



Module 7 Nature of Light

HSC Style questions

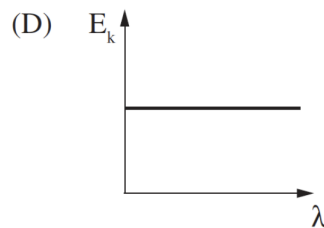
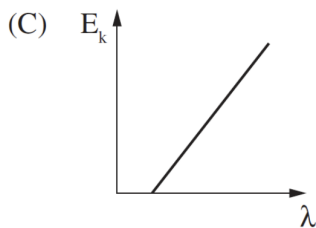
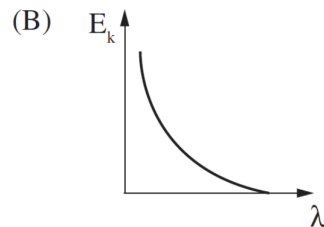
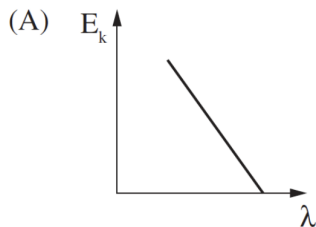
19 marks

2011

- 17 When photons with energy E strike a metal surface, electrons may be emitted.

The maximum kinetic energy (E_k) of the electrons is given by $E_k = E - W$ where W is a constant for the metal.

Which of the following graphs shows the relationship between the maximum kinetic energy of these electrons (E_k) and the wavelength of the photons (λ)?



Question 29 (5 marks)

- (a) Calculate the number of photons, $\lambda = 450 \text{ nm}$, which are required to transfer $1.0 \times 10^{-3} \text{ J}$ of energy. 3
- (b) A 1 W beam of light transfers 1 J per second from one point to another. 2

With reference to the particle model of light, contrast a 1 W beam of red light and a 1 W beam of blue light.

2012

- 2 What is currently used to define the standard metre?
- (A) The speed of light
 - (B) The signals from GPS satellites
 - (C) The wavelength of light from a krypton lamp
 - (D) The distance between two lines on a platinum iridium bar

Question 28 (7 marks)

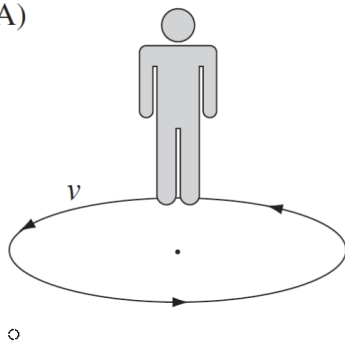
- (a) Outline ONE piece of evidence supporting Einstein's theory of relativity. 2
- (b) What criteria are used to test and validate a theory? 3
- (c) The distance between the cathode and screen in a cathode ray tube is 40 cm. 2

If an electron travels through the tube at $3.0 \times 10^7 \text{ m s}^{-1}$, what is the apparent distance from the cathode to the screen in the electron's frame of reference?

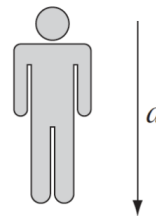
2013

- 8 Which of the diagrams best represents an example of an inertial frame of reference?

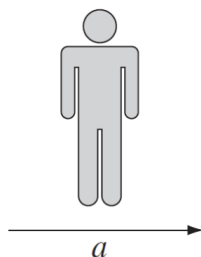
(A)



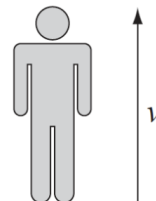
(B)



(C)



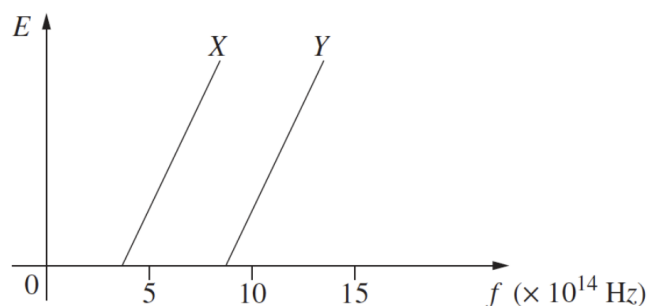
(D)



- 19 A spaceship moves close to the speed of light, relative to a planet.

The rest-frame length of the spaceship can be determined by an observer who is

- (A) on the spaceship measuring the time taken for light to travel between two points on the planet.
 - (B) on the planet measuring the time taken for light to travel from the front to the back of the spaceship.
 - (C) on the spaceship measuring the time taken for light to travel from the front to the back of the spaceship.
 - (D) on the planet measuring the difference in the arrival time of light from the front and the back of the spaceship.
- 20 The graph shows the maximum kinetic energy (E) with which photoelectrons are emitted as a function of frequency (f) for two different metals X and Y .



The metals are illuminated with light of wavelength 450 nm.

What would be the effect of doubling the intensity of this light without changing the wavelength?

- (A) For metal X , the number of photoelectrons emitted would not change but the maximum kinetic energy would increase.
- (B) For metal X , the number of photoelectrons emitted would increase but the maximum kinetic energy would remain unchanged.
- (C) For both metals X and Y , the number of photoelectrons emitted would not change but the maximum kinetic energy would increase.
- (D) For both metals X and Y , the number of photoelectrons emitted would increase but the maximum kinetic energy would remain unchanged.

2014

- 11** Why is there low intensity of black body radiation at very short wavelengths?
- (A) The energy of each photon is reduced at very short wavelengths.
 - (B) There are fewer photons with high energy at very short wavelengths.
 - (C) Only photons of very short wavelengths are reabsorbed by the black body.
 - (D) Photons of very short wavelengths interact with each other causing destructive interference.

- 19** The rest length of a train is 200 m and the rest length of a railway platform is 160 m. The train rushes past the platform so fast that, when observed in the platform's frame of reference, the train and the platform are the same length.

How fast is the train moving?

- (A) $0.60c$
- (B) $0.75c$
- (C) $0.80c$
- (D) $1.25c$