Test Your fiziks concepts!

Topic: Electromagnetic Theory

(For CSIR NET-JRF, GATE, JEST and TIFR Aspirants)

Q. Consider an electrostatic field $\vec{E}$ in a region of space. Identify the INCORRECT statement.

(a) The work done in moving a charge in a closed path inside the region is zero

(b) The curl of $\vec{E}$ is zero

(c) The field can be expressed as the gradient of a scalar potential

(d) The potential difference between any two points in the region is always zero

Ans.: (d)

Note:

For detailed solutions, visit the *Free Download* section at www.physicsbyfiziks.com

Test Your fiziks concepts!

Topic: Solid State Physics

(For IIT-JAM, JEST, TIFR and CUET Aspirants)

Q. Arrange the following crystal structures in ascending order of their coordination number.

(A) Diamond (B) Sodium Chloride

(C) Cesium Chloride (D) Zinc with hexagonal closed packed structure

Choose the correct answer from the options given below:

(a) A, B, C, D (b) D, B, C, A

(c) B, A, D, C (d) C, B, D, A

Ans.: (a)

Solution.:

(A) Diamond**-4**

(B) Sodium Chloride**-6**

(C) Cesium Chloride**-8**

(D) Zinc with hexagonal closed packed structure**-12**

Note:

For detailed solutions, visit the *Free Download* section at www.physicsbyfiziks.com

Test Your fiziks concepts!

Topic: Mechanices

(For PGT: KVS, NVS, DSSSB, State Education Boards, etc.)

Q. A skater is using very low-friction rollerblades. A friend throws a Frisbee straight at her. In which case does the Frisbee impart the greatest impulse to the skater:

(a) she catches the Frisbee and holds it

(b) she catches it momentarily but drops it

(c) she catches it and at once throws it back to her friend

(d) she can't catch it at all

Ans.: (c)

Solution.: Impulse = change in momentum of the Frisbee.

(a) catches and holds it:

Frisbee momentum changes from initial to zero, so impulse $= m\Delta v$

(b) catches momentarily but drops it:

final momentum is not zero (since it drops), so less momentum change.

(c) catches and throws it back:

changes Frisbee momentum from initial to opposite direction, so impulse magnitude $= m\left(v_f - v_i\right)$ with sign reversal, which is **larger** than just stopping it.

(d) can't catch it:

impulse almost zero relative to her.

Note:

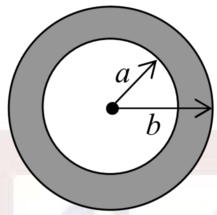
For detailed solutions, visit the *Free Download* section at www.physicsbyfiziks.com

Test Your fiziks concepts!

Topic: Electromagnetic Theory

(For CSIR NET-JRF, GATE, JEST and TIFR Aspirants)

Q. A hollow spherical shell carries charge density $\rho = \frac{k}{r^2}$ in the region $a \le r \le b$.



Then the potential at the center is:

(a) $\frac{k}{\varepsilon_0}\left(\frac{b}{a}\right)$ (b) $-\frac{k}{\varepsilon_0}\left(\frac{b}{a}\right)$ (c) $\frac{k}{\varepsilon_0}\ln\left(\frac{b}{a}\right)$ (d) $-\frac{k}{\varepsilon_0}\ln\left(\frac{b}{a}\right)$

Ans.: (c)

Solution.:

$$r < a: \left|\vec{E}\right| = 0, \quad a < r < b: \vec{E} = \frac{k}{\varepsilon_0}\left(\frac{r-a}{r^2}\right)\hat{r}, \quad r > b: \vec{E} = \frac{k}{\varepsilon_0}\left(\frac{b-a}{r^2}\right)\hat{r}$$

$$V(0) = -\int_{\infty}^{0} \vec{E}.d\vec{l} = -\int_{\infty}^{b} \frac{k}{\varepsilon_0}\left(\frac{b-a}{r^2}\right)dr - \int_{b}^{a} \frac{k}{\varepsilon_0}\left(\frac{r-a}{r^2}\right)dr - \int_{a}^{0}(0)\,dr$$

$$V(0) = \frac{k}{\varepsilon_0}\left(\frac{b-a}{b}\right) - \frac{k}{\varepsilon_0}\left[\ln\left(\frac{a}{b}\right) + a\left(\frac{1}{a} - \frac{1}{b}\right)\right] \Rightarrow V(0) = -\frac{k}{\varepsilon_0}\ln\left(\frac{a}{b}\right) = \frac{k}{\varepsilon_0}\ln\left(\frac{b}{a}\right)$$

Note:

For detailed solutions, visit the *Free Download* section at www.physicsbyfiziks.com

H.No. 40-D, G.F., Jia Sarai, Near IIT, Hauz Khas, New Delhi-16
Phone: 011-26865455/+91-9871145498, Website: www.physicsbyfiziks.com, Email: fiziks.physics@gmail.com

Test Your fiziks concepts!

Topic: Solid State Physics

(For IIT-JAM, JEST, TIFR and CUET Aspirants)

Q. The first maxima for Bragg's diffraction pattern by a crystal is observed at 30° when X-rays wavelength of $0.32\,nm$ are used. The distance between the atomic planes is:

(a) $0.32\,nm$ (b) $0.48\,nm$ (c) $0.84\,\text{Å}$ (d) $0.48\,\text{Å}$

Ans.: (a)

Solution.: $2d\sin\theta = n\lambda \Rightarrow \lambda = 2d\sin 30^0 \Rightarrow d = \lambda = 0.32\,nm$ $\because n = 1$

Note:

For detailed solutions, visit the *Free Download* section at www.physicsbyfiziks.com

Test Your fiziks concepts!

Topic: Mechanics

(For PGT: KVS, NVS, DSSSB, State Education Boards, etc.)

Q. The engine of a rocket in outer space, far from any planet is turned on. The rocket ejects burnt fuel at constant rate. In the first second of firing, it ejects 1/100 of its initial mass at relative speed of $2000\,m/s$. The initial acceleration of the rocket is:

(a) $5\ m/s^2$ (b) $-10\ m/s^2$ (c) $+20\ m/s^2$ (d) $-30\,m/s^2$

Ans.: (c)

Solution.: Rocket thurst equation: Thurst $F = v_{exhaust} \times \frac{dm}{dt}$ and acceleration $a = \frac{F}{M}$.

Here $v_{exhaust} = 2000\,m/s$, $\Delta m = \frac{1}{100}M_0$ and $\Delta t = 1\,\text{sec}$, so $\frac{dm}{dt} \approx \frac{\Delta m}{1s} = \frac{M_0}{100}kg/s$

Thus $F = 2000 \times \frac{M_0}{100} = 20M_0\,N \Rightarrow a_0 = \frac{F}{M_0} = 20\,m/s^2$

Note:

For detailed solutions, visit the *Free Download* section at www.physicsbyfiziks.com

H.No. 40-D, G.F., Jia Sarai, Near IIT, Hauz Khas, New Delhi-16
Phone: 011-26865455/+91-9871145498, Website: www.physicsbyfiziks.com, Email: fiziks.physics@gmail.com