[Max. Marks:80]

SECTION-A [40 Marks]

1(a)A girl of mass 20kg is sitting at a distance of 4m from the middle of a see-saw. Where should a girl of mass 40kg sit so as to balance the see-saw?
[2]

Sol:

let the distance of the girl of mass 40kg from thee mean position be x meter.

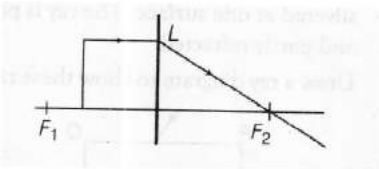
Using principle of moments,

$20 \times 4 = 40 \times x$

$\Rightarrow x = 2$

So, the girl of mass 40kg should sit at a distance 2m from the middle of see saw to balance it.

(b)(i)Study the given diagram and answer the given question: Name the lens L and also name the points F_2 and F_2. [2]



Sol:

The lens is a convex lens. F_1 and F_2 are called the focal points of the lens.

(ii)Which the common device that uses electromagnet.

Sol:

Electric bell uses electromagnet.

(c)(i)Why does a man carry the pole? Walks along a tight rope, carrying a long pole. [1+1]

Sol:

The pole lowers his center of gravity. This increases the stability of the man.

(ii)Desire the principle of moments .Give one device as an application of it.

Sol:

According to principle of moments, "in equilibrium the sum of anti-clockwise moments is equal to the sum of the clockwise moments. A physical balance works on the principle of moments.

(d)(i)State one way to reduce the moment of given force about a given axis to rotation.[2]

Sol:

One way of reduce the moment of a force is by reducing the magnitude of force applied.

(ii) find the type of motion it is possible to have an accelerated motion with speed?

Sol:

Yes, uniform circular motion.

(e)(i) write one condition to make a body more stable. [2]

Sol:

The center of gravity should be as low as possible.

(ii) Find the type of equilibrium is a cone resting on its base?

Sol:

A cone resting on its base is in stable equilibrium.

2.(a)Determine the work done by a force, when [2]

(i)There is no displacement

Sol:

Work done (W) = Force (F) × Displacement (d)

For no displacement, d = 0

$\Rightarrow W = F \times (0) = 0$

(ii) Displacement is normal to force.

Sol:

Work done (W) = Force (F).Displacement (d)

$= F.s\cos\theta$

Here,

$\theta = 90^0$

$\Rightarrow W = F \times d \times 0 = 0$

(b)What kind of energy is associated with **[2]**

(i)a compressed spring

Sol:

Potential energy

(ii)a body who is running.

Sol:

Kinetic energy

(c)(i)Given an example for kind of lever? **[2]**

Sol:

Foot treadle is a third order lever.

(ii) Find the CGS unit of energy?

Sol:

The CGS unit of energy is erg.

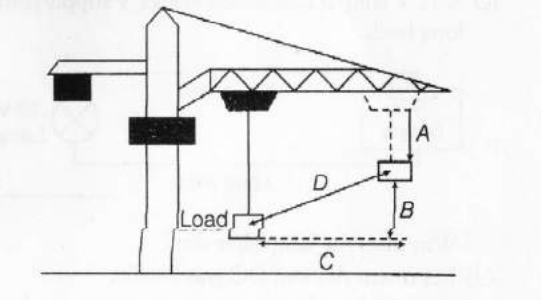
(d)Differentiate between centripetal and centrifugal force. **[2]**

Sol:

Centripetal	Centrifugal
Force directed towards the center of the circle at each part.	A force acting away from the center of circular path.
e.g Revolving of electrons around the nucleus.	e.g A person throwing a hammer.

(e)Find the increase in gravitational potential energy of the load? A crane moves its load diagonally, as shown by distance must the weight of the load be multiplied.

[2]



Sol:

The increase in gravitational potential energy is only dependent on the increase in vertical height.

Increase in gravitational potential energy

= Force x Distance

= Weight × change in vertical height

3(a)(i) Find the lever has a mechanical advantage always more than one? [2]

Sol:

The Mechanical Advantage (MA) of a lever is given by

$$MA = \frac{Effort \text{ arm}}{\text{Load arm}}$$

In levers of class II, i.e the lever in which the load (L) lies in between the effort (E) and the fulcrum (F), the effort arm is always longer than the load arm. Therefore, the mechanical advantage of these levers is always more than one.

