PHY101 Short notes

Q#1) Define charge density

When the charges are continuously over a region-a line, the surface of a material, or inside a sphere-we must specify the charge density. Depending upon how many dimensions the region has, we define:

(a) For linear charge distribution: $dq = \lambda ds$

(b) For surface charge distribution: $dq = \sigma dA$

(c) For volume charge distribution: $dq = \rho dv$

The dimensions of are determined from the above definitions.

Q#2) Define Gauss's Law?

Ans: The total electric flux leaving a closed surface is equal to the charge enclosed by the surface divided by $\varepsilon_\circ$.We can expressed in mathematics form

$$\Phi = \int \vec{E}.d\vec{A} = \frac{q_{enclosed}}{\varepsilon_\circ}$$

Q#3) Define electric potential?

Ans: The electric potential is the energy of a unit charge in an electric field. So in our MKS units the unit of potential is 1Joule/Coulombs=1Volt.Another useful unit is 1Electron Volt.

Q#4) Define 1Ev?

Ans:- One electron-volt=enrgy gained by moving one electron charges through one volt.

$$= \left(1.6x10^{19}C\right)x1V = 1.6x10^{-19}J$$

It is useful to note that

$$1Kev = 10^3 eV$$
$$1Mev = 10^6 eV$$
$$1Gev = 10^9 eV$$

Q#5) Given a system of charges, we can always compute the force - and hence the potential - That arises from them. Here are some important general statements:

a) Potentials are more positive in regions which have more positive charge.

b) The electric potential is a scalar quantity (a scalar field, actually).

c) The electric potential determines the force through F=− du/dr, and hence the electric Field because F= qE.

d) The electric potential exists only because the electrostatic force is conservative

Q#6) Define Capacitor?

Ans:- Two conductors isolated from one another and from their surroundings, from a capacitor. These conductors may be of any shape and shape, and at any distance from each other.

If a potential difference is created between the conductors (say, by connecting the terminals of a battery to them), then there is an electric field in the space between them. The electric field comes from the charges that have been pushed to the plates by the battery. The amount of charge pushed on to the conductors is proportional to the potential difference between the battery terminals (which is the same as between the capacitor plates). Hence $Q \propto V$. To convert this into equality, we write $Q = CV$. This provides the definition of capacitance, $C = \frac{Q}{V}$

Q#7) Define Ampere?

Ans:- Electric current is the flow of electrical charge. If a small amount of charge dq flows in time dt, then the current is $i = \frac{dq}{dt}$. If the current is constant in time, then in time t, the current that flows is $q = i \times t$. The unit of charge is ampere, which is defined as:

$$1\,ampere = \frac{1\,Coulombs}{Second}$$

A car's battery supplies up to 50 amperes when starting the car, but often we need to deal with smaller values:

$$1\,miliampere = 1ma = 10^{-3}A$$
$$1\,microampere = 1\mu A = 10^{-6}A$$
$$1\,nanoampere = 1nA = 10^{-9}A$$
$$1\,picoampere = 1pA = 10^{-12}A$$

Q#8) Define Resistance?

Ans:- Resistance is directly proportional to the voltage V and inversely proportional to the current I.

$$R = \frac{V}{I}$$

Imp:-
When resistors are put in series with each other, the same current flows through both.
When current flows in a circuit work is done.

Q#9) Unit and definition of power?

Ans:- This is an important formula. It can also be written as $P = \frac{V^2}{R}$ *or as* $p = iV$ .The unit of power is: $1\,volt - ampere = 1\frac{joule}{coulomb}.\frac{coulomb}{second} = 1\frac{joule}{second} = 1\,watt$

Q#10) Define Kirchhoff's Law

Ans: - The sum of the potential differences encountered in moving around a Closed circuit is zero.

$$V_a = -iR + \varepsilon = 0$$

Q#11) Define magnetic field

Ans: - The magnetic field exerts a force upon any charge that moves in the field. The greater the size of the charge, and the faster it moves, the larger the force. The direction of the force is perpendicular to both the direction of motion and the magnetic field. If θ is the angle between $\vec{v}$ *and* $\vec{B}$ then $F = qvB\sin\theta$ is the magnitude of force.
The unit of magnetic field that is used most commonly is the tesla. A charge of one Coulomb moving at 1 meter per second perpendicularly to a field of one tesla experiences

a force of 1 Newton tesla. Equivalently,

$$1\ tesla = 1\frac{newton}{coulomb.meter/\sec ond} = 1\frac{newton}{ampere.meter} = 10^4\ gauss(CGS\ unit)$$

$$Earth\ Surface = 10^{-4}T$$

$$Bar\ magnet = 10^{-2}T$$

$$Powerful\ electromagnet = 1T$$

$$Superconducting\ magnet = 5T$$

Q#12) Define Lorentz force

Ans:- When both magnetic and electric fields are present at a point, the total force acting upon a charge is the vector sum of the electric and magnetic forces, $\vec{F} = q\vec{E} + q\vec{v}\ x\ \vec{B}$ .This is called Lorentz force.

