ID 16721
Muhammad Abbas

Q1 6- part (b)

Sol:-

Weight of the object $W = mg = 32N$ force applied $F_1 = 45 N$ Distance covered by object $= 50 m$

Angle b/w the direction of the force & direction of the displacement $\theta = 45°$

$W = ?$

using the equation

$W = F S \cos\theta$

$= 45 (N)(50 m)(\cos 45°)$

$= (45 N)(50 m)(0.526)$

$= 1183.5 Nm$

Q1: A) What Is Meant By The Term Work Done? Derive Equations For Positive And Negative Work Done. Ans:

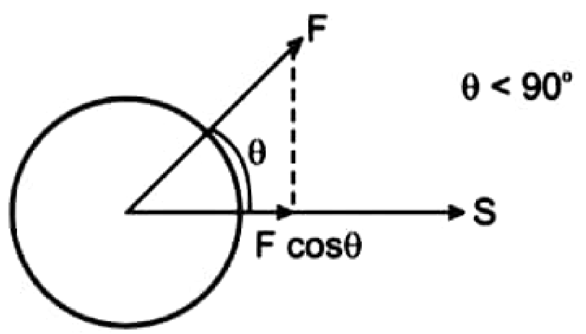
We Already Know That Work Is Said To Be Done When A Force Produces Motion. Work Done Is Defined In Such A Way That It Involves Both Force Applied On The Body And The Displacement Of The Body.

Introduction To Work Done

- In Our Everyday Life We Use Terms Like Work And Energy.
- Term Work Is Generally Used In Context To Any Kind Of Activity Requiring Physical Or Mental Effort.
- But This Is Not The Way How We Define Work Done In Physics.
- When We Push Or Pull A Heavy Load Or Lift It Above The Floor Then We Are Doing Work, But A Man Carrying Heavy Load And Standing Still Is Not Doing Any Work According To Scientific Definition Of Work.

Positive Work Done:

If A Force Acting On A Body Has A Component In The Direction Of The Displacement, Then The Work Done By The Force Is Positive.

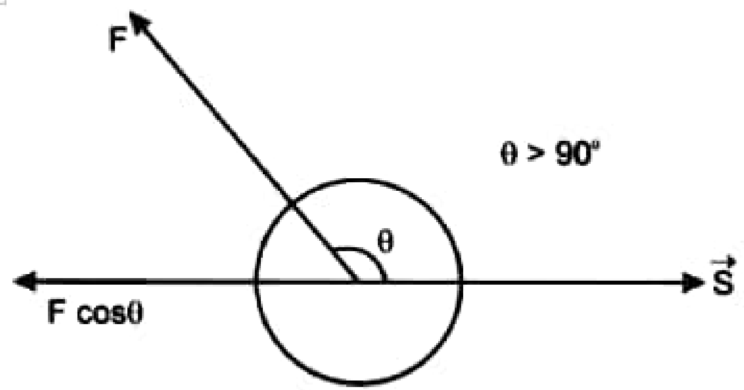


E.G A) When A Body Falls Freely Under Gravity ($\Theta=0^\circ$) The Work Done By The Gravity Is Positive.
B) When A Spring Is Stretched, Both The Stretching Force And The Displacement Act In The Same Direction. So Work Done Is Positive.

Negative Work

If A Force Acting On A Body Has A Component In The Opposite Direction Of Displacement, The Work Done Is Negative.

$W=Fs\cos\theta$=A Negative Value


F
θ > 90°
θ
$\vec{S}$
F cosθ

B) Explain Using Diagrams And Mathematical Expressions Concept Of Electric Flux.

Electric Flux Formula

The Total Number Of Electric Field Lines Passing A Given Area In A Unit Time Is Defined As The Electric Flux. Similar To The Example Above, If The Plane Is Normal To The Flow Of The Electric Field, The Total Flux Is Given As:

$\Phi p = EA$

When The Same Plane Is Tilted At An Angle Θ, The Projected Area Is Given As Acosθ And The Total Flux Through This Surface Is Given As:

$\Phi = Eacos\theta$

Where,

- E Is The Magnitude Of The Electric Field
- A Is The Area Of The Surface Through Which The Electric Flux Is To Be Calculated
- Θ Is The Angle Made By The Plane And The Axis Parallel To The Direction Of Flow Of The Electric Field

Q3) A) Describe The Existence Of Magnetic Force On Electric Current Carrying Conductor In A Magnetic Field. Obtain Equation For The Force.

