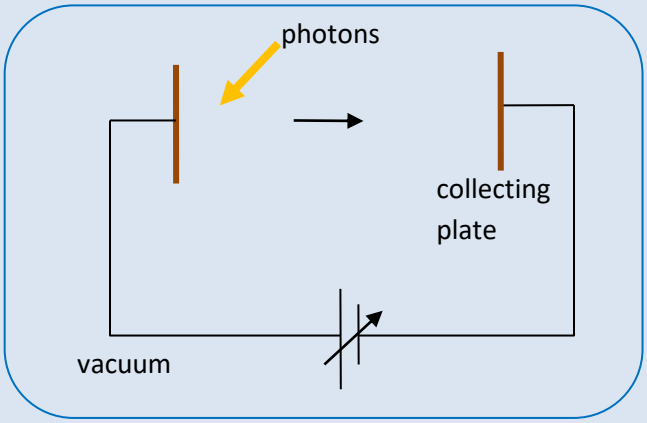
Quiz E22

Quantum physics HL

1. A monochromatic beam of photons is incident normally on a surface. The wavelength is now doubled and the intensity incident on the surface doubles as well. What happens to the number of photons incident on the surface per unit area per unit time?

A It has increased by a factor of 4
B It has increased by a factor of 2
C It has decreased by a factor of 4
D It has decreased by a factor of 2

2. Photons incident on a metal plate in vacuum cause the emission of electrons. The work function of the metal is 2.1 eV and the photons have energy 3.8 eV.



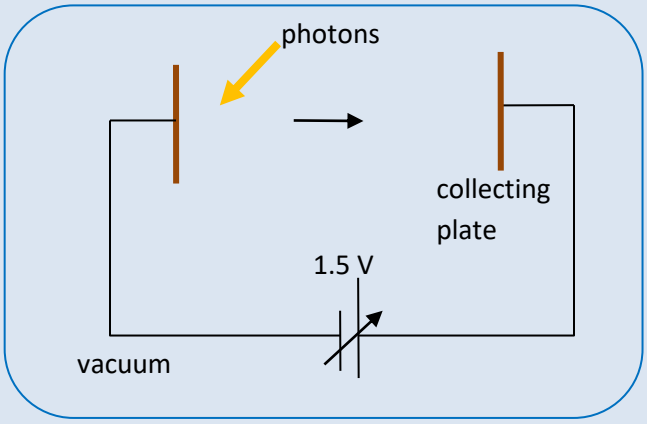
What is the stopping voltage?

A 5.9 eV **B** 5.9 V **C** 1.7 eV **D** 1.7 V

3. Light incident on a metal plate in vacuum does not cause the emission of electrons. Electrons **may** be emitted if

A the intensity of light is increased
B the wavelength of light is increased
C the metal is replaced with one of lower work function
D the vacuum is replaced by a gas at high pressure

4. Photons incident on a metal plate in vacuum cause the emission of electrons. The work function of the metal is 1.2 eV. The electrons arrive at the collecting plate with maximum kinetic energy 2.8 eV.



What is the energy of one of the incident photons?

A 1.3 eV **B** 2.5 eV **C** 3.1 eV **D** 4.0 eV

5. In an experiment on the photoelectric effect a student plots the stopping voltage against frequency. What is the gradient of the straight line graph?

A h **B** $\frac{e}{h}$ **C** $\frac{h}{e}$ **D** eh

6. The longest wavelength of electromagnetic radiation that will eject electrons from a metal surface is λ. The maximum kinetic energy of emitted electrons when radiation of wavelength $\frac{\lambda}{2}$ is incident on the surface is K. What is the kinetic energy of the emitted electrons when the wavelength is $\frac{\lambda}{3}$?

A K **B** $2K$ **C** $3K$ **D** $4K$

7. A photon scatters off an electron at rest. At what photon scattering angle is the energy transferred to the electron the largest?

A 0° **B** 90° **C** 120° **D** 180°

8. A photon scatters off an electron at rest. The wavelength of the scattered photon at a scattering angle of 90° is 4×10^{-12} m. The energy of the incident photon is doubled. What is the wavelength of the photon scattered at 60°? ($\frac{h}{m_e c} = 2.4\times10^{-12}$ m)

A 2×10^{-12} m **B** 4×10^{-12} m **C** 8×10^{-12} m **D** 16×10^{-12} m

9. A proton and an alpha particle are both accelerated from rest by the same potential difference. What is the ratio $\frac{\lambda_p}{\lambda_\alpha}$ of the de Broglie wavelength of the proton to that of the alpha particle after acceleration?

A 2 **B** $\sqrt{8}$ **C** $\frac{1}{2}$ **D** $\frac{1}{\sqrt{8}}$

10. The de Broglie wavelength of a proton is of order 10^{-14} m. What is an estimate of the kinetic energy of this proton?

A 1 MeV **B** 10 MeV **C** 10^2 MeV **D** 10^3 MeV

Quiz E22 Answers	
1	A
2	D
3	C
4	B
5	C
6	B
7	D
8	A
9	B
10	B