Module 6 Nature of Light
HSC Style questions
20 marks

2009

14 Blue light is found to cause photoelectric emission from a sodium surface but not from a platinum surface.

Which of the following best accounts for this difference?

(A) Platinum does not absorb photons.

(B) Platinum has more electrons than sodium.

(C) More energy is needed to remove an electron from a platinum surface.

(D) The intensity of the blue light is not high enough to remove electrons from the platinum surface.

Question 18 (4 marks)

The nearest galaxy to ours is the Large Magellanic Cloud, with its centre located 1.70×10^5 light years from Earth. Assume you are in a spacecraft travelling at a speed of $0.99999\,c$ toward the Large Magellanic Cloud.

(a) In your frame of reference, what is the distance between Earth and the Large Magellanic Cloud? **2**

(b) In your frame of reference, how long will it take you to travel from Earth to the Large Magellanic Cloud? **2**

Question 27 (7 marks)

In an experiment to investigate the photoelectric effect, light is shone onto a silver surface and the resulting maximum electron kinetic energy is measured and recorded.

Light wavelength (nm)	*Electron kinetic energy* (eV)
250	0.25
215	1.08
187	1.90
167	2.73
150	3.56

(a) Determine the frequency of the highest energy photons used in the experiment. **2**

(b) What effect would changing the intensity of the light have on the measured electron kinetic energy? **1**

2010

3 A scientist at a particle accelerator laboratory observes the lifetime of a particular subatomic particle to be 1.0×10^{-6} s when it is travelling at 0.9999 c.

What would the lifetime of the particle be if it were stationary in the laboratory?

(A) 1.4×10^{-8} s

(B) 4.5×10^{-8} s

(C) 1.0×10^{-6} s

(D) 7.1×10^{-5} s

13 What was Max Planck's contribution to the development of quantum physics?

(A) He combined the quantised wave and particle models of light.

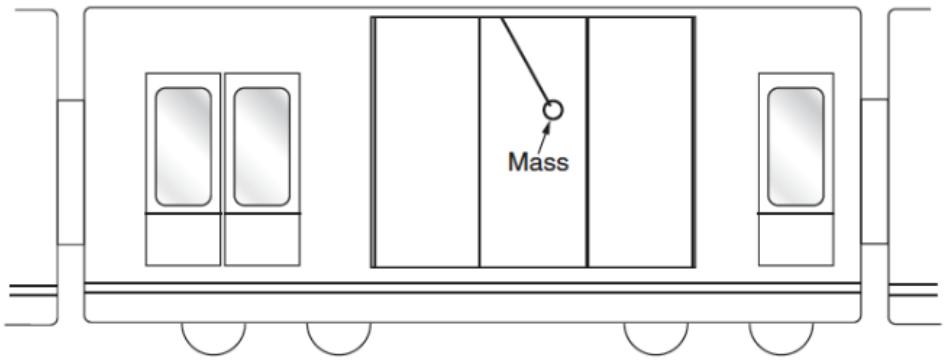
(B) He analysed the photoelectric effect and described light as quantised energy packets.

(C) He explained black body radiation and the photoelectric effect using quantised energy.

(D) He hypothesised that the radiation emitted and absorbed by the walls of a black body cavity is quantised.

Question 23 (5 marks)

A train is travelling on a straight horizontal track. A student on the train attaches a mass on a string to the ceiling of the train. The student observes that the mass remains stationary in the position shown.



(a) Why does the mass hang with the string at an angle to the vertical? **2**

(b) The string then breaks and the mass falls. **3**

Indicate the path of the mass on the diagram above. Explain why the mass has taken this path.

Question 31 (5 marks)

(a) What is the energy of a photon having a wavelength of 1000 nm? **2**

(b) Explain why light having a wavelength longer than a certain value does not produce an electric current in a photocell. **3**