ALLEN CAREER INSTITUTE

PRELIMINARY EXAM : 2019-20

Paper Set : SET-I(HT) **SUBJECT : Physics**

ICSE Board - Sample Paper - 1 Solutions

SECTION - A ---- (40 Marks)

Q.1 (A) Given F = 2 N, Diameter = 2m

The perpendicular distance between B and O = 1 m = r

i) Moment of force at point O = F × r

= 2 × 1 = 2 Nm (Clockwise)

ii) Moment of force at point A = F × r

= 2 × 2 Nm (Clockwise)

(B) (i) The position of centre of gravity of a body of given mass depends on its (i) shape and (ii) size of the body i.e. Distribution of mass of the body.

(ii) S.I. unit of the moment of force is Nm (newton-meter)

(C) Yes, this could be possible. In uniform circular motion body is executing circular motion with constant speed but still it is having centripetal acceleration.

(D) (i) Single fixed pulley is the type of single pulley which is very often used as a machine even though if does not give any gain in mechanical advantage.

(ii) It is used only to change the direction of the force applied.

(E) P_i = initial momentum = mu (u = initial velocity, v = final velocity)

$P_f = mv$

$\Delta P = P_f - P_i = m(v - u)$ ....(i)

Now, $F = ma = \frac{m(v-u)}{t}$ ....(ii)

So, $F \quad \frac{\Delta P}{t}$. Hence proved.

Q.2 (A) $1\ eV = 1.6 \times 10^{-19}$ J

Now, $1\ J = 10^7$ erg.

$1\ eV = 1.6 \times 10^{-19} \times 10^7$ erg

$1\ eV = 1.6 \times 10^{-12}$ erg

(B) (i) Photoelectric cell : Light energy into electric energy.

(ii) Nuclear Reactor : Nuclear energy into thermal energy, then thermal energy into mechanical energy and mechanical energy into electric energy.

(C) (i) Work done in moving the block from A to B = F × d = 200 × 3 = 600 J

(ii) Gain in potential energy = mgh = 30 × 10 × 1.5 = 450 J

(D) On seeing the printed piece of paper by a convex lens, keeping it very close to the paper, enlarged, erect letters are seen, while with the concave lens at the same position, diminished and erect letters are seen.

On moving the printed piece of paper before the lens; if the image is always diminished then it is a concave lens otherwise, it is convex lens.

(E) (i) When an object is placed under water than observing it from outside the water it appears to be raised above.

The ratio of real depth and apparated depth is equal to the refractive index of the medium.

$$\mu \quad \frac{\text{Real depth}}{\text{Apparent depth}}$$

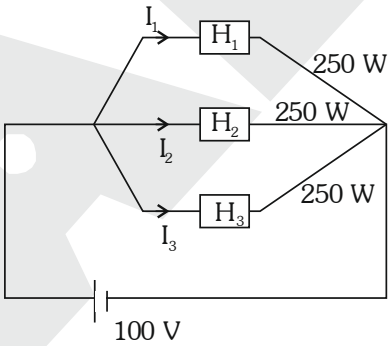
(ii) Scattering is the characteristic property of light which is responsible for the blue color of the sky.

Q.3 (A) (i) Frequency determines the pitch of note.

(ii) Intensity of sound determine's loudness of the sound.

(iii) Waveform decides the quality of the note.

(B) (i) Total current drawn



$I = I_1 + I_2 + I_3$.

Since each heater is of 250 W.

$I_1 = I_2 = I_3 = I$

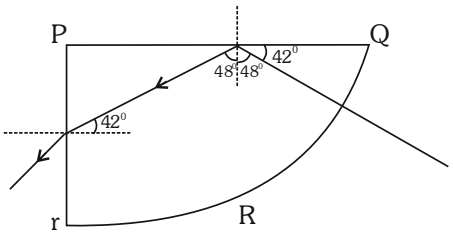
& Total current I = 3I

$$I = 3 \times \frac{250}{100} = 3 \times 2.5A \quad 7.5A$$

(ii) Since $P \quad \frac{V^2}{R}$, $R \quad \frac{V^2}{P} \quad \frac{100 \times 100}{2500} \quad 40\ \Omega$

$\therefore$ 40 Ω is the resistance of each heater.

(C)



(D) When acaustic resonance takes place, the natural frequency becomes equal to the frequency of external applied force hence a loud sound is heard.

(E) (i) Let, Energy (E) = Power × Time

$= 1000 \times 2$

$E = 2000$ KWh

(ii) Since 1 KWh = 3.6×10^6 J

Energy consumed = $2000 \times 3.6 \times 10^6$ J

$= 7.2 \times 10^9$ J

Q.4 (A) (i) An A.C. generator or dynamo converts mechanical energy into electrical energy.

(ii) An A.C. Generator works on the principal of electromagnetic induction.