Q#13) Define Weber?

Ans: - The dimension of flux is magnetic field x area, and the unit is called Weber.

$$1weber = 1tesla.meter^2$$

Q#14) Define alternating current

Ans: - Alternating current (AC) is current that flows first in one direction along a wire, and then in the reverse direction.

Q#15) Red Light has $\lambda = 700nm$ .The frequency can v can be calculated as?

Ans:- $v = \frac{3.0x10^8\ m/sec}{7x10^{-7}m} = 4.29x10^{14}\ Hertz$

Q#16) Define Emission?

Ans: - Matter releases energy as light.

Q#17) Define Absorption?

Ans: - Mater takes energy from light.

Q#18) Define Transmission?

Ans:- Matter allows light to pass through it.

Q#19) Define Reflection?

Ans: - Matter repels light in another direction.

Q#20) Define Diffraction?

Ans: - The bending of light around objects (into what would otherwise be a shadowed region) is known as diffraction. Diffraction occurs when light passes through very small apertures or near sharp edges.

Q#21) Define statically mechanics

Ans: - The study of heat, considered as arising from the random motion of the basic constituents of matter, is an area of physics called statistical mechanics.

Q#22) what are the lifetime of the polonium, krypton, strontium, radium, carbon and uranium?

Ans: -

Polonium ${}^{214}_{84}P$ $1.64x10^{-4}s$

Krypton ${}^{89}_{36}K$ 3.16 min*utes*

Stronium ${}^{90}_{38}Sr$ 28.5 *years*

Radium ${}^{226}_{88}Ra$ 1600 *years*

Carbon ${}^{14}_{6}C$ 5760 *years*

Uranium ${}^{238}_{92}U$ $4.5x109$ *years*

Q#23) what are the basics solar facts?

Ans: -

a) Mass of sun 2 x10^{30} kg = 333,000 Earth's

b) Diameter of sun 1, 392, 000 km = 10^{9} Earth's

c) Age of sun 4.6 billion years

d) Rotation Period = 25 days at equator, 36 at poles (surface)

e) Tem perature = 15 million K at core, 5770 K at surface

f) Density = 8 x gold at the core, average is ~ 1.5 water

g) Composition: 72% H, 25% He, rest is metals

Q#24) In a cool room, a metal or marble table top feels much colder to the touch than does a wood surface even though they are at the same temperature. Why?

Search Results

Because **metal** and stone conduct heat better **than wood**. Skin **temperature** is higher **than room temperature**, so **when we touch metal**, **we** give heat **more** quickly to the **metal than wood**. Another reason is **that metal** and stone store **more** energy **than** a like sized object of **wood**

Q#25) Initial is pushing but the box does not move. What is the force of static friction shown in below figure?

If there is **no** relative motion between objects in contact, then the friction **force** (if there is ... When the truck accelerates and the **box moves** with ... directed opposite to the way you are walking, **but** the **force** of **static friction** ... **shown** in **Figure** 5.2. ... Step 2 - What is the **force** of friction acting on the **box** if you **push** horizontally on.

Q#26) is it true to say that Centre of mass and Centre of graving are the same? Either yes or no explain in each case.

Many people assume that the terms "**centre of mass**" and "**centre** of gravity" are synonymous, but this is not the **case**. ... The **centre of mass** and the **centre** of gravity of an object are in the **same** position if the gravitational field in which the object exists is uniform.

Q#27) Describe a few examples in which the force of friction exerted on an object is in the direction of motion of the object.

Example is an **object** travelling with a moving **object**. If you are on a train, the relative **motion** of you to the train is backward because you don't move.

Q#28) Is it possible for two objects to be in thermal equilibrium if they are not in content with each other? Explain.

According to the law of thermodynamics, the **two objects which are not** in contact with each **other** may be in **thermal equilibrium.**

Q#29) Wave spend in a string is a fiction of frequency, so if the wave frequency, will the wave speed increase to?

Ans **If speed** = **frequency** * **wavelength**. ... That means **speed** is directly proportional to **frequency**. **When frequency increases**, **speed increases and** vice versa.

