Version No.			

ROLL NUMBER						

Answer Sheet No.____________

Sign. of Candidate ___________

Sign. of Invigilator ___________

PHYSICS SSC–I (3^{rd} Set Solution)

SECTION – A (Marks 12)

Time allowed: 15 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

Q.1 Fill the relevant bubble for each part. All parts carry one mark.

(1) Which one of the following instrument is most suitable for measuring thickness of the physics book?

A. Meter rule ○ B. Vernier calipers ●
C. Measuring tape ○ D. Screw gauge ○

(2) Acceleration of bodies falling freely is:

A. Different for different heights ○
B. Different for different masses ○
C. Same for all bodies ●
D. Different for different materials ○

(3) The coaster cars move around the loop, the track provides:

A. Applied force ○ B. Normal force ○
C. Centripetal force ● D. Frictional force ○

(4) A body has a weight of 20N. How much force is required to move it vertically upward with an acceleration of $2ms^{-2}$?

A. 10 N ○ B. 20 N ○
C. 2.040 N ○ D. 4.1 N ●

(5) The angle between two rectangular components of a vector is:

A. 30° ○ B. 45° ○
C. 60° ○ D. 90° ●

(6) It is easy to open a door by pulling or pushing at:

A. Axis point ○ B. Middle of door ○
C. Corners of the door ○ D. Handle of the door ●

(7) The value of universal gravitational constant is:

A. $6.4 \times 10^6\ Nm^2kg^{-2}$ ○ B. $6 \times 10^{24}\ Nm^2kg^{-2}$ ○
C. $6.67 \times 10^{-11}\ Nm^2kg^{-2}$ ● D. $10\ Nm^2kg^{-2}$ ○

(8) The work done in lifting an object of mass 10kg through height of 1m is:

A. 0J ◯ B. 10J ◯
C. 100J ● D. 1000J ◯

(9) Barometer is used to measure:

A. Weight ◯ B. Density ◯
C. Atmospheric pressure ● D. Volume ◯

(10) Sum of kinetic and potential energies associated with all particles of an object is called:

A. Heat ◯ B. Temperature ◯
C. Internal energy ● D. Mechanical energy ◯

(11) The temperature of an object is $60^\circ C$. Its temperature in Fahrenheit is:

A. $120^\circ F$ ◯ B. $130^\circ F$ ◯
C. $140^\circ F$ ● D. $150^\circ F$ ◯

(12) The rate of emission of radiation from certain object depends on:

A. Internal energy ◯ B. Heat ◯
C. Surface area ● D. Latent heat ◯

Federal Board SSC-I Examination
Physics Model Question Paper
(Curriculum 2006)

Time allowed: 2.45 hours Total Marks: 53

Note: Answer any eleven parts from Section 'B' and attempt any two questions from Section 'C' on the separately provided answer book. Write your answers neatly and legibly.

SECTION – B (Marks 33)

Q.2 Attempt any **ELEVEN** parts from the following. All parts carry equal marks.
(11 × 3 = 33)

i. How measuring cylinder can be used to measure volume of an irregular object?

Answer: Measuring cylinder can be used to find the volume of a small irregular shaped solid that sinks in water. Let us find the volume of a small stone. Take some water in a graduated measuring cylinder. Note the volume V_i of water in the cylinder. Tie the stone with a thread. Lower the stone into the cylinder till it is fully immersed in water. Note, again, the volume V_f of water and the stone. Volume of the stone will be equal to $V_f - V_i$.

ii. What is zero error? Differentiate between positive and negative zero error in case of Vernier caliper.

Answer:
Zero Error: On closing the jaws, if zeros of main and Vernier scale coincides then it has no zero error.

Zero error will be positive if zero line of Vernier scale is on the right side of the zero of the main scale and will be negative if zero line of Vernier scale is on the left side of zero of the main scale.

iii. A boy throws a ball vertically up. It returns the ground after 10 seconds. Find the maximum height reached by the ball.

Answer:
Given Data:
Gravitational acceleration = g = -10 m/s^2
Time for up and down motion = t_o= 10s
Velocity at maximum height = v_f = 0 m/s
Finding:
The maximum height reached by ball = h =?
Formula:

$v_f = v_i + gt$

h = $v_i t + \frac{1}{2} gt^2$

Procedure:
To find height first we need initial velocity of ball = v_i = ?