Because Charges Ordinarily Cannot Escape A Conductor, The Magnetic Force On Charges Moving In A Conductor Is Transmitted To The Conductor Itself.

We Can Derive An Expression For The Magnetic Force On A Current By Taking A Sum Of The Magnetic Forces On Individual Charges. (The Forces Add Because They Are In The Same

Direction.) The Force On An Individual Charge Moving At The Drift Velocity V_d Is Given By F = Qv_db Sin Θ. Taking B To Be Uniform Over A Length Of Wire L And Zero Elsewhere, The Total Magnetic Force On The Wire Is Then F = (Qv_db Sin Θ)(N), Where N Is The Number Of Charge Carriers In The Section Of Wire Of Length L. Now, N = Nv, Where N Is The Number Of Charge Carriers Per Unit Volume And V Is The Volume Of Wire In The Field. Noting That V = Al, Where A Is The Cross-Sectional Area Of The Wire, Then The Force On The Wire Is F = (Qv_db Sin Θ) (Nal). Gathering Terms,

$$F=(Nqavd)Lbsin\theta f=(Nqavd)Lbsin\ \Theta.$$

Because $Nqav_d$ = I (See Current),

$$F=Ilbsin\theta f=Ilbsin\ \Theta$$

Is The Equation For Magnetic Force On A Length L Of Wire Carrying A Current I In A Uniform Magnetic Field B, As Shown In Figure 2. If We Divide Both Sides Of This Expression By L, We Find That The Magnetic Force Per Unit Length Of Wire In A Uniform Field Is Fl=Ibsinθfl=Ibsin Θ. The Direction Of This Force Is Given By RHR-1, With The Thumb In The Direction Of The Current I. Then, With The Fingers In The Direction Of B, A Perpendicular To The Palm Points In The Direction Of F,

Q4) A) Give Electrical Classification Of Solids, Give Three Examples For Each Type Of Material.

Solids Can Be Classified As Metals, Semiconductors Or Insulators Based On Conductivity Or Resistivity And Energy Bands In Electronics. This Helps Us Understand The Band Theory And The Importance Of Valence And Conduction Bands In Solids. Let Us Also Study The Types Of Semiconductor.

Classification Based On Conductivity

The Relative Values Of Electrical Conductivity (Σ) And Resistivity (P=1/Σ) Help Classify Solids As:

- Metals – These Are Solids Which Have Very Low Resistivity Or Very High Conductivity). Hence,
  $\Sigma \sim 10^2 - 10^8$ S/M
  $P \sim 10^{-2} - 10^{-8}\ \Omega m$

- Insulators – These Are Solids Which Have Very High Resistivity Or Very Low Conductivity. Hence,

$\Sigma \sim 10^{-11} - 10^{-19}$ S/M
$P \sim 10^{11} - 10^{19}\ \Omega m$

- Semiconductors – These Are Solids Which Have Resistivity Or Conductivity Values Between Those Of Metals And Insulators. Hence,
$\Sigma \sim 10^{5} - 10^{-6}$ S/M
$P \sim 10^{-5} - 10^{6}\ \Omega m$

Q2 a) state and mathematically explain coulomb's law. Apply coulomb's laws to discuss role of the material medium in between the charge

Coulomb's law states that The magnitude of the electrostatic force of attraction or repulsion between two point charges is directly proportional to the product of the magnitudes of charges and inversely proportional to the square of the distance between them. The force is along the straight line joining them. if the two charges have the same sign, the electrostatic force them is repulsive if they have different signs, the force between them is attractive

MATHEMATICAL explain coulomb's law

let q_1 and q_2 be two stationary point charges separated by a distance (r). According to the coulomb's law force (F) between two stationary point charges is given by,

$$F_e \propto q_1 q_2$$

$$F_e \propto \frac{1}{r^2}$$

$$F_e \propto \frac{q_1 q_2}{r^2}$$

$$F_e = (constant) \frac{q_1 q_2}{r^2}$$

$$F_e = k \frac{q_1 q_2}{r^2}$$

coulomb's law to discuss role of the of the material medium between charge

Dielectric

A material in which all the electrons are tightly bound to the nuclei of the atoms is called a dielectric (or insulator)

Glass, Plaster, mica, all are example of dielectrics.

When the medium surrounding the charge is not a vacuum but is non conducting or dielectric medium then the Coulomb force between the charges is reduced. The effective Coulomb force is now given by

$$F_e = \frac{1}{4\pi\varepsilon} \frac{q_1 q_2}{r^2} \hat{r}$$

Q3b| what is the force per meter length on a wire carrying 1.2A current in a 0.75 T magnetic field?

