Sir Syed University of Engineering & Technology

ANSWER SCRIPT

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Date

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Ques. 1 (a)

No, here, Gauss's law requires only net electric flux (E.da) is zero, because there may be a charge on the Surface which contributes no electric field.

yes, here, electric flux must be zero the converse is true. therefore no net charge contains inside the surface.

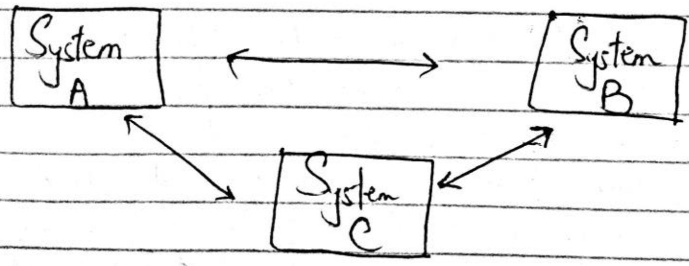
Ques 1 (b):-

Zeroth law of Thermodynamics:-

The zeroth law of thermodynamics is one of thermodynamics

Statement:-

If two systems A and B are in thermal equilibrium with a third system C, seperately then the system A and B will also be in thermal equilibrium with each other.



Example:-

When we have two glasses of water, One glass will have hot water and other will contain cold. Now we leave them in the table for few hours they will attain thermal equilibrium with the temperature of room.

Ques: ~~2~~ 1 (c):-

Ductile:-

A material that can be easy bent or material can be drawn into wires. Such material will undergo plastic deformation before fracture. Under tensile stress, percentage elongation before fracture is higher in these materials. Under tensile load, they can absorb more energy before fracture. Metal forming operations like rolling, drawing or bending can be made on such materials.

Example: copper, rubber, gold, silver and metals.

Brittle:-

Date

Ques. 2 (a)

Consewation of mass and conservation of Energy states that mass and Energy can neither be created nor be destroyed. these principle are more easily described by using the model of an ideal fluid which has zero viscosity and incompressible. the continuety of equation is a statement of the conservation of mass in a System

Let V_1 and V_2 be the average flow speeds at the cross sections of A_1 and A_2 of the pipe.

then

mass rate at one end = mass rate at another end

$$S_1 V_1 A_1 = S_2 V_2 A_2$$

Where SVA = mass rate

= desity × velocity × Area.

the momentum is also conserved

momentum at one end = normal another end.

ques 2 b

The best real engine will be a frictionless engine. The loss of energy due to the friction, visco-sity and insufficient combustion will reduce the efficiency of a heat engine from its ideal value.

We assume, then, the same idealiza-tion that we did when we studies the conservation of energy that is a perfectly frictionless engine. We must also consider the along of frictionless motion "frictionless" heat transfer. If we put a hot object at a high temperature against a cold object, so that the heat flows, then it is not possible to make that heat flows, then it is not possible to make that heat flows, then it is not possible to make that heat flow in a reverse direction by a very small change on the temperature of either object. But when we have a partically frictionless machine. if we push it with a little force the other way, it goes the other way. The fuels used by real engines like coal, gasoline or fissionable material are all free from friction. These fuels in the working substance. That is why for real engines, we are concerned to find suitable fuels such as coal, gasoline or fissionable mat-erial. But in the case of stones as a fuel. it will not free from friction That is why, we cannot use stone as a fuel in the real engine.

Qno: 3(a)

Gauss's Law is very helpful in determining expressions for the electric field.

Let us suppose charge q is uniformly distributed in a hypothetical spherical surface of radius a. Since electric field does not remain the same everywhere on the surface as it varies inversely with the square of radial distance so, we divide the whole surface into a large number of equal and small flat surfaces of area $\Delta A_1, \Delta A_2 \ldots$

Maximum electric flux passing through such surface is:

$$\phi_1 = E\Delta A_1$$

$$\phi_2 = E\Delta A_2$$

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$$\phi_N = E\Delta A_N$$

total flux is the sum of all flux passing through surface

$$\phi = \phi_1 + \phi_2 + \ldots\ldots + \phi_n$$

$$\phi = E\Delta A_1 + E\Delta A_2 + \ldots\ldots E\Delta A_N$$

$$\phi = E(\Delta A_1 + \Delta A_2 + \ldots\ldots \Delta A_N)$$

$$\phi = \Sigma E \Delta A$$

$$\phi = E \Sigma \Delta A$$

Where $\Sigma \Delta A$ is the area of Gaussian surface:

$= 4\pi r^2$

so,

$$\phi = E \times 4\pi r^2 \quad \text{— (1)}$$

According to Gauss's law.

$$\phi = \frac{q}{\epsilon_0} \quad \text{— (2)}$$

By equating eq (1) & (2)

We =

$$E \times 4\pi r^2 = \frac{q}{\epsilon_0}$$

$$E = \frac{1}{4\pi r^2} \frac{q}{\epsilon_0}$$

that is why we cannot use stone as a fuel in the real engine.