As the acceleration due to gravity is uniform, hence time taken by the ball to go up will be equal to the time taken to come down = $\frac{1}{2}t_0$

t = $\frac{1}{2}t_0 = \frac{1}{2}(10) = 5sec.$

Applying first kinematics equation

$v_f = v_i + gt$

$v_f = v_i + g$

$0 = v_i + (-10)(5)$
$v_i = (10)(5) = 50\ \text{ms}^{-1}$

Applying second kinematics equation

$h = v_i t + \frac{1}{2} g t^2$

$h = (50)(5) + \frac{1}{2}(-10)(5)^2$

$h = 250 + \frac{1}{2}(-10)(25)$

$h = 250 - 125$

$h = 125$ m

The maximum height to which ball rises is 125 m.

iv. Can a body moving with certain velocity in the direction of east have acceleration in the direction of west?

Answer: Yes, it is possible. If a body is moving towards east with decreasing velocity, it has retardation or negative acceleration in opposite direction of velocity that is in the direction of west.

v. In terms of Newton's 3rd law of motion, discuss action and reaction forces in the following examples:
(a) Book kept on table. (b) Motion of rocket (c) Pushing a shopping cart.

Answer: According to Newton's third law, action is always accompanied by a reaction force and the two forces must always be equal and opposite.
a) Consider a book lying on a table. The weight of the book is acting on the table in the downward direction. This is the action. The reaction of the table acts on the book in the upward direction.

b) A rocket moves on the same principle. When its fuel burns, hot gases escape out from its tail with a very high speed. The reaction of these gases on the rocket causes it to move opposite to the gases rushing out of its tail.

c) When you push a shopping cart down an aisle, the cart rolls away. However, the same amount of force is being applied to you. The forward motion of your arms is slowed or stopped, giving the action an equal and opposite reaction.

vi. How a banked road makes driving safe?

Answer: When a car takes a turn, centripetal force is needed to keep it in its curved track. The friction between the tyres and the road provides the necessary centripetal force. The car would skid if the force of friction between the tyres and the road is not sufficient enough particularly when the roads are wet. This problem is solved by banking of curved roads. Banking of a road means that the outer edge of a road is raised. Imagine a vehicle on a curved road. Banking causes a component of vehicle's weight to provide the necessary centripetal force while taking a turn. Thus banking of roads prevents skidding of vehicle and thus makes the driving safe.

vii. Why vehicles are made heavy at the bottom?

Answer: The vehicles are made heavy at its bottom to keep its centre of gravity as low as possible. A lower centre of gravity keeps it stable. Moreover, the base of a vehicle is made wide so that the vertical line passing through its centre of gravity should not get out of its base during a turn, so that it could not over turn.

viii. Define gravitational field and gravitational field strength.

Answer: The area, space, boundary or region in which effect of certain force is experienced is known as field of that force. The region in which the Earth attracts objects towards its center is known as Earth gravitational field, the force of attraction is known as Earth gravitational force. The weight of a body is due to the gravitational force. It is assumed that a gravitational field exists all around the Earth, directed towards the centre of the Earth.
In the gravitational field of the Earth, the gravitational force per unit mass is called the gravitational field strength of the Earth.

Gravitational field strength near Earth Surface = $\frac{Gravity}{mass}$

Gravitational field strength near Earth Surface = $\frac{W}{m} = \frac{mg}{m} = g\ Nkg^{-1}$

At any place its value is equal to the value of "g" at that point. Near the surface of the Earth, the gravitational field strength is 10 Nkg^{-1}.

ix. Briefly describe working principle of see-saw.

Answer: See saw is a simple machine (example of lever).
See Saw Principle:
Any two persons can balance each other when sitting on opposite sides of a seesaw, regardless of their weights. It is only necessary that each person contributes the same moment, calculated by multiplying the person's weight times the distance to the fulcrum. For example, if an 80 kg child sits at one end of a 20 m plank, 8 m from the fulcrum, a 200 kg adult can balance this system.
The seesaw principle is really a statement about the equilibrium of forces. On either side of the seesaw, gravity is acting on either body, and we need the forces to balance out. Its simple mathematical statement:

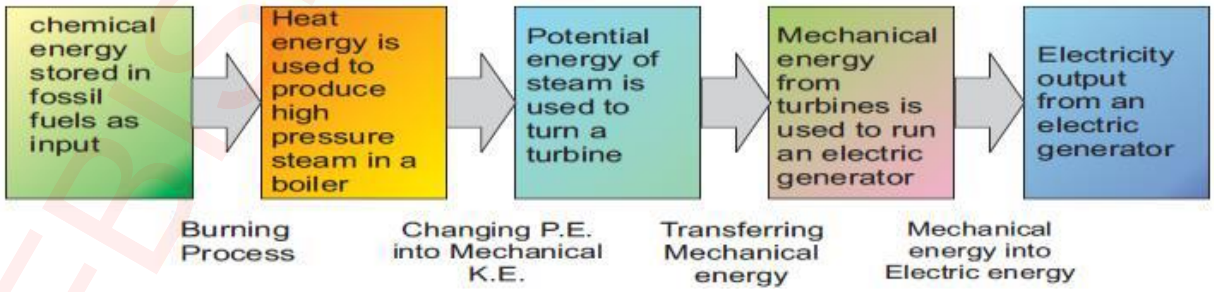
Clock wise torque = Anti clock wise Torque

$$W_1 d_1 = W_2 d_2$$

Where W_1 is weight of object 1 and d_1 is its moment arm, similarly W_2 is weight of object 2 and d_2 is its moment arm.

x. Briefly describe producing of electrical energy from fossil fuels, using block diagram.

Answer:



xi. Explain the use of Hydrometer to measure the density of a car battery acid.

Answer: Hydrometer is a glass tube with a scale marked on its stem and heavy weight in the bottom. It is partially immersed in a fluid, the density of which is to be measured. One type of hydrometer is used to measure the concentration of acid in a battery. It is called acid meter.

This is performed by measuring the density of the electrolyte, which is accomplished by measuring the specific gravity of the electrolyte, knowing the specific gravity of the electrolyte in batteries gives insight into the level or state of charge of a battery or cell.

xii. The weight of a metal spoon in air is 0.38 N. Its weight in water is 0.32 N. Find its density.

Answer:
Given Data:
Weight of spoon = W_S = 0.38 N
Weight of spoon in water = W_{sw} = 0.32 N
Density of water = $\rho_W = 1000\ kg\ m^{-3}$
Finding:
Density of spoon = $\rho_S = ?$
Formula:

$$\rho_S = \left(\frac{W_S}{W_S - W_{SW}}\right) \times \rho_W$$

Procedure:

$$\rho_S = \left(\frac{0.38}{0.38 - 0.32}\right) \times 1000$$

$$\rho_S = \left(\frac{0.38}{0.06}\right) \times 1000 = 6333.3 \text{ kg m}^{-3}$$

xiii. What is anomalous expansion of water?

Answer: Water has anomalous expansion during heating and cooling. During cooling from any higher temperature to 4°C, it contracts but from 4°C to 0°C, instead of contraction, it expands. So, it has highest density at 4°C.

Similarly on heating from 0°C in ice phase to 4°C in the form of water, it contracts instead of expansion. After 4°C, on heating, water expands just like other liquids. This strange behavior of water is called anomalous expansion of water.

xiv. Briefly explain convection in seawater to support marine life.

Answer: During the day, sea water receives large amount of heat. In the evening or during night, water at top gets cold and becomes denser than water below it. Due to it, cold water moves downward and hot water moves upward. So, large water currents are established in sea water due to convection. This convectional process allows heat exchange from top and bottom of oceans, which is necessary for marine life to survive.

xv. Why is the cutting edge of the knife made very thin?

Answer:
We know that $P = \frac{F}{A}$, as cutting edge of knife is thin and sharp so it has small area. So a small force is applying greater pressure which helps to cut food etc. easily.

SECTION – C (Marks 20)

Note: Attempt any **TWO** questions. All questions carry equal marks. **(2 × 10 = 20)**

Q.3 a. Write detailed note on significant figures. **(6)**

Answer:
Significant Figures: In any measurement accurately digit and 1st doubtful digit are known as significant figures.
The value of a physical quantity is expressed by a number followed by some suitable unit. Every measurement of a quantity is an attempt to find its true value. The accuracy in measuring a physical quantity depends upon various factors:

- the quality of the measuring instrument
- the skill of the observer
- the number of observations made

