SUCCESS KEY TEST SERIES

First Term Examination [MODEL ANSWER]

Std: 11th Science | **Subject: Physics** | **Time: 3Hrs**

Date : | **Chapter 1 To 7** | **Max Marks: 70**

Section A (MCQ & VSA 1 MARKS Questions)

Q.1 Select and write the correct answer: **10**

(i) Ans. (c)

(ii) Ans. (c)

(iii) Ans. (d)

(iv) Ans. (d)

(v) Ans. (a)

(vi) Ans. (d)

(vii) Ans. (b)

(viii) Ans. (d)

(ix) Ans. (b)

(x) Ans. (c)

Q.2 Answer the following: **8**

(i) Ans. Displacement = Final position – Initial position
= 15 m – 12 m = 3 m
Path length = Total distance travelled = 3 m
In this case, the magnitude of displacement is equal to path length.

(ii) Ans. Newton's first law of motion defines inertia.

(iii) Ans. At equator $\Theta = 0$, $\cos \Theta = 1$, Therefore $g' = g - R\omega^2$.

(iv) Ans. Toughness is the ability of a material to resist fracturing when a force is applied to it.

(v) Ans. Zeroth law of thermodynamics states that when 2 bodies are in thermal equilibrium with a third body separately, then the two bodies are also in thermal equilibrium with each other.

(vi) Ans. Calculus is the study of continuous change in mathematical quantities.

(vii) Ans. The maximum value of stress up to which stress is directly proportional to strain is called the elastic limit.

(viii) Ans. Brick is a bad conductor of heat and hence, it reduces the flow of heat from the surroundings to the storage rooms.

Section B (SA I - 2 MARKS EACH)

Attempt any Eight: **16**

Q.3 Ans. The factors affecting the time period of a conical pendulum are:
(i) The length of the pendulum
(ii) The vertical distance of the horizontal circle

Q.4 Ans. Using $\frac{d}{dx}\left[\frac{f_1(x)}{f_2(x)}\right] = \frac{1}{f_2(x)}\frac{df_1(x)}{dx} - \frac{f_1(x)}{f_2^2(x)}\frac{df_2(x)}{dx}$

For $f_1(x) = x$ and $f_2(x) = \sin x$

$$\therefore \frac{d}{dx}\left(\frac{x}{\sin x}\right) = \frac{1}{\sin x} \text{ x } \frac{d(x)}{dx} - \frac{x}{\sin^2 x} \text{ x } \frac{d(\sin x)}{dx}$$

$$= \frac{1}{\sin x} \text{ x } 1 - \frac{x}{\sin^2 x} \text{ x } \cos x \quad \text{.... } [\because \frac{d}{dx}(\sin x) = \cos x]$$

$$= \frac{1}{\sin x} - \frac{x \cos x}{\sin^2 x}$$

Q.5 Ans. (i) The unit used for measuring length is metre.
(ii) The unit used for measuring mass is kilogram.
(iii) The unit used for measuring time is seconds.
(iv) The unit used for measuring temperature is Kelvin
Respectively as they are the fundamental units of measurement.

Q.6 Ans. (i) A vector having a unit magnitude in the given direction is called a unit vector.
(ii) Unit vectors are used to indicate the directions as they have magnitude as unity.

Q.7 Ans. For a lift moving with a net upward acceleration, the upward force is greater than the downward force, i.e.,

$$F = ma_u = N - mg$$

$$\therefore N = mg + ma_u, \text{ i.e., } N > mg$$

Hence the apparent weight of the body increases.

Q.8 Ans. i) Elastic collision : (b), (c), (f)
ii) Inelastic collision : (a)
iii) Perfectly inelastic collision : (d), (c)
iv) Head on collision : (c), (f)

Q.9 Ans. Given :

$L = 125$ m,

$r = 1 \text{ mm} = 1 \times 10^{-3}$ m

$l = 125.25 - 125 = 0.25$ m,

$F = 800$ N

To find the Young's modulus (Y) for the material of the wire, the formula to be used is:

$$Y = \frac{FL}{Al} = \frac{FL}{\pi r^2 l}$$

Calculation :

Using the formula,

$$Y = \frac{800 \times 125}{3.14 \times 10^{-6} \times 0.25} = 1.27 \times 10^{11} \text{ N/m}^2$$

Therefore, the Young's modulus of telephone wire is 1.27×10^{11} N/m².