(ii) Define the principle of an ideal machine.

Sol:

An ideal machine is that in which there is no dissipation of energy in any manner. The work output is equal to the work input.

(b)A ray of light travels from air into glass. The refractive index of the glass is 1.5.Which of the following pairs could be values of the angle of incidence and the angle of refraction?

[2]

	Angle of incidence	Angle of refraction
A	21.5^0	20.0^0
B	10.0^0	$.60.0^0$
C	60.0^0	35.3^0
D	80.0^0	53.3^0

Sol:

$$\text{Refractive index} = \frac{\sin i}{\sin r} = \frac{\sin 60.0^0}{\sin 35.3^0} = 1.5$$

(c)(i)Define the way to increase the frequency of vibration in air column. **[2]**

Sol:

Frequency in air column can be increased decreasing length of air column.

(ii) Give the one condition for a body to execute free vibration.

Sol:

No, resistive force even by medium should act on vibrating body.

(d)(i)What is the commercial unit of electric energy? **[2]**

Sol:

Kilowatt-hour (kWh).

(ii)Which part of an electrical appliance is earthed?

Sol:

Metallic body of an electrical appliance is earthed.

(e)(i)In which one use of y-rays. **[2]**

Sol:

They are used in medical science to kill cancer cells.

(ii) Name the region beyond the violet end of electromagnetic spectrum.

Sol:

Ultraviolet region.

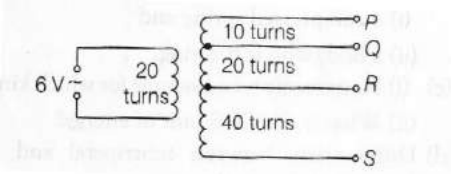
4(a) Sate, how does the volume of ice change when it is heated from 0^0C to 10^0C? [2]

Sol:

As, the ice melts at 0^0C on heating, its volume decreases and converts into water at 0^0C . When water at 0^0C is heated further it starts contracting till it has minimum volume at 4^0C. Thereafter on heating, the volume of water begins to increase.

(b)(i)The number of turns between each pair of output terminals of a transformer is shown in the diagram.

[2]



Between which two terminals will the output be 12V?

Sol:

By using the equation below,

$$\frac{\text{Secondary voltage}}{\text{primary volage}} = \frac{\text{Number of secondary turns}}{\text{Number of primary turns}}$$

To obtain a secondary voltage of 12V, number of secondary turns required is $\frac{12}{6} \times 20 = 40$.

Thus, the required terminal is *R* and *S* .

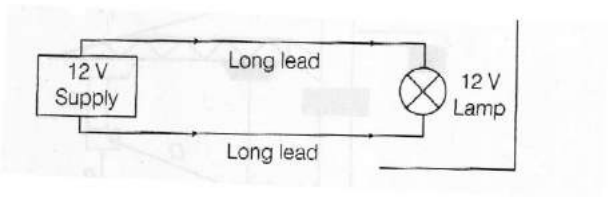
(ii)Explain the polarity of the terminal obtained in (i)

Sol:

Polarity of the terminal between *R* and *S* will be same as that of input.

(c)A 12V lamp is connected to a 12V supply using very long leads.

[2]



Why does AC and DC graphically.

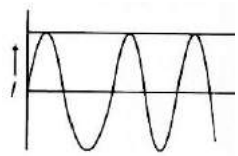
Sol:

The long lead would have a high resistance. A large proportion of the electrical energy would be lost as heat in the long leads. Therefore, a small current will pass through the circuit and will light up the lamp dimly.

(d) Represent AC and DC graphically.
[2]

Sol:

AC and DC are graphically shown below



(e)(i) Which radiation produces maximum biological damage? [2]

Sol:

y-radiation produces maximum biological damage.

(ii)What happens the atomic number of an element, when the radiation named by you in part(i) is emitted?

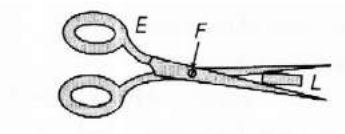
Sol:

There is no change in atomic and mass number of element formed after y-radiation are emission.