For example, a student measures the length of a book as 18 cm using a measuring tape. The numbers of significant figures in his measured value are two. The left digit 1 is the accurately known digit. While the digit 8 is the doubtful digit for which the student may not be sure.
Another student measures the same book using a ruler and claims its length to be 18.4 cm. In this case all the three figures are significant. The two left digits 1 and 8 are accurately known digits. Next digit 4 is the doubtful digit for which the student may not be sure. A third student records the length of the book as 18.425 cm. Interestingly, the measurement is made using the same ruler. The numbers of significant figures is again three; consisting of two accurately known digits 1, 8 and the first doubtful digit 4. The digits 2 and 5 are not significant. It is because the reading of these last digits cannot be justified using a ruler. Measurement upto third or even second decimal place is beyond the limit of the measuring instrument.
An improvement in the quality of measurement by using better instrument increases the significant figures in the measured result. The significant figures are all the digits that are known accurately and the one estimated digit. More significant figure means greater precision.
Rules:
The following rules are helpful in identifying significant figure:
(i) Non-zero digits are always significant e.g. 624m has 3 significant digits.
(ii) Zeros between two significant figures are also significant e.g. 7009 has 4 significant digits.
(iii) Final or ending zeros on the right in decimal fraction are significant e.g. 2.40 has 3 significant digits.
(iv) Zeros written on the left side of the decimal point for the purpose of spacing the decimal point are not significant e.g. 0.02 m has only 1 significant digit.
(v) In whole numbers that end in one or more zeros without a decimal point. These zeros may or may not be significant. In such cases, it is not clear which zeros serve to locate the position value and which are actually parts of the measurement. In such a case, express the quantity using scientific notation to find the significant zero e.g. $2.32 \times 10^5\ m$ has only 3 significant digits.

b. Calculate the value of g, the acceleration due to gravity at an altitude of 100 km. The mass of Earth is 6.0×10^{24} Kg. The radius of Earth is 6400 km. **(4)**

Answer:
Mass of Earth = $M_e = 6.0 \times 10^{24}$ kg
Radius of Earth = R_e = 6400 km
Altitude = h = 100 km
Value of Universal Gravitational Constant = G = $6.67 \times 10^{-11}\ N\ m^2\ kg^{-2}$
Finding:
Value of gravitational acceleration = $g_{h'} = ?$
Formula:

$$g_h = \frac{GM_e}{(h')^2}$$

$$h' = R + h$$

Procedure:

$h' = 6400 + 100 = 6500\ km$

$$g_h = \frac{(6.67 \times 10^{-11}\ N\,m^2 kg^{-2})(6.0 \times 10^{24}\ kg)}{(6.5 \times 10^6\ m)^2}$$

$$g_h = \frac{40.038}{42.25} \times 10^{-11+24-12}$$

$g_h = 9.476\ ms^{-2} = 9.5\ ms^{-2}$

Q.4 a. What is kinetic energy. Derive its mathematical relation (K.E = $\frac{1}{2}$ mv^2) **(6)**

Answer: The energy possessed by a body due to its motion is called its kinetic energy. Moving air is called wind. We can use wind energy for doing various things. It drives windmills and pushes sailing boats. Similarly, moving water in a river can carry wooden logs through large distances and can also be used to drive turbines for generating electricity. Thus a moving body has kinetic energy, because it can do work due to its motion. The body stops moving as soon as all of its kinetic energy is used up.

Consider a body of mass *m* moving with velocity *v*. The body stops after moving through some distance *S* due to some opposing force such as force of friction acting on it. The body possesses kinetic energy and is capable to do work against opposing force *F* until all of its kinetic energy is used up.

K.E. of the body = Work done by it due to motion

K.E. = FS………… (1)

$V_i = V$

$V_f = 0$ m/s

As F = ma

Since motion is opposed, hence, a is negative.

a = - F/m

Using 3rd equation of motion:

$2as = V_f^2 - V_i^2$

$2(-F/m) = (0)^2 - (V)^2$

FS = $\frac{1}{2}$ mv^2 …………………(2)

From equation 1 and 2, we get

K.E. = $\frac{1}{2}$ mv^2 ……………… (3)

Equation 3 gives the K.E. possessed by a body of mass *m* moving with velocity *v*.

b. Find the volume of a brass cube at 100°C, whose side is 10cm at 0°C (coefficient of linear thermal expansion of brass= 1.9 x 10^{-5} k^{-1}). **(4)**

Answer:

Given Data:

l = 10 cm

coefficient of linear thermal expansion of brass= 1.9 x 10^{-5} k^{-1}

Finding:

Volume of a brass, V = ?