Q.10 Ans. Given :

$(L_T)_i - (L_T)_{al} = 1.5$ m, $T_0 = 0\ ^\circ C$,

$\alpha_{al} = 24.5 \times 10^{-6} / ^\circ C$

$\alpha_i = 11.9 \times 10^{-6} / ^\circ C$

To find the length of aluminium and iron rod,

$(L_0)_{al}$ and $(L_0)_i$ the following formula is used:

$(L_T) = L_0[1 + \alpha(T - T_0)]$

Calculation :

For $T_0 = 0\ ^\circ C$

Using the formula,

$L_T = L_0(1 + \alpha T)$

For aluminimum

$(L_T)_{al} = (L_0)_{al}(1 + \alpha_{al} T)$ .... (i)

For iron

$(L_T)_i = (L_0)_i(1 + \alpha_i T)$ .... (ii)

Subtracting equation (2) by (1)

$$(L_T)_i - (L_T)_{al} = [(L_0)_i + (L_0)_i \alpha_i T] - [(L_0)_{al} + (L_0)_{al} \alpha_{al} T]$$

$$= (L_0)_i - (L_0)_{al} + [(L_0)_i \alpha_i - (L_0)_{al} \alpha_{al}]T$$

$$\therefore 1.5 = 1.5 + [(L_0)_i \alpha_i - (L_0)_{al} \alpha_{al}]T$$

$$\Rightarrow [(L_0)_i \alpha_i - (L_0)_{al} \alpha_{al}]T = 0$$

$$\therefore (L_0)_{al} \alpha_{al} = (L_0)_i \alpha_i$$

$$\therefore (L_0)_{al} = (L_0)_i \frac{\alpha_i}{\alpha_{al}}$$

$$= (L_0)_i \times \frac{11.9 \times 10^{-6}}{24.5 \times 10^{-6}}$$

$$= (L_0)_i \times \frac{17}{35}$$

$$(L_0)_{al} = \left[(L_0)_{al} + 1.5\right]\frac{17}{35}$$ .... [Given:

$\left[(L_T)_i - (L_T)_{al}\right] = 1.5$ m for all temperature]

$$\therefore\ 35(L_0)_{al} = 17(L_0)_{al} + 1.5 \times 17$$

$$\therefore\ 35(L_0)_{al} - 17(L_0)_{al} = 1.5 \times 17$$

$$\therefore\ 18(L_0)_{al} = 1.5 \times 17$$

$$\therefore (L_0)_{al} = \frac{1.5 \times 17}{18} = 1.417\,\text{m}$$

$$\therefore (L_0)_i = 1.5 + (L_0)_{al}$$

$$= 1.5 + 1.417$$

$$= 2.917\ \text{m}$$

Therefore, the length of aluminum rod at 0 °C is 1.417 m and that of iron rod is 2.917 m.

Q.11 Ans. Let $a_1, a_2, \ldots\ldots a_n$ be the accelerations of a system of point masses $m_1, m_2, \ldots\ldots m_n$. Acceleration of the centre of mass of the system is given by

$$\vec{a}_{cm} = \frac{\sum_{1}^{n} m_i \vec{a}_i}{\sum_{1}^{n} m_i} = \frac{\sum_{1}^{n} m_i \vec{a}_i}{M}$$

$$= \frac{\text{resultant force}}{\text{total mass}}$$

For continuous distribution,

$$\vec{a}_{cm} = \frac{\int \vec{a}\ dm}{M}$$

Q.12 Ans. Here the thermometric property P is the resistance. Using Equation,

$$T = \frac{100\ (P_T - P_1)}{(P_2 - P_1)}$$

If R is the resistance at 27 °C, we have

$$27 = \frac{100\ (R - 95.2)}{(138.6 - 95.2)}$$

$$\therefore\ R = \frac{27 \text{ x } (138.6 - 95.2)}{100} + 95.2$$

$$= 11.72 + 95.2 = 106.92\ \Omega$$

Q.13 Ans. (i) The friction between two bodies in contact when one body is rolled over the surface of the other is known as rolling friction.