5.(a)Sketch a diagram to illustrate the position of fulcrum load and effort in working of scissors.[3]

Sol:

The diagram of working scissors is given below as,



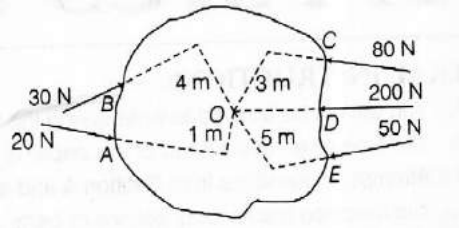
Where, *E* is effort, *F* is fulcrum and *L* is load.

(b)(i)What is the energy conversion taking place in a microphone?
[3]

Sol:

Electrical energy $\Leftrightarrow$ Sound energy

(ii)Calculate the resultant torque from the following digram.



Sol:

Resultant torque = clockwise moments + Anti-clockwise moments

$$= -[(30N \times 4m) + (50N \times 5m)] + (20N \times 1m) + (80N \times 3m) + (200N \times 0)$$

(since, perpendicular distance between the rotation axis and the point of application of force is zero, hence torque is zero)

$$= -(120N - m + 250N - m) + 260N - m$$
$$= -110N - m$$

(c) A block and tackle system has 5 pulleys, if an effort on 1000N is in the downward direction to raise a load of4500N.
[4]

(i) Find the mechanical advantage and the velocity ratio.

Sol:

Mechanical advantage,

$$MA = \frac{\text{Load}}{Effort} = \frac{4500N}{1000N} = 4.5$$

Velocity ratio, VR = Number of pulleys, n = 5

(ii) Find the efficiency of the system.

Sol:

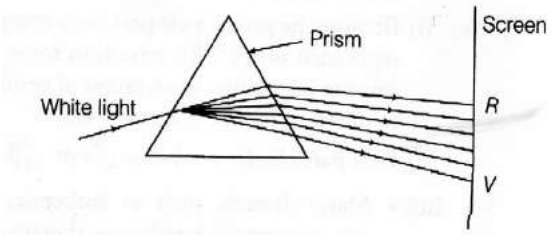
Efficiency,

$$\eta = \frac{MA}{VR} \times 100\% = \frac{4.5}{5} \times 100\% = 90\%$$

6(a)(i) Define the Dispersion of light? [3]

Sol:

The phenomenon of splitting of white light into its constituent colours after passing through a Prism is called dispersion.



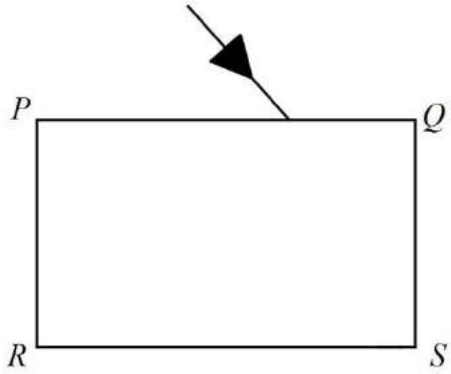
(ii) Which colour of light gets scattered the least, in the atmosphere?

Sol:

Red

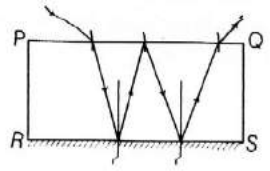
(b)(i) The diagram below shows a ray of white light Which is incident on a rectangular glass block, silvered at one surface. The ray is partly reflected and partly refracted. [3]

Draw a ray diagram to show these rays.



Sol:

Ray diagram



(ii)On what factors does the critical angle for a given pair of media depend?

Sol:

The colour (or wavelength) of light.

The temperature.

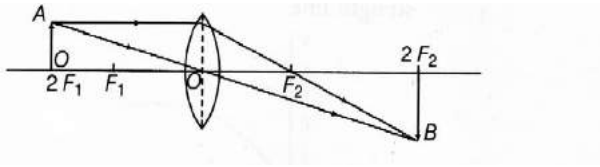
(c)The diagram below shows an object OA and its image IB formed by a lens. **[4]**

(i)Complete the ray diagram.