Formula:

$V = V_0\,(1 + \beta \Delta t)$

Procedure:

l = 10 cm = 0.1 m

$V_0 = l \times l \times l = 0.001\ m^3$

$\alpha = 1.9 \times 10^{-5}\ k^{-1}$

$\beta = 3\alpha = 3 \times 1.9 \times 10^{-5}$

$\beta = 5.7 \times 10^{-5}\ k^{-1}$

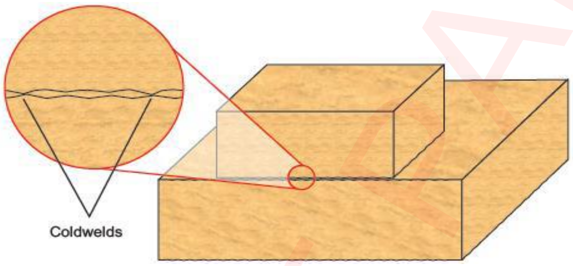
$t_1 = 0°C$

$t_2 = 100°C$

$t = t_2 - t_1 = 100°C = 100K$
$V = (0.001)[1 + (5.7 \times 10^{-5})(100)]$
$V = (0.001)[1 + (5.7 \times 10^{-3})]$
$V = (0.001)[1.0057]$
$V = 0.0010057\ m^3$
$V = 0.0010057 \times 10^6\ cm^3 = 1005.7\ cm^3$

Q.5 a. Define friction. How friction opposes motion. Enlist two disadvantages of it? **(1+3+2)**

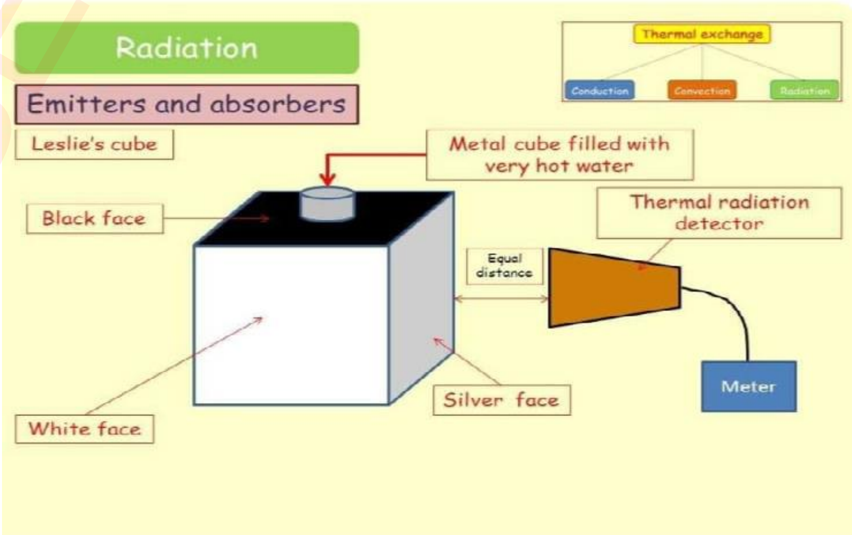
Answer:
Friction:
The force that opposes the motion of moving objects is called friction.
Causes of Friction:
No surface is perfectly smooth. A surface that appears smooth has pits and bumps that can be seen under a microscope. Following figure shows two wooden blocks with their polished surfaces in contact. A magnified view of two smooth surfaces in contact shows the gaps and contacts between them.



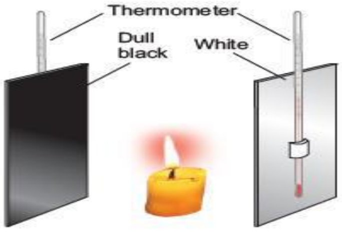
The contact points between the two surfaces form a sort of cold welds. These cold welds resist the surfaces from sliding over each other. Adding weight over the upper block increases the force pressing the surfaces together and hence, increases the resistance. Thus, greater is the pressing force greater will be the friction between the sliding surfaces.
Disadvantages:
i. It worn the tyres of vehicles.
ii. It rises temperature of the machines.

b. How various surfaces can be compared by a Leslie cube? **(4)**

Answer:
Leslie Cube:
A Leslie cube is a metal box having faces of different nature. The four faces of Leslie's cube may be as follows:
- A shining silvered surface
- A dull black surface
- A white surface
- A coloured surface



Hot water is filled in the Leslie's cube and is placed with one of its face towards a radiation detector. It is found that black dull surface is a good emitter of heat. The rate at which various surfaces absorb heat also depends upon the nature of those surfaces. For example, take two surfaces, one is dull black and the other is a silver polished surface as shown in the figure with a candle at the middle of the surface.



It is found that:
A dull black surface is a good absorber of heat as its temperature rises rapidly.
A polished surface is poor absorber of heat as its temperature rises very slowly.

Surfaces	Emitter	Absorber	Reflector
dull black surface	best	best	worst
coloured surface	good	good	bad
White surface	bad	bad	good
shining silvered surface	worst	worst	best

* * * * *