(ii) The point of contact of the body rolling over the surface keeps changing this gives rise to rolling friction.

Q.14 Ans. (i) The change from solid state to vapour state without passing through the liquid state is called sublimation and the substance is said to sublime.

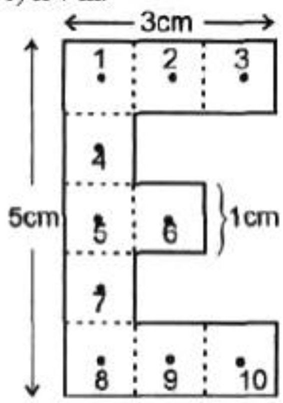
(ii) The triple point of water is that point where water in a solid, liquid and gas state co-exists in equilibrium and this occurs only at a unique temperature and a pressure.

Section C (SA II - 3 MARKS EACH)

Attempt any Eight: **24**

Q.15 Ans. As the sheet is uniform, each square can be taken to be equivalent to mass m concentrated at its respective centre. These masses will then be at the points labelled with numbers 1 to 10, as shown in figure. Let us select the origin to be at the left central mass m_5, as shown and all the co-ordinates to be in cm.

By symmetry, the centre of mass of m_1, m_2 and m_3 will be at m_2 (1, 2) having effective mass 3m. Similarly, effective mass 3m due to m_8, m_9 and m_{10} will be at m_9 (1, - 2). Again, by symmetry, the centre of mass of these two (3m each) will have co-ordinates (1, 0). Mass m_6 is also having co-ordinates (1, 0). Thus, the effective mass at (1, 0) is 7 m.



Using symmetry for m_4, m_5 and m_7, there will be effective mass 3m at the origin (0, 0).

Thus, effectively, 3m and 7m are separated by 1 cm along x-direction. Y-coordinate is not required.

$$x_c = \frac{m_1x_1 + m_2x_2}{m_1 + m_2}$$

$$= \frac{3\times 0 + 7\times 1}{3+7} = 0.7 \text{ cm}$$

Alternately, for two point masses, the centre of mass divides the distance between them in the inverse ratio of their masses. Hence, 1 cm is divided in the ratio 7:3.

$\therefore\ x_c = \frac{7}{7+3}\times 1 = 0.7$ cm from 3m, i.e., from the origin at m_c

Q.16 Ans. Let the vector be $\vec{w} = w_x\hat{i} + w_y\hat{j}$

Given:

$$|\vec{w}| = \sqrt{w_x^2 + w_y^2} = 10$$

$$\therefore w_x^2 + w_y^2 = 100 \quad \text{..........} \text{ (i)}$$

Also,

$\vec{v}\cdot\vec{w} = vw$ ...... ($\because |\vec{v}|$ and $|\vec{w}|$ are parallel vectors)

Substituting the values:

$$\Rightarrow \left(\hat{i} - 2\hat{j}\right)\cdot\left(w_x\hat{i} + w_y\hat{j}\right) = \sqrt{(1)^2 + (-2)^2} \times 10$$

$$\left(\because \quad |\vec{v}| = \sqrt{(1)^2 + (-2)^2}\right)$$

$$\therefore w_x - 2w_y = 10\sqrt{5}$$

$$\text{Or } w_x = 10\sqrt{5} + 2w_y \text{ ....} \text{ (ii)}$$

Substituting w_x in equation (i) using equation (ii),

$$\left(10\sqrt{5} + 2w_y\right)^2 + w_y^2 = 100$$

$$\therefore 500 + 40\sqrt{5}\, w_y + 4w_y^2 - 100 = 0$$

$$\therefore 5w_y^2 + 40\sqrt{5}\, w_y + 400 = 0$$

$$\therefore w_y^2 + 8\sqrt{5}\, w_y + 80 = 0$$

From the factorization formula,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$w_y = \frac{-8\sqrt{5} \pm \sqrt{\left(8\sqrt{5}\right)^2 - 4\times1\times80}}{2\times1}$$

$$= w_y = \frac{-8\sqrt{5} \pm 0}{2} = -4\sqrt{5} = \frac{-20}{\sqrt{5}}$$

Now from equation (ii),

$$w_x = 10\sqrt{5} + 2\left(\frac{-20}{\sqrt{5}}\right)$$

$$= 10\sqrt{5} - \frac{40}{\sqrt{5}}$$

$$= \frac{\left(10\sqrt{5} \times \sqrt{5}\right) - 40}{\sqrt{5}} = \frac{50 - 40}{\sqrt{5}} = \frac{10}{\sqrt{5}}$$

$$\therefore \vec{w} = w_x\hat{i} + w_y\hat{j} = \frac{10}{\sqrt{5}}\hat{i} - \frac{20}{\sqrt{5}}\hat{j}$$

