Academic Year 2023-24

Tutorial #09

PH100: Mechanics and Thermodynamics

1. What is the maximum wavelength of incident light that can produce photoelectrons from silver (\phi= 4.64 eV)? What will be the maximum kinetic energy of the photoelectrons if the wavelength is halved?

2. An experimenter finds that no photoelectrons are emitted from tungsten unless the wavelength of light is less than 270 nm. Her experiment will require photoelectrons of maximum kinetic energy 2.0 eV. What frequency of light should be used to illuminate the tungsten?

3. In a photoelectric experiment it is found that a stopping potential of 1.00 V is needed to stop all the electrons when incident light of wavelength 260 nm is used and 2.30 V is needed for light of wavelength 207 nm. From these data determine Planck's constant and the work function of the metal.
4. The phase velocity of ocean waves is \sqrt[(g \lambda)/2 \pi], where g is the acceleration of gravity. Find the group velocity of ocean waves.

5. Find the de Broglie wavelength of a 1.0-mg grain of sand blown by the wind at a speed of 20 m/s.

6. Consider electrons of kinetic energy 6.0 eV and 600 keV. For each electron, find the de Broglie wavelength, particle speed, phase velocity (speed), and group velocity (speed).

7. Two waves are traveling simultaneously down a long Slinky. They can be represented by \psi_{1}(x, t) = 0.0030 sin(6.0x- 300t) and \psi_{2}(x, t)= 0.0030 sin(7.0x - 250t). Distances are measured in meters and time in seconds. (a) Write the expression for the resulting wave. (b) What are the phase and group velocities?