Calculate linear momentum of a nanogram particle with de - Broglie wavelength of 700 nm. If the particle is located in a nonometer box, determine the uncertainty in its linear momentum measurement.

Problems based on Uncertainty principle

What is the uncertainty in the velocity of an electron if the uncertainty in it sposition is 1Å?

What is the standard deviation in the velocity of an electron if the uncertainty in its position is 100pm?

The lifetime of an excited species is 2 ns. Determine the uncertainty in energy in SI units. How can the width of the spectral line be determined from this data?

Problems based on ple in box & degenracy

What is the degeneracy of the level for which the total energy

i) $14h^2/8ma^2$ and

ii) $21h^2/8ma^2$

Find the degeneracy of the levels for which total energy of a particle in 3 d box is $\frac{86h^2}{8ma^2}$.

What is the degeneracy of the level for which the total energy

i) $14h^2/8ma^2$

ii) $17h^2/8ma^2$

When a particle of mass 9.1×10^{-28}g in one dimensional box goes from A=5 to n=2 level, it emits a photon of frequency of 6×10^{14} Hz. Find the length of the box.

Calculate the transition energy when an electron in a box of length 500 pm undergoes a transition from n = 1 to n = 2.

Calculate the absorption band in cm^{-1} for hexatriene from the following data.

[C-C bond length = 154pm, C=C bond length = 135 p.m., radius of c-atom = 77.0pm.].

Evaluate the energy of an electron in a molecule of 528 pm length in the first energy level.

Other Problems

Calculate the change in entropy when 10g of ice at 0°C is added to 50 g of water at 40°C in an isolated system. The latent heat of fusion of ice is 334 KJ g^{-1} and the sp. heat of water is 4.18 J k^{-1} g^{-1}.

Calculate the number of photons emitted by a mW bulb emitting 700nm. radiation in one hour.