(B) (i) Gamma rays cause sever disorder and depending on the duration and region of exposure even X-ray can have harmful effects.

(ii) Alpha and beta radiation can be deflected by electric field.

(C) Heat energy supplied = 1300 J

Mass of lead = 0.5 kg

$\Delta T = 20^0C$

Specific heat capacity of lead

$C \quad \frac{\Delta Q}{m\Delta T} \quad \frac{1300}{0.5 \times 20} = 130$ J/kg K

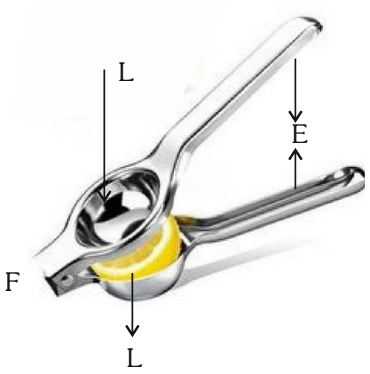
(D) A current carrying solenoid behaves like a bar magnet. We know that a freely suspended bar magnet align itself in the North-South direction.

So freely suspended current carrying solenoid also aligns itself in the North-South direction.

(E) Since the heat is used to overcome the force of attraction, the temperature of the substance does not change. The heat energy absorbed in this case is called as the latent heat.

SECTION - B ---- (40 Marks)

Q.5 (A)



(B) The efficiency of a pulley will be n = output / input = load x height / effort x distance

or

height = n x effort x distance / load

Here, n = 0.75

load = 500 kg x 10 m/s^2 = 5000 N

distance = 8 m

effort = 100kg x 10 m/s^2 = 1000 N

(i) $\text{Power} \quad \frac{\text{Effort} \times \text{Displacement}}{\text{Time}}$

$\text{Power} \quad \frac{1000 \times 8}{4} \quad 2000 \text{ W}$

(ii) Efficiency of a pulley = 0.75

(iii) thus, the height moved will be

h = 0.75 x 1000 x 8 / 5000

or

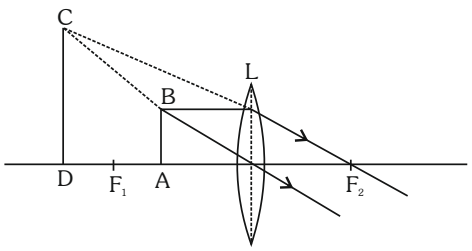
h = 6000/5000 = 1.2m

(C)

Resonant vibrations	Forced vibrations
Forced vibration in which the frequency of the disturbing force is very close to the natural frequency of the system, so that the amplitude of vibration is very large.	When one object vibrating at the same natural frequency of a second object forces that second object into vibrational motion. The result of resonance is always a large vibration. This is also an example for resonance.

Q.6 (A)

(i)



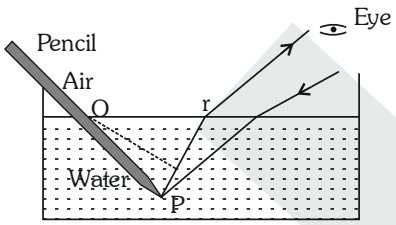
(ii) When radii of curvature of the two surfaces of lens are equal.

(B) (i) The pencil under the water appears to be shortened and raised up.

(ii) Refraction of light :

Refraction is defined as the bending of light when it travels from one medium to another. Here, light travels from water to air after reflecting from the surface of the pencil.

(iii) Ray diagram showing how the eye sees the pencil is shown.



(C) (i) In a rectangular glass slab, the emergent ray is parallel to the incident ray but they are not along the same line whereas in a prism the emergent ray is not parallel to the incident ray.

This is because in a glass block the two surfaces at which refraction occurs is parallel to each other.

(ii) The magnifying power of a compound microscope increases with (a) the focal length of objective lens is increased and that of eye lens is decreased (b) the focal length of eye lens is increased and that of objective lens is decreased (c) focal lengths of both objects and eye-piece are increased (d) focal lengths of both objects and eye-piece are decreased.

Q.7 (A) $R_S = 40\ \Omega$ in series

$R_P = 64\ \Omega$ in parallel

Let R_1 and R_2

$R_1 + R_2 = 40$

$$\frac{1}{R_1} \quad \frac{1}{R_2} \quad \frac{1}{6.4}$$

By solving

$R_1 = 32\ \Omega$ and $R_2 = 8\ \Omega$

(B) (i) $F \quad \frac{1}{l}$

(a) Frequency inversely proportional to the length of the string.

(b) Frequency is directly proportional to square root of tension.

$F \quad \sqrt{T}$

(ii)

(a) Fork B has high pitch because of high frequency.

(b) Fork A has higher loudness because of high amplitude.