(ii) Locate the focus of the lens by labeling correctly.

(iii)State the type of the lens used.

Sol:



Lens used in convex. Image is real and inverted.

7.(a)(i)Which quantity determines the loudness of a sound wave? **[3]**

Sol:

The loudness of sound is determined by amplitude.

(ii)Find the loudness related to the quantity mentioned above in part (i)?

Sol:

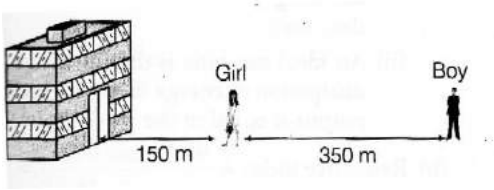
The loudness of sound is directly proportional to the square of the amplitude of the vibrating body.

(iii)In which characteristic of sound is responsible to distinguish between a grave note of same loudness.

Sol:

Pitch.

(b) A girl, standing 150 m in front of a tall building, fires a shot using a starting pistol. A boy, standing 350 m behind her, hears two bangs 1s apart.
[3]



From this information.

(i)find the speed of sound in air

Sol:

The time difference between the given sound is 1 second.

i.e

$t_2 - t_1 = 1$

$\frac{d_2}{v} - \frac{d_1}{v} = 1$

$\Rightarrow \frac{1}{v}(d_2 - d_1) = v$

$\Rightarrow (d_2 - d_1) = v$

$(650 - 350) = v$

$\therefore v = 300 m/s$

(ii)Find the distance between two sounds heard.

Sol:

The distance between the two sounds is always

$= 2d = 150 \times 2 = 300m$ apart.

(c)If the stem of a vibrating tunning fork is pressed against a table top.
[4]

(i) will it produce an audible sound?

Sol:

Yes, it will produce audible sound.

(ii)Does it cause the table top to set in vibrations. If yes, what type of vibration are they?

Sol:

yes, it will set the table top into forced vibrations.

(iii) Under what condition does it leads to resonance?

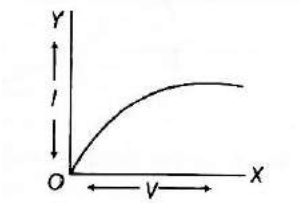
Sol:

It will leads to resonance, when the natural frequency of vibrations of the table top becomes equal to the natural frequency of the vibrating tanning fork.

8.(a)What do you mean by ohmic and non-ohmic resistors? Give at least one example of each. Also, show their current voltage relationship.
[3]

Sol:

The conductors which obey Ohm's law are called ohmic resistors, e.g., All metallic conductors like Ag,Al,Cu,Fe, etc., for such conductors current voltage relationship is a straight line.



For non-ohmic resistors

The conductors which do not obey Ohm's law are called non-ohmic resistors or non-linear resistances,e.g. Diode valve, triode valve, electrolytes, etc. for these conductors graph plotted *V* versus *I* is not a straight line.

(b)(i) A cell is sending current in an external circuit. How does the terminal voltage compare with the emf of the cell?
[3]

Sol:

Terminal voltage (V) is less than emf (E) of the cell, i.e $V = E - IR$

(ii)What is the use of a fuse in an electrical circuit?

Sol:

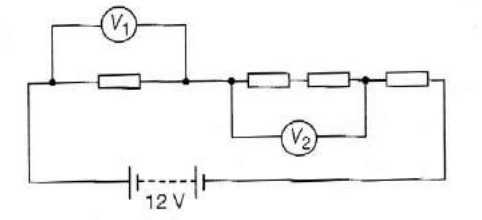
The use of fuse wire is an electrical circuit is to limit the current and thus delicate instruments are saved.

(iii)what are the characteristic properties of fuse wire?

Sol:

Fuse wire must have low melting point and high resistance.

(c) The circuit diagram shows four identical resistors connected in series with a 12V battery. [4]



What would be the reading of

(i)voltmeter V_1 and (ii) voltmeter V_2?

Sol:

Since, the resistors are identical, the pd of 12V is shared equally among each resistor, i.e pd across each resistor is $\frac{12}{4} = 3V(V_1)$.

