Chapter 19:-

19.1:-

The two observers in relative motion will always agree upon:

The speed of light $c = 3 \times 10^8 m$

The force acting.

The laws of Physics.

19.2:-

Yes, Time really passes more slowly in moving system due to relative speed. The proper Time (t_o) and Time (t) are related as:

$$t = \frac{t_o}{\sqrt{1 - \frac{v^2}{c^2}}}$$

As $\sqrt{1 - \frac{v^2}{c^2}} < 1$

So, $t > t_0$.

19.3: v.v imp

i) If we are moving in a spaceship at a very high speed relative to earth. There will not be any difference in our pulse D. rate because the phase of frome my mine is same as the spaceship

ii) There will be difference in the pulse D. rate. of people on Earth. Because the frame of reference are different.

19.4:-

According to the

special Theory of relativity

$$t = \frac{t_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

if $c \to \infty$

So,

$$t = \frac{t_0}{\sqrt{1 - 0}} \Rightarrow t = t_0$$

And

$$l = l_0\sqrt{1 - \frac{v^2}{c^2}}$$

if $c \to \infty$

So,

$$l = l_0\sqrt{1 - 0}$$

$$l = l_0$$

And,

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

if $c \to \infty$

So, $m = \frac{m_0}{\sqrt{1 - 0}} \Rightarrow m = m_0$

And,

$$E = mc^2$$

if $c \to \infty$

Then $E = \infty$

19.5:-

Yes, we can conclude that a compressed spring has more mass than the same spring when it is not compressed.

Because compressed spring has elastic P.E that slightly increases its mass.

19.6:-

As the solid is heated and begins to glow, it emitts radiations having energy according to temperature provided. As the temperature increases the wavelength of emitted radiations will decrease.

So, firstly radiations of greater wavelength will

emitt that are used in colour.

19.7:- According to Stefan Boltzmann law:

$$E = \sigma T^4$$

if absolute temperature is doubled.

$$E' = \sigma (2T)^4$$

$$= 16\sigma T^4$$

$$E' = 16E \quad \because E = \sigma T^4$$

So the total radiation energy will be increased by 16 Times when absolute temperature is doubled.

19.8:- According to Planck's:

$$E = hf$$

$$E = \frac{hc}{\lambda}$$

$$E_n = \frac{nhc}{\lambda}$$

$$n = \frac{\lambda E_n}{hc}$$

$$n \propto \lambda$$

As the wavelength for red light is 6 greater than 1 blue light. So, it will have greater number of photons.

$$\lambda_{red} > \lambda_{blue}$$

So,

$$n_{red} > n_{blue}$$

19.9:-

We know that:

$E = hf$ and $E = pc$

As the blue color has greater frequency then Red or green. So. Photon of blue carries the most energy and momentum

19.10:-

As the frequency

(a) radio waves is less than frequency of x-rays.

So, radio waves have lower energy than

$$E = hf$$

$$f_{\text{radio waves}} < f_{\text{x-rays}}$$

$$E_{\text{radio waves}} < E_{\text{x-rays}}$$

19.11:-

The brightness of a beam of light depends upon the number of photons.

Because the number of photons determines the intensity of light that determines the brightness.

19.12:-

Infrared light has energy less than visible

light.

So, when infrared light falls on the Dyes. visible light can not be emitted.

Whereas, ultraviolet light has energy greater than visible. So they can be visible light.

19.13:-

Yes, bright light will eject more electrons from a metal surface than dimmer light of same colour.

Because the bright light will contain more photons to eject more number of electrons.

Brightness & photons & no. of emit electrons.

19.14:-

No, Higher frequency light will not affect the no. of electrons ejected from low frequency light. When Numbers of ejected electrons same in both case. Frequency determines the energy of ejected electrons.

Frequency & energy of ejected electrons.

19.15:-

Yes, momentum is transmitted in the metal surface. When light shines on the surface. Because when light strikes on metal surface photons falls on the metal and transfer energy and momentum.

mathematically:-

$E = hf$ and $E = P$

19.16:-

Red light has smaller energy than blue or white light due to smaller frequency. So red light will not disturb the developing films in the photographic dark room.

Therefore, the red light can be used in dark room but blue or white light contain greater energy and can not be used.

19.17:-

Given that:

$E_A = 2E_B$

we know that:

$P_A = \frac{E_A}{c}$ and $P_B = \frac{E_B}{c}$

$P_A = \frac{2E_B}{c}$

$$= 2\left(\frac{E_0}{c}\right)$$

$$P_A = 2 P_B$$

So the momentum of Photon A will also be doubled than photon B.

$$\frac{P_A}{P_B} = 2$$

$$P_A : P_B = 2 : 1.$$

19.18:-

Compton effect can not be observed with visible light because it has less energy and momentum to emitt electron and compton wavelength to observe the compton effect x-rays are used.

19.19:-

No; Pair production can not be take place in vacuum.

Because for the pair

production There should be a nucleus which breaks down into electron and positron due to striking of x-rays. But vacuum Chuck will not be any nucleus. So pair production can not be observed.

19.20:-

No, it is not possible to create single electron from energy. Because it is against the law of conservation of energy. when nucleus breaks down it will produce electrons with anti-~~proton~~ electron that is positron. Single electron can not be produced.

19.21:-

If electrons behaves only like particles then

They will just strike to the sudden and no diffraction pattern will observe.

19.22:-

We know that

$P = mv$ and $P = \frac{h}{\lambda}$

comparing both eq:-

$$mv = \frac{h}{\lambda}$$

$$v = \frac{h}{m\lambda}$$

For same wavelength:-

$$v \propto \frac{1}{m}$$

As electron has less mass 9.1×10^{-31} kg than mass of proton 1.67×10^{-27} kg

Therefore, electron has greater speed than the proton.

19.23:-

We do not notice the de Broglie wavelength for a pitched cricket ball due its large mass.

$$\lambda = \frac{h}{mv}$$

Due to large mass, the wavelength will be small that can not be noticed.

19.24:-

Alpha particle has greater mass due to shorter wavelength than electron, neutron and proton, mathematically.

$$\lambda = \frac{h}{mv}$$

19.25:-

Light behaves as a wave for the following phenomenon.

- Reflection.
- Refraction.

- Diffraction
- Interference
- Polarization

light behaves as a particle for the following phenomenon:

- Photoelectric effect.
- Compton effect.
- Pair production.

1926:- Electron microscope has following advantages over optical microscope:

Electron microscope has good resolution of 0.5 to 1nm as compared to optical microscope having 0.2 to 0.2 μm.

Electron microscope has good magnification than optical microscope.

Electron microscope can produce three dimensional's. Electron microscope can produce the internal structure of object.

19.27:-

No. The measurements can not show precise momentum if they show precise position for an electron.

Because according To Heisenberg's uncertainty principle The momentum and position of an electron can not be measured accurately at same time.

$\Delta x \cdot \Delta p \geq h$