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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION

Solutions for sample question

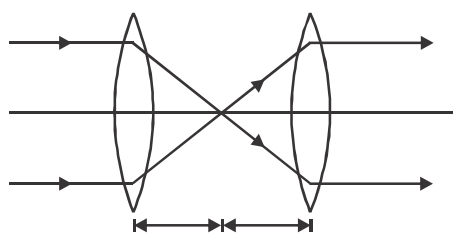
Class: 12 (PCB)

Biology

- (D)** The process mitogenesis, the notochord formation, takes place immediately after gastrulation.
- (B)** Von Baer's law was reinterpreted in the light of evolutionary theory by Muller and Haeckel (1864) and named as 'Bio-genetic law'
- (D)** HIV attaches to CD4 receptor site of helper T-cells by the help of GP120 on the protein coat of the virus.
- (B)** Five major classes of immunoglobulins are IgA, IgD, IgE, IgG and IgM.
- (C)** Mendel's law of inheritance (1866).
Chromosome theory of inheritance (1902).
DNA, hereditary material experiments (1944, 52)

Physics

- (B)** As shown in the figure the distance between the lenses should be 30 cm.



$$f_1 = 20 \text{ cm} \quad f_2 = 10 \text{ cm}$$

- (A)** $F = 6 \times 10^{-6} \text{ N}$
$$n = \frac{F}{3 \times 10^{-10}} = \frac{6 \times 10^{-6}}{3 \times 10^{-10}} = 2 \times 10^4$$
- (B)** Here, rate of production of energy at the atomic power house,
 $P = 400 \text{ MW} = 400 \times 10^6 \text{ J s}^{-1}$

Therefore, total energy produced in a day i.e., $24 \times 60 \times 60$ s,

$$E = P \times 24 \times 60 \times 60 = 400 \times 10^6 \times 24 \times 60 \times 60 = 3.456 \times 10^{13} \text{ J}$$

If mass of U^{235} consumed per day is m (in kg) so as to produce the required amount of energy, then

$$E = m c^2$$

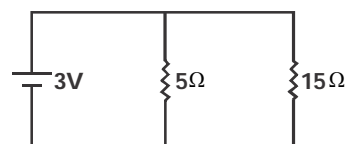
$$\text{or } 3.456 \times 10^{13} = m c^2$$

$$\text{or } m = \frac{3.456 \times 10^{13}}{c^2} = \frac{3.456 \times 10^{13}}{(3 \times 10^8)^2}$$

$$= 0.384 \times 10^{-3} \text{ kg} = 0.384 \text{ g}$$

- (B)** Polarity of emf will be opposite in the two cases while entering and while leaving the coil. Only in option (B) polarity is changing.
- (B)** Equivalent resistance in series is sum of individual resistances.

In the given figure 3 resistors of 5Ω are connected in series.



$$\therefore R' = 5 + 5 + 5 = 15 \Omega$$

This 15Ω resistor is connected with the 5Ω resistor in parallel hence, equivalent resistance now is

$$\frac{1}{R''} = \frac{1}{15} + \frac{1}{5}$$

$$\frac{1}{R''} = \frac{5 + 15}{5 \times 15}$$

$$\Rightarrow R'' = 3.75 \Omega$$

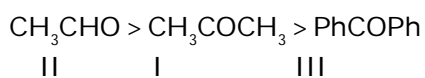
From Ohm's law, $V = IR$

$$\therefore I = \frac{V}{R} = \frac{3}{3.75} = 0.8 \text{ A}$$

Chemistry

11. (C) Ketones are less reactive than aldehydes.

The aromatic aldehydes and ketones are less reactive than the aliphatic aldehydes and ketones. So



12. (C) Doping of Si with P gives extra electrons while doping with Al gives rise to holes.

13. (C) Vapour pressure of pure, $P_A^0 = 40 \text{ mm Hg}$

Vapour pressure of A in solution, $P_A = 32 \text{ mm Hg}$

According to the Raoult's law,

$$P_A = P_A^0 X_A$$

Then,
$$X_A = \frac{P_A}{P_A^0} = \frac{32 \text{ mm Hg}}{40 \text{ mm Hg}} = 0.8$$

14. (C) $\text{PH}_3(\text{g}) + 4\text{Cl}_2(\text{g}) \rightarrow \text{PCl}_5 + 3\text{HCl}(\text{g})$
Phosphine

15. (C) Cell potential

$$= E_{\text{Red}}^0(\text{RHS}) - E_{\text{Red}}^0(\text{LHS})$$

$$= 0.34 - (-0.76) = + 1.10 \text{ V}$$