Therefore the required vector is $\frac{10}{\sqrt{5}}\hat{i} - \frac{20}{\sqrt{5}}\hat{j}$

Q.17 Ans. Given :

Length, $l = 4.234$ m,

Breadth, $b = 1.005$ m,

Thickness, $t = 2.01$ cm $= 2.01 \times 10^{-2}$ m $= 0.0201$ m

The formula to be used for finding the area of sheet (A) and the volume of sheet (V) to correct significant figures are:

i. $A = 2(lb + bt + tl)$

ii. $V = l \times b \times t$

Using formula (i), we get areas as,

$A = 2(4.234 \times 1.005 + 1.005 \times 0.0201 + 0.0201 \times 4.234)$

$A = 8.721$ m^2

Using formula (i), we get volume as,

$V = 4.234 \times 1.005 \times 0.0201$

$= 0.085528917$ m^3

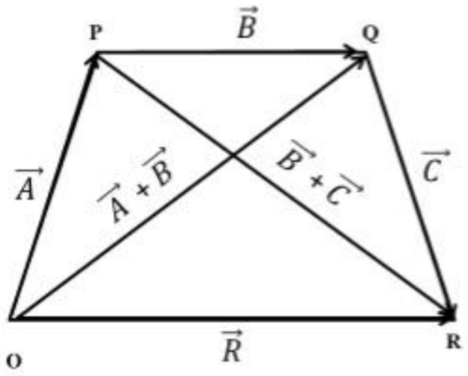
Up to correct significant figure (rounding off)

$V = 0.086$ m^3

i) Area of sheet to correct significant figures is 8.72 m^2. ii) Volume of sheet to correct significant figures is 0.086 m^3.

Q.18 Ans. If A, B and C are three vectors the,

$$\left(\vec{A}+\vec{B}\right)+\vec{C}=\vec{A}+\left(\vec{B}+\vec{C}\right)$$



The figure shows addition of three vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ in two different ways to give the resultant $\vec{R}$.

$\vec{R}=\left(\vec{A}+\vec{B}\right)+\vec{C}$ ....from triangle OQR

$\vec{R}=\vec{A}+\left(\vec{B}+\vec{C}\right)$ ....from triangle OPR

i.e., $\left(\vec{A}+\vec{B}\right)+\vec{C}=\vec{A}+\left(\vec{B}+\vec{C}\right)$

Q.19 Ans. Given :

$T_1 = 80\ ^\circ C$, $T_2 = 60\ ^\circ C$, $T_3 = 40\ ^\circ C$, $T_0 = 30\ ^\circ C$, $(dt)_1 = 6$ min.

To find the time taken in cooling $(dt)_2$, the formula to be used is:

$$\frac{dT}{dt}=C\left(T-T_0\right)$$

Calculation :

Using the formula,

$$\left(\frac{dT}{dt}\right)_1=C\left(T_1-T_0\right)$$

$$\therefore \frac{(80-60)}{6}=6\left(80-30\right)$$

$$\therefore \quad C=\frac{20}{6\times 50}=\frac{1}{15}\ /\text{min}$$

Now, $\left(\dfrac{dT}{dt}\right)_2=C\left(T_2-T_0\right)$

$$\therefore \frac{(60-40)}{(dt)_2}=\frac{1}{15}\left(60-30\right)$$

$$\therefore \quad (dt)_2=\frac{60-40}{30/15}=10\ \text{min}$$

$\boxed{\text{Therefore, the time taken in cooling is 10 min.}}$

Q.20 Ans. 1. The law of conservation of linear momentum states that the total momentum of an isolated system is conserved during any interaction.