Q#30) A 2000kg car is moving with a velocity of 20 m/s collides and locks with a 1500 kg car at rest a stop sign. Show the momentum is conserved.

A 2000-kg car moving with a speed of 20 m/s collides with and sticks to a 1500-kg car at rest at a stop sign. Show that because momentum is conserved in the rest frame, momentum is also conserved in a reference frame moving with a speed of 10 m/s in the direction of the moving car

Q#31)

Light from sun takes approximately 8.3 min to reach the earth during the earth is rotating with the constant speed continuously. How far is the actual direction of the sun?

Ans:

z = 149.4 million km.

Explanation:

This is fairly simple you just have to remember a simple equation.
z = c * t
if you know the time that light takes to reach us then you can calculate the distance to that object and vice versa.
In the above equation,
z is the distance to the object.
t is the time light takes from the object to reach us
c is the speed of light which is always constant about 300,000 km/ sec.
The time light takes to reach us from the Sun is about 8.3 minutes.
z = 8.3 * 300,000
Note that the speed of light is in units of km/ sec so we will have to convert minutes into seconds.
1 minute = 60 seconds
8.3 minutes = 8.3 * 60
8.3 minutes = 498 seconds.
z = 498 * 3
z = 149400000 km
OR
z = 149.4 million km.

Q#32) Do all current-carrying conductors emit electromagnetic waves?

... Yes **all current carrying conductors emit electromagnetic waves**, and these are at the right angle of the **current** passes through as right hand rule of Fleming's explains it.

Q#33)If you hold water in a paper cup over flame, can you bring the water to boil, if then how?

Just fill a **paper cup** with **water** and start trying to burn it from the outside. The **water will boil** vigorously inside the **cup**, but the **paper** itself **wills** not combust. ... The **boiling water can**'t get **above** 212 degrees, and the **paper** is thin enough that this **water** keeps its temperature from climbing high enough to combust.

Q#34) All objects radiate energy then why are we not able to see all the objects in the dark?

Our eyes are **not** sensitive to infrared radiation so **we** do **not see** it. Cold bodies **radiate** mostly in the infrared zone (invisible to the human eye), but as the temperature increases the body will emmit higher frequencies with more intensity. So room temperature objects will **not be seen** due to black body radiation.

Q#35) If an electron and proton have same De Broglie's wavelength, which particle has greater speed

The de Broglie wavelength of a particle is inversely proportional to its momentum p = m v; since a proton is about 1800 times more massive than an electron, its momentum at the same speed is 1800 times that of an electron, and therefore its wavelength 1800 times smaller. The electron has the longer wavelength.

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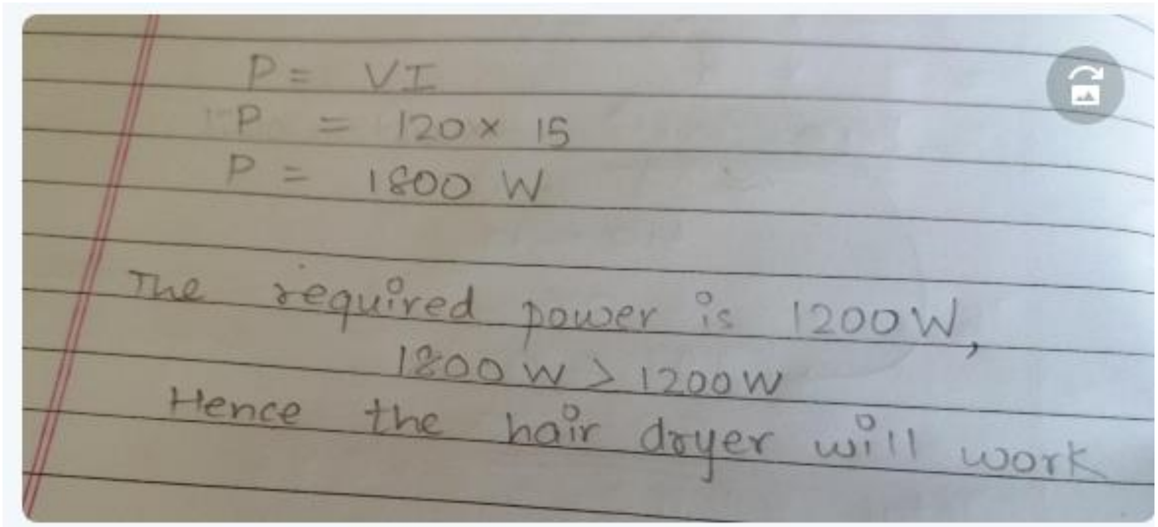
Q#36) Explain why mercury rises in thermometer when is it put in the hot water?