For two resistors, the potential difference across them is equal to the sum of the potential difference across the individual resistor i.e.

$pd = 3 + 3 = 6V(V_2)$

9.(a)(i)What is the reason that land cools at a faster rate then water? [3]

Sol:

Water has specific heat capacity $(4200 J/kg^0C)$.Therefore , a certain mass of water will impart nearly five time times more heat energy than that given by the same mass of land for same fall in temperature.

(ii)Why do we feel cool under a fan?

Sol:

We feel cool and comfortable under a fan because the sweat from our body evaporates rapidly due to the movement of air. Since, evaporation causes cooling, therefore, we get a cooling sensation.

(b)(i)Define heat? [3]

Sol:

Heat is a form of energy that flows from a body having higher temperature to the body having lower temperature.

(ii) what is temperature?

Sol:

The temperature is the degree of hotness or coldness of a body or heat is the total kinetic energy possessed by the molecules of the body and thee temperature is the average kinetic energy of the molecules of the body .

(iii)Describe the calorimeters.

Sol:

The measurement of the quantity of heat is called calorimemetry.

(iv) What is the SI unit of specific heat capacity?

Sol:

The SI unit of specific heat capacity is $Jkg^{-1}k^{-1}$.

(c)250g of water at 30^0C is present in a copper vessel of mass 50g. find the mass of ice required to bring down the temperature of the vessel and its contents to 5^0C.

(Take, specific latent heat of fusion of ice = 336 x 10^3 Jkg^{-1},specific heat capacity of copper vessel = 400Jkg^{-1} $^oC^{-1}$ and specific heat capacity of water = 4200 Jkg^{-1} $^oC^{-1}$)
[4]

Sol:

Given that,

Mass of water = 250g = 0.25kg

Mass of copper vessel = 50g =0.5kg

Initial temperature of water and vessel = 30^0C

Final temperature of mixture = 5^0C

Let, mass of ice added = m kg

Heat given by water,

$= 0.25 \times 4200 \times (30 - 5) = 26250J$

Heat given by copper vessel

$= 0.5 \times 400 \times (30 - 5) = 500J$

Heat taken by ice

$= m \times (336 \times 10^3) + m \times 4200 \times (5 - 0)$
$= 357000mJ$

Assuming no loss of heat,

Heat given by water and vessel = heat taken by ice

$26250 + 500 = 357000m$

$\therefore$ Mass of ice added,

$m = \frac{26750}{357000}$
$= 0.0749kg(or 74.9k)$

10.(a)(i)In which case the nucleus of an atom become radioactive. [3]

Sol:

The nucleus of an atom becomes radioactive when the number of neutrons exceed the number of protons, present inside the nucleus which thereby increases it instability.

(ii)Find the number of α and β-particles are emitted when uranium nucleus $_{92}U^{238}$ decays to lead $_{82}Pb^{206}$.

Sol:

8 α-particles and 6 β-particles are emitted as the change in atomic number is 1.0 and the change in mass number is 32.

(b)(i)compare the ionizing power. [3]

Sol:

Ionizing power of α-particles is the most and of ϒ-radiations the least, i. e ionizing power α<β<ϒ;(α-10000 times ϒ and 100 times β,β-100 times ϒ).

(ii)Compare the penetrating power of α,β and ϒ-radiations.

Sol:

The penetrating power of α-particle is 1/10000 times that of ϒ-radiation.

(c)(i)Why do stable nuclei never have more protons than neutrons? [4]

Sol:

Because the protons are positively charged and repel each other. This repulsion force is more causing instability, so an excess of neutrons are required to reduce this repulsion.

(ii)A certain radioactive nucleus emits a particle that leaves its mass unchanged, but increases its atomic number by one.

Identify the particle and write its symbol.

Sol:

Beta particle. Its symbol is $^{0}_{-1}e$ or $^{0}_{-1}\beta$.

(iii)Explain the medical use of radioactivity.

Sol:

May diseases such as leukemia, cancer, etc. are cured by radiation therapy.

Radioactive tracers salts such as radio-sodium chloride, radio-iron, radio-iodine are used for diagnosis.

They detect the suspected brain tumors and blood clots before they become dangerous.