(C) (i) These musical instruments are provided with hollow boxes in order to increase the surface area (a) of viberation , which increase the loudness / intensity of the sound produced as I directly proprtional to a morever , the air inside the hollow box is set in forced vibrations which also increases the loudness of sound produce.

ii) We know s = d/t

$\Rightarrow$ d = s x t

$\Rightarrow$ d = 340 x 1.8/2

$\therefore$ d = 306 m

Q.8 (A) (i) The device used to increase voltage at the generating station is the step-up transformer.

(ii) The residential houses are supplied with AC of frequency 50Hz.

(iii) The switch is connected to the live (or phase) wire in a house-hold electric circuit.

(B) (i) In Fig. the current in coil is in direction DCBA. By Fleming's left hand rule, on the arm AB, the force is outward at right angles to the plane of coil. On the arm BC no force acts. On the arm CD, the force is inwards perpendicular to the plane of coil. On the arm DA, no force acts.

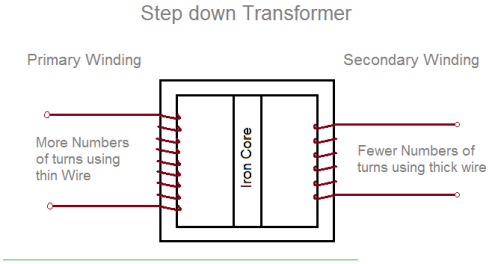
(ii) The force on the arms AB and CD are equal in magnitude, but opposite in direction. They form a clockwise couple. So the coil will rotate clockwise with the arm AB coming out and the arm CD going in. On interchanging the terminals of battery, the direction of current in coil is reversed so the coil will rotate anticlockwise.

(iii) Give to the equal and opposite forces coil rotate.

(C) i) The working principle of a transformer is very simple. Mutual induction between two or more windings (also known as coils) allows for electrical energy to be transferred between circuits.

ii) A transformer in which the output (secondary) voltage is greater than its input (primary) voltage is called a step-up transformer. The step-up transformer decreases the output current for keeping the input and output power of the system equal.

iii)



iv) Transformer is nothing but a pair of inductor coils which is wound on a magnetic core. If you apply DC to it, there wont be varying magnetic flux, so since there is no change in magnetic flux linking to the coil, emf is not induced on the secondary. So no DC output.

Q.9 (A) Let the final temperature be tt.

Heat gained by body == heat lost by other body (conserving heat)

So, $m_1c_1(t - t_1) = m_2c_2(t_2 - t) m_1c_1(t - t_1) = m_2c_2(t_2 - t)$

B) Heat Gained by Ice = Heat Lost by water

$2000 \times 334 = M \times 4.186 \times 100$

$M = 66804.186$

$M = 1.596$ kgs

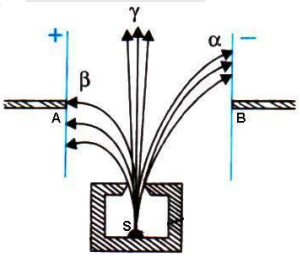
Thus we require 1.6 Litres of Water at 100^0C

C) (i) The reason is that the specific latent heat of fusion of ice is sufficiently high, so when the water of lake freezes, a large quantity of heat has to be released and hence the surrounding temperature becomes pleasantly warm.

(ii) Heat supplied to a substance during its change of state, does not cause any rise in its temperature because this is latent heat of phase change which is required to change the phase only.

Q.10 (A)

(i)



(ii) The radioactive substances are kept in thick lead containers with a very narrow opening, so as to stop radiations coming out from other direction because they may cause biological damage.

(B) (i)

a) $^{235}_{92}U + ^{1}_{0}n \rightarrow ^{141}_{56}Ba \;\; ^{92}_{36}Kr \;\; 3^{1}_{0}n$

b) $^{235}_{92}U + ^{1}_{0}n \rightarrow ^{148}_{57}La \;\; ^{85}_{35}Br \;\; 3^{1}_{0}n \;\; energy$

(ii) Nuclear fission is a process by which a large nucleus is split into two smaller nuclei, or fission fragments; nuclear fission takes place after the nucleus absorbs a neutron that usually is a product of another atom's radioactive decay.

The newly-formed fission fragments have highly unstable neutron to proton ratios, which makes them extremely radioactive.

(C)

(i)

Radioactive decay	**Nucler Fission**
It is self process	It does not occur by itself. Neutrons are bombarded on a heavy nucleus.
The nucleus emits either the a or b particles with emissions of energy in form of g rays which is not very large.	A fremenday amount of energy is released when a heavy nucleus is bombarded with neutrons and the nucleus splits in two nearly equal fragments.
The rate of decay cannot be controlled	Can be controlled

(ii) Mass defect is converted into energy

$\Delta m = 0.3$ amu

So energy released = $E = 0.3 \times 931$ MeV

$= 279.3$ MeV