2. It is a consequence of Newton's second law of motion which states that the resultant force is equal to the rate of change of linear momentum or F = dP/dt

3. In other words, if there is no resultant force, the linear momentum will not change or will remain constant or will be conserved.

4. Mathematically, if is constant (or conserved). This leads us to the law of conservation of momentum.

5. Collision of two balls conserves linear momentum.

6. Conservation of linear momentum holds good in the bursting of crackers.

Q.21 Ans. (i) Bulk modulus is the modulus of elasticity related to change in volume of an object due to applied deforming force.

(ii) Bulk modulus of elasticity is a property of solids, liquids and gases.

(iii) When a sphere made of rubber is completely immersed in a liquid, it will be uniformly compressed from all the sides. Let F be the compressive force. If the change in pressure on the sphere is dP and the corresponding change in volume is dV, then the volume strain is defined as:

$$\text{Volume strain} = \frac{\text{change in volume}}{\text{original volume}}$$

$$= -\frac{dV}{V}$$

(iv) The negative sign indicates that there is a decrease in volume.

(v) Bulk modulus defined as the ratio of volume stress to strain.

$$\text{Bulk modulus} = \frac{\text{volume stress}}{\text{volume strain}} = K$$

$$K = \frac{dP}{\left(\frac{dV}{V}\right)} = V\frac{dP}{dV}$$

(vi) The SI unit of bulk modulus is N/m^2.

(vii) Bulk modulus measures the resistance offered by gases, liquids or solids when a force is applied to change their volume.

Q.22 Ans. $\overrightarrow{v_1} = d\overrightarrow{x_1}/dt = 0$ as $\overrightarrow{x_1}$ does not depend on time t.

Thus, the particle is at rest.

$\overrightarrow{v_2} = d\overrightarrow{x_2}/dt = 5\hat{i} + 5\hat{j}$ m/s. $\overrightarrow{v_2}$ does not change with time. $\therefore\ \overrightarrow{a_2} = 0$

$v_2 = \sqrt{5^2 + 5^2} = 5\sqrt{2}$ m/s,

$\tan\theta = 5/5 = 1$ or $\theta = 45°$. Thus, the direction of v_2 makes an angle of 45° to the horizontal.

$\overrightarrow{v_3} = d\overrightarrow{x_3}/dt = 5\hat{i} + 20t\,\hat{j}$.

$\therefore\ v_3 = \sqrt{5^2 + (20t)^2}$ m/s. Its direction is along

$\theta = \tan^{-1}\left(\frac{20t}{5}\right)$ with the horizontal.

$$\overrightarrow{a_3} = \frac{d\overrightarrow{v_3}}{dt} = 20\hat{j}\ \text{m/s}^2$$

Thus, the particle 3 is getting accelerated along the y-axis at 20 m/s^2.

Q.23 Ans.

(i) $\int_0^{\pi/2} \sin x \, dx$

Using the relation:

$$\int_a^b f(x)\, dx = F(x)\Big|_a^b$$

$$\therefore \int_0^{\frac{\pi}{2}} \sin x \; dx = -\cos x\Big|_0^{\pi/2} = -\left[\cos\left(\frac{\pi}{2}\right) - \cos 0\right]$$

Now, $\cos\left(\frac{\pi}{2}\right) = 0$ and $\cos 0 = 1$

$$\boxed{\int_0^{\pi/2} \sin x \, dx = -(0-1) = 1}$$

$\int_1^5 x \, dx$

Using the relation:

$$\int_a^b f(x)\, dx = F(x)\Big|_a^b$$

We get:

$$\int_1^5 x \; dx = \frac{x^2}{2}\Big|_1^5$$

$$= \frac{5^2}{2} - \frac{1^2}{2}$$

$$= \frac{25-1}{2} = \boxed{12}$$

Q.24 Ans. (i) The specific heat capacity is defined as the amount of heat per unit mass absorbed or given out by the substance to change its temperature by one unit.

(ii) If ΔQ is the amount of heat absorbed or given out by a substance of mass m when it undergoes a temperature change ΔT, then the specific heat capacity of that substance is given by:

$$s = \frac{\Delta Q}{m\Delta T}$$

(iii) If m = 1 kg and $\Delta T = 1°C$, then $s = \Delta Q$.