Ano: 3(b)

Dual Nature of Light:

light can behave both as a wave d particle. When we consider otoelectric effect, the electrons gets tted which is attributed to the rticle nature of light. On the ner hand, phenomenon like ffraction and interference shows

the behavior of light as waves.
When light get diffracted by a sharp edge, there is distribution of intensity and not a sharp rise or fall of intensity.
The single slit experiment is an example of diffraction of light and hence shows the wave nature of light.

The mathematical relation is
n x wavelength = ~~a x sin (theta)~~ a x sin θ

Where n is the order of the fridge. a is the slit width and θ depends on the order of diffraction we are analysing.

We have the central maxima in diffraction which is the region of maximum intensity. As we go towards the left or right of the central maxima, the intensity will keep reducing [illegible]

Date

Ques. 4 (a)

$A = 4 + y$
$y = 0 + 2 + 2 = 4$
$A = 8$

Data..

$\lambda = 742\ nm \Rightarrow 742 \times 10^{-9}\ m$
$\theta = 35^\circ$
$m_1 = 1$, $m_2 = 2$
$d = ?$, $\theta = ?$

Sol

$d \sin\theta_2 = m\lambda$

$d = \frac{m\lambda}{\sin\theta_2}$

$d = \frac{(2)(742 \times 10^{-9})}{\sin 35}$

$d = 2.58 \times 10^{-6}\ m$

$\sin\theta_1 = \frac{m_1\lambda}{d} \Rightarrow \frac{(1)(742 \times 10^{-9})}{2.58 \times 10^{-6}}$

$\sin\theta = 0.287$
$\theta = \sin^{-1}(0.287)$
$\boxed{\theta = 16.6^\circ}$ m

Date

Ques 4 (b)

Data:

$Q_H = 8\ kJ \Rightarrow 8 \times 10^3\ J$

$Q_L = 8+4 \rightarrow 12\ kJ \rightarrow 12 \times 10^3\ J$

$\eta = ?$

$W = ?$

Formula:

$$\eta = \left(\frac{Q_H - Q_L}{Q_H}\right) \times 100$$

$$W = Q_H - Q_L$$

Sol

$$\eta = \left(\frac{Q_H - Q_L}{Q_H}\right) \times 100$$

$$\eta = \left(\frac{8\times10^3 - 12\times10^3}{8\times10^3}\right) \times 100$$

$$\eta = \left(\frac{-4}{8}\right)\left(\frac{\times10^3}{\times10^3}\right) \times 100$$

$$\boxed{\eta = -50\ \%\quad Ans}$$

For W.

$W = Q_H - Q_L$

$W = 8\times10^3 - 12\times10^3$

$$\boxed{W = -4\times10^3\ kJ}\quad Ans$$

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Ques. 5 (a)

A = 4 + Y = 4 + 4 = 8.
m = 90 × 8 = 720

Data:-

$l = 530\ cm = 5.3 m$
$d = 0.25 cm = 0.25 \times 10^{-2} m$

Sol

Cross Section Area, $A = \pi d^2/4$

$= \frac{\pi \times (0.25 \times 10^{-2})}{4}$

$= 4.207 \times 10^{-6}\ m^2$

Young's modulus $Y = 5 \times 10^9$ Dyne/cm²
$= 5 \times 10^8\ N/cm^2$

Hanging mass = $m = 720g = \frac{720}{1000} = 0.72 kg$

Applied force = $F = mg = 0.72 \times 9.8 N$
$= \cancel{7.938}$ 7.056 N

∴ Stress = $\frac{F}{A}$ = $\frac{7.056 N}{4.208 \times 10^{-6}}$

= 1729411.765 N/m²

∴ Strain = $\frac{Stress}{Y} = \frac{1729411.765}{5 \times 10^8} = 3.45 \times 10^{-3}$

Dat

$$\Rightarrow \frac{\Delta\lambda}{0.25\times10^{-2}} = 3.78\times10^{-3}$$

$$\Delta\lambda = 9.45\times10^{-6}$$

$$\boxed{\Delta\lambda = 0.00945 \text{ mm}}$$ A