CHAPTER 19
DAWN OF MODERN PHYSICS

1. Encircle the correct answers.

i. Which one of the following physical quantities change with relativistic speed?
a) Length
b) Time
c) Mass
d) All of above

ii. For a black body, the product if λ_m and T known as:
a) Wien's constant
b) Planck's constant
c) Davison constant
d) Lumber's constant

iii. The photoelectric effect predicts that light is made of:
a) Photons
b) Neutrons
c) Protons
d) None of these

iv. The unit of work function is:
a) Electron
b) Ampere
c) Volt cell
d) Hz

v. If the energy of photon is 10 eV and work function is 5 eV. Then the a value of stopping potential will be:
a) 50 V
b) 2 V
c) 5 V
d) 15 V

vi. Einstein photoelectric equation is:
a) $\text{hf} = \phi + \frac{1}{2}mV^2_{\max}$
b) $\phi = h\text{f} + \frac{1}{2}mV^2_{\max}$
c) $\text{hf} + \phi = \frac{1}{2}mV^2_{\max}$
d) None of these

vii. The Compton effect is associated with:
a) X-rays
b) γ-rays
c) Positive rays
d) β-rays

viii. The numerical value of Compton wavelength is equal to:
a) $3.43\times10^{-12}m$
b) $1.43\times10^{-12}m$
c) $2.43\times10^{-12}m$
d) $0.43\times10^{-12}m$

ix. Unit of Stephen's constant is:
a) W m K^{-2}
b) W m^{-2} K^{-4}
c) W m K^{-4}
d) None

x. Compton shift is maximum for scattering angle of photon:
a) 0^0
b) 90^0
c) 180^0
d) 45^0

Q.2 Write the short answers.

i. As a solid is heated and begins to glow, why does it first appear red?
ii. What happens to total radiation from a blackbody if its absolute temperature is doubled?
iii. Which photon, red, green, or blue carries the most (a) energy and (b) momentum?
iv. Which has the lower energy quanta? Radio waves or X-rays?
v. Will bright light eject more electrons from a metal surface than dimmer light of the same colour?
vi. Will higher frequency light eject greater number of electrons than low frequency light?
vii. When light shines on a surface, is momentum transferred to the metal surface?
viii. Can pair production take place in vacuum? Explain?
ix. When does light behave as a wave? When does it behave as particle?

Note: Long questions:

Q.3 **(a)** State and prove the Heisenberg uncertainty principle.

(b) What is the mass of a 70 kg man in a space rocket traveling at 0.8 c from us as measured from Earth?

Q.4 **(a)** What is Compton effect. Find expression for Compton shift.

(b) What is the maximum wavelength of the two photons produced when a positron annihilates an electron? The rest mass energy of each is 0.51 Mev.