Solution

Current following through the wire, $I = 1.2\,A$

strength of the magnetic field, $B = 0.75\,T$

force per meter length, $\frac{F}{L} = ?$

The magnitude of the force per unit meter is- $\frac{F}{L} = IB$

$$\frac{F}{L} = (1.2A)(0.75T)$$

$$= 0.9\,AN^{-1}m^{-1}$$

$$= 0.9\,Nm^{-1}$$

$$\frac{F}{L} = 0.9\,\frac{N}{m}$$

Q5) what is Photo electric effect? How it is experimentally studied? what are the major features of photo electric effect. describe by giving example?

Ans| PHOTO ELECTRIC EFFECT:

The Phenomenon in which electrons are emitted from metal surface (Photo

sensitive plate) when it is illuminated with a high frequency of electromagnetic radiations is called photoelectric effect and the process is called photoelectric emission.
The electron emitted in this process are called photoelectric and the current produced due to these photo electrons is called photoelectric current.
Modern application of the photoelectric ~~of~~ effect are automatic door openers, burglar alarm, television cameras, exposure meters and many other photo-electronic device.

Experimental studied of photoelectric effect:
The experimental finding about photoelectric effect ~~is called~~ are the following:
(i) ~~The~~ Threshold frequency:
The minimum frequency required to initiate photoelectric effect is called threshold frequency or cut off frequency (f_0).

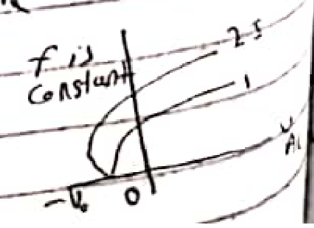
Now matter how intense the light may be, no photoelectron are emitted, if the frequency of the light is less than a certain minimum frequency f_0. The value of the threshold frequency depends on the nature of the photosensitive cathode. for most metals f_0 is in the blue or ultraviolet region of the electromagnetic spectrum.

(ii) Instantaneous effect:
Photo electric effect is an instantaneous process. No matter how weak the beam of light is, if its frequency $f > f_0$, electrons are emitted at the instant the light strikes the cathode, the photoelectric effect occurs at once with no time delay.

(iii) Dependence on Light Intensity:
with $f > f_0$, the number of photo electron emitted from the cathode is directly proportional to the intensity of the light beam.
The number of photoelectron

ejected depends upon the intensity of incident light.
The maximum kinetic energies of the photo electrons do not depend on the intensity of the light. it depends on the frequency of the incident light.

(iv) Maximum kinetic Energy:
The maximum kinetic energy $(KE)_{max}$ of the ejected electron is determined by reversing the battery in the circuit and making the cathode C negative with respect to the collector B.
As C is made more and more negative the current rapidly decreases and stop at some definite retarding potential V_0 which is called the stopping potential detected by the voltmeter.
(v) The maximum kinetic energy is measured for light of different frequency. The graph of KE against the frequency of the light is found to be a straight line as shown in fig.



The equation of the line is

$(KE_{max}) = e V_0 = hf - hf_0$

$(KE_{max}) = h (f - f_0)$ ...B

where h is the slope of the line and f_0 is the threshold frequency.

Major feature of photo electric effect

The photo electric effect has three important feature that cannot be explained by classical physics. (1) the absence of lag time.

(2) the independence of the kinetic energy of photo electrons on the intensity of incident radiation.

(3) the presence of a cutt-off frequency.

Difference Between Intrinsic and Extrinsic Semiconductor

- In an intrinsic semiconductor, the addition of impurity with a pure semiconductor does not take place, whereas the extrinsic semiconductor is formed by dopping of impurity in a pure semiconductor.
- The density of electrons and holes in the intrinsic semiconductor is same, i.e. the number of free electrons present in the conduction band is equal to the number of holes in the valence band.but in the case of extrinsic semiconductor the number of electrons and holes are not equal. In a p-type semiconductor, the holes are in excess and n-type semiconductor the number of electrons is greater than the number of holes.

- The impurity like arsenic, antimony, phosphorus, aluminium indium, etc. is added to the pure form of silicon and germanium to form an extrinsic semiconductor. The pure form of silicon and germanium crystal is used in an intrinsic semiconductor.
- Electrical conductivity in intrinsic semiconductor is a function of temperature alone, but in extrinsic semiconductor the electrical conductivity depends upon the temperature and the amount of impurity doping in the pure semiconductor.