It consists of a bulb containing **mercury** which is then attached to a narrow glass tube. As **temperature rises**, the level of **mercury** in the tube **increases**. This happens because the volume of **mercury** slightly **increases** with **temperature.**

Q#37) Why is glass transparent to visible light but opaque to UV light?

Beyond the range of **UV light** (wavelength >400 nm), the energy of **visible** and **infrared light** are not enough to excite the electrons and most of the incident **light** gets transmitted. Thus **glass** appears **transparent to visible** and **infrared light**

Q#38) If a120v line to a socked is limited to15a by a safety fuse will it operate a 1200w hair dryer?



Q#39) wearing a metal bracelet in a region of strong magnetic filled could be hazardous?

Answer. As the **bracelet** is metallic it will be pulled towards the **strong magnetic** force acting around it, and you can also be pulled with the **bracelet** if the force is **strong** enough which can cause ham to you.

Q#40) what is the changing in entropy of 1mol of water at0c that freeze?

We can use the definition of entropy change to find the change in entrop of the liquid water as it freezes.

The change of entropy of the water is given by:

$$\Delta S = \frac{Q_{rem}}{T}$$

Where the heat removed from the water is Q_{rem} .

Q_{rem} is also a product of the latent heat of fusion and its mass.

$$Q_{rem} = -mL_f = -nML_f$$

Where n is the number of moles and M is the molar mass.

Then,

$$\Delta S = \frac{Q_{rem}}{T} = \frac{-nML_f}{T} = \frac{-(1.00 mol)\left(18.015\frac{g}{mol}\right)\left(333.5\frac{J}{g}\right)}{273K} = -22.0\frac{J}{K}$$

Showing results for *explain* the fusion reactions sun?

Inside the **Sun**, this process begins with protons (which is simply a lone hydrogen nucleus) and through a series of steps. These protons fuse together and are turned into helium. This **fusion** process occurs inside the core of the **Sun**, and the transformation results in a release of energy that keeps the **sun** hot.

If a total charge inside a surface is known but the distribution of the charge is unspecified can u use the cause?

No. We can't find the electric field if we don't know the exact charge distribution. This is because symmetry might not be there and we can't use Gauss theorem.

Law to find the electric field all object radiate energy?

The experimental Stefan's **law** states that the total **power** of radiation emitted across the entire spectrum of wavelengths at a given temperature is proportional to the fourth **power** of the Kelvin temperature of the **radiating** body.

is Heisenberg's uncertainly principal a case of using the meter to measure the temperature of glass of water?

For example, for a **thermometer to measure** the **temperature** of a **glass of water**, it is put into thermal contact **with** the water. **Heisenberg's uncertainty principle** , however, is not the same as the observer effect ... When you are studying the movement of electrons, this ceases to be the **case**

Do you think light was wave nature and particle nature .give strong reason?

Dual **nature** of **light** as "both a **particle** and a **wave**" has been proved. it's essential theory was further evolved from electromagnetic into quantum mechanics. Einstein believed **light** is a **particle** (photon) and the flow of photons is a **wave**.

Do you agree or not that stationary charge or steady current can produce electromagnetic waves?

Maxwell's four equations describe how electric **charges** and **currents** create electric ... that there **are no** "magnetic **charges**" analogous **to** electric **charges**, and that ... waves **are** the combination of electric and magnetic field. waves **produced** by both electric and magnetic fields in an **electromagnetic wave will** fluctuate in

Do you agree or not that stationary charge or steady current can produce electromagnetic waves?

An electromagnetic wave can be created by accelerating chargers. Charges moving back and forth will produce oscillating electric and magnetic fields and these travels at the speed of light. Stationary charges and constant currents are not accelerating. Hence it cannot produce electromagnetic waves.

What happens to current in other lamps if one lamp in a series circuit burns out?

The same **current** flows through each part of a **series circuit**. **If** the **circuit** is broken at **any** point there won't be **any current** that will flow. ... In this case, **if one** of the **bulbs** blew **out**, the **other bulb** would not be able to **light** up because the flow of electric **current** would have been interrupted.

Given that electrons behave like waves, how is droppler shift described in terms of momentum.

Today, this idea is known **as** de Broglie's hypothesis of matter **waves**. ... a new theory of **wave** quantum mechanics to **describe** the physics of atoms and ... and **momentum** is a de Broglie **wave** of **frequency** f and wavelength λ: ... that an **electron** in a hydrogen atom **behaves** not **like** a particle but **like** a **wave**.