(iv) The SI unit of specific heat capacity is J/kg°C or J/kg K and the C.G.S. unit is erg/g°C or erg/gK.

(v) The specific heat capacity is a property of the substance and weakly depends on the temperature of the substance.

Q.25 Ans. The frictional force, which balances the applied force when the body is static is called the static friction.

Static friction prevents the sliding motion of the object. Static friction opposes impending motion i.e., the motion that would take place in the absence of friction under the applied force.

The force of static friction is self-adjusting, which means that as the applied force increases the static frictional force increases to keep the body at rest.

The laws of static friction are:

1. The limiting force of static friction is directly proportional to the normal reaction between the two surfaces in contact.

$\therefore F_L \propto N$

$\therefore F_L = \mu_s N$

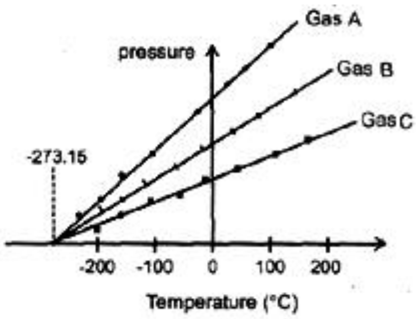
where, μ_s is the constant of proportionality and is called the coefficient of static friction.

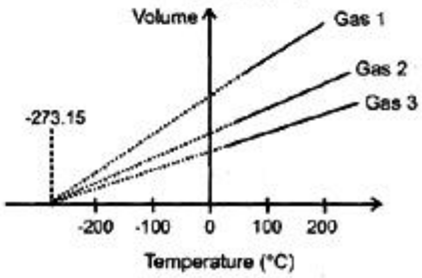
$\therefore \mu_s = \dfrac{F_L}{N}$

2. As long as the normal reaction remains the same, the limiting force of friction is independents of the apparent area between the surfaces in contact.

3. The force of limiting friction depends on the material in contact and the nature of the surfaces in contact.

Q.26 Ans. (i) The volume - temperature or pressure - temperature graphs for a gas are straight lines as shown.





(ii) But it can be seen from the graphs that the lines do not pass through the origin, i.e. have non-zero intercept along the y-axis.

(iii) If it is assumed that the gases do not liquefy even at low temperatures, one can extend the lines backwards for low temperature.

(iv) Now, if we extrapolate the graph of pressure P versus temperature Tc, the temperature of a gas where the pressure of a gas would become zero is -273.15°C.

(v) It can be seen that all the lines for different gases cut the temperature axis at the same point at -273.15°C.

(vi) This temperature is known as the absolute zero of temperature.

(vii) It is not possible to attain a temperature lower than this value.

Section D (SA II - 4 MARKS EACH)

Attempt any Three: **12**

Q.27 Ans. Let a particle is performing circular motion in a circular path of radius r, particle makes θ with centre of the circular path.

Let, angular velocity is ω, angular acceleration is α.

We know, $v = r\omega$

So, $\omega = r/v$

Also,

$\theta = \omega t$

$So, \dfrac{d\theta}{dt} = \omega$

Now, acceleration,

$a = \dfrac{dv}{dt}$

$a = \dfrac{dv}{d\theta}\left(\dfrac{d\theta}{dt}\right)$

$a = \dfrac{dv}{d\theta}\omega$

$a = v\omega$

$a = r\omega.\omega$

$\boxed{a = \omega^2 r}$

Q.28 Ans. Join $\overrightarrow{OB}$ to complete Δ OAB as shown in (a)

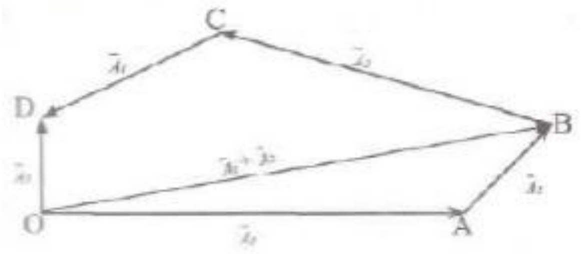


fig. (a)

Now, $\overrightarrow{OB} = \overrightarrow{OA} + \overrightarrow{AB} = \overrightarrow{A_1} + \overrightarrow{A_2}$

Join $\overrightarrow{OC}$ to complete triangle OBC as shown in (b).

