AIEEE Test Paper (Answer Key)

1. (C)	**2.** (B)	**3.** (A)	**4.** (C)	**5.** (C)	**6.** (A)
7. (A)	**8.** (A)	**9.** (B)	**10.** (D)	**11.** (C)	**12.** (A)
13. (B)	**14.** (B)	**15.** (B)	**16.** (C)	**17.** (A)	**18.** (D)

Solution

PHYSICS

1. $a = \frac{F_0}{m}\cos\left(\frac{\pi}{2}t\right)$

$\int_0^0 dv = \frac{F_0}{m}\int_0^{t_0}\cos\left(\frac{\pi}{2}t\right)dt \Rightarrow 0 = \frac{F_0}{m(\pi/2)}\sin\left(\frac{\pi}{2}t_0\right)$

$\Rightarrow t_0 = 2$ sec

$\frac{dx}{dt} = v = \frac{F_0}{m(\pi/2)}\sin(\frac{\pi}{2}t)$

$\int_0^x dx = \frac{2F_0}{\pi m}\int_0^2 \sin\left(\frac{\pi}{2}t\right)dt \Rightarrow x = \frac{8F_0}{m\pi^2}$

4. If q charge flows to the ground

Then $V = \frac{k(Q-q)}{a} - \frac{kQ}{b} = 0$

$\Rightarrow \frac{Q}{a} - \frac{q}{a} - \frac{Q}{b} = 0$

$Q - \frac{a}{b}Q = q$

$\therefore \quad q = Q\left[1 - \frac{a}{b}\right]$

5. Combination of two prisms and one glass plate

Mathematics

7. (A) Let z be a complex number stisfying $z^5 = (z-1)^5$

$\Rightarrow \quad |z^5| = |(z-1)^5| \Rightarrow |z|^5 = |z-1|^5$

$\Rightarrow \quad |z| = |z-1| 1.$

Thus, z lies on the perpendicular bisector of the segment joining the origin and $A(1+i0)$ i.e. z lies on Re $(z) = 1/2$.

8. (A) Applying $R_3 \to R_3 - \cos\varphi R_1 + \sin\varphi R_2$,

we get $\Delta = \begin{vmatrix} \cos\theta & -\sin\theta & 1 \\ \sin\theta & \cos\theta & 1 \\ 0 & 0 & \sin\varphi - \cos\varphi \end{vmatrix}$

$= (\sin\varphi - \cos\varphi)(\cos^2\theta + \sin^2\theta)$

$= \sqrt{2}\left\{\frac{1}{\sqrt{2}}\sin\varphi - \frac{1}{\sqrt{2}}\cos\varphi\right\} = \sqrt{2}\sin(\phi - \pi/4)$

As $-1 \le \sin(\phi - \pi/4) \le 1$,

$-\sqrt{2} \le \sqrt{2}\sin(\varphi - \pi/4) \le \sqrt{2}$ or $-\sqrt{2} \le \Delta \le \sqrt{2}$.

9. (B) Since $f(4)=f(5)=f(6)=f(7)=0$, so by Rolle's theorem applied to the intervals $[4,5],[5,6][6,7]$ there exist $x_1 \in (4,5), x_2 \in (5,6), x_3 \in (6,7)$ such that $f'(x_1)=f'(x_2)=f'(x_3)=0$. Since f' is a polynomial of degree 3 so cannot have four roots.

10. (D) Since the given circle passes through the origin $p-3=0 \Rightarrow p=3$ and the equation of the given circle is

$x^2+y^2+9x-3y=0$

Equation of the tangent at the origin to this circle is

$9x-3y=0$ (i)

Let the equation of the required circle which also passes through the origin be

$x^2+y^2+2gx+2fy=0.$

Equation of the tangent at the origin to this circle is

$gx+fy=0$ (ii)

If (i) and (ii) represent the same line, then

$\frac{g}{9}=\frac{f}{-3}=k$ (say) (iii)

We are given that $\sqrt{g^2+f^2}=2\sqrt{\left(\frac{9}{8}\right)^2+\left(\frac{-3}{2}\right)^2}=\sqrt{81+9}$

From (iii) we get $|k|\sqrt{9^2+3^2}=\sqrt{90} \Rightarrow k=\pm 1$

For $k=1$,

$g=9, f=-3$ and the equation of the required circle is

$$x^2+y^2+18x-6y=0.$$

11. (C) $\because \sin^{-1}\left(\frac{2x}{1+x^2}\right)=\begin{cases}\pi-2\tan^{-1}x, & x>1\\ 2\tan^{-1}x, & -1\le x\le 1\\ -\pi-2\tan^{-1}x, & x<-1\end{cases}$

and $\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)=\begin{cases}2\tan^{-1}x, & x\ge 0\\ -2\tan^{-1}x, & x<0\end{cases}$

For $0<x<1$

$\sin^{-1}\left(\frac{2x}{1+x^2}\right)=\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$

Let $u=\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ and $v=\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$

$\therefore \frac{du}{dv}=1$ $(\because u=v)$

12. (A) The algebraic perpendicular distance from (2,1) to the line $3x-2y+1=0$ is $\frac{3(2)-2(1)+1}{\sqrt{(3)^2+(-2)^2}}=\frac{5}{\sqrt{13}}L_1$ (say) and the algebraic perpendicular distance from $(-3,5)$ to the line $3x-2y+1=0$

is $\frac{3(-3)-2(5)+1}{\sqrt{(3)^2+(-2)^2}}=-\frac{18}{\sqrt{3}}=L_2