Now, $\overrightarrow{OC} = \overrightarrow{OB} + \overrightarrow{BC} = \overrightarrow{A_1} + \overrightarrow{A_2} + \overrightarrow{A_3}$

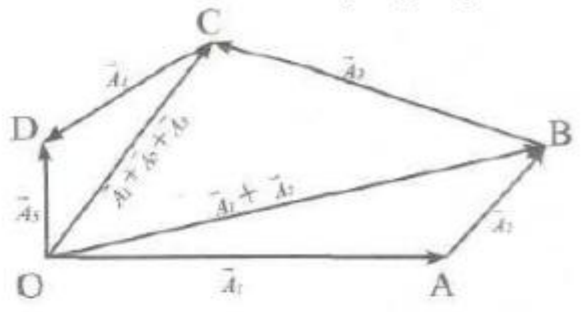


Fig. (b)

From triangle OCD,

$\overrightarrow{OD} = \overrightarrow{As} = \overrightarrow{OC} + \overrightarrow{CD} = \overrightarrow{A_1} + \overrightarrow{A_2} + \overrightarrow{A_3} + \overrightarrow{A_4}$

Thus $\overrightarrow{OD}$ is the resultant of the four vectors, $\overrightarrow{A_1}$, $\overrightarrow{A_2}$, $\overrightarrow{A_3}$ and $\overrightarrow{A_4}$, represented by

$\overrightarrow{OA}$, $\overrightarrow{AB}$, $\overrightarrow{BC}$ and $\overrightarrow{CD}$, respectively.

Q.29 Ans. (i) (a) For a given set of measurements of a quantity, the magnitude of the difference between mean value (Most probable value) and each individual value is called absolute error (Δa) in the measurement of that quantity.

(b) For a given set of measurements of a same quantity, the arithmetic mean of all the absolute errors is called mean absolute error in the measurement of that physical quantity.

(ii)

We know that,

$$R = 1.3 \times 10^{-16} \times A^{1/3}\ m$$

Now for A = 125

$$R = 1.3 \times 10^{-16} \times (125)^{1/3}$$

$$= 1.3 \times 10^{-16} \times 5$$

$$= 6.5 \times 10^{-16}$$

$$= 0.65 \times 10^{-15} m$$

$$\boxed{\therefore \text{ the order of magnitude} = -15}$$

Q.30 Ans. (i) If a body regains its original shape and size after removal of the deforming force, it is called an elastic body and the property is called elasticity.

(ii)

Given,

Volume of cube = $V = l^3 = (1)^3 = 1\ m^3$

Change in volume = $dV = 1.5 \times 10^{-5}\ m^3$

Bulk modulus = $K = 6.6 \times 10^{10}\ N/m^2$.

To find : Change in pressure dP

$$K = V\frac{dP}{dV}$$

$$dP = K\frac{dV}{V}$$

$$dP = \frac{6.6 \times 10^{10} \times 1.5 \times 10^{-5}}{1}$$

$$dP = 9.9 \times 10^{5}\ N/m^2.$$

Q.31 Ans. (i) 1. Work and energy are two sides of a coin. This statement can be justified as the work done by a force appears as the mechanical energy of the body.

2. Vice versa if an object is moving against a conservative force, the kinetic energy of the body decreases by an amount equal to the work done against the force.

(ii)

Given :

Height of the storage tank (h) = 10 m, ρ = 0.9 g/cc = 900 kg/m^3, g = 10 m/s^2

Volume of oil (V) = 40000 litre = $40000 \times 10^3 \times 10^{-6}$ m^3

= 40 m^3

Time (T) = 30 min = 1800 s

The formula to be used to find the power (P) is:

$$P = \frac{W}{t} = \frac{h\rho g V}{t}$$

Calculation:

Using the formula,

$$P = \frac{10 \times 900 \times 10 \times 40}{1800}$$

$\therefore$ P = 2000 W

$\therefore$ P = 2 kW

$\therefore$ the power of the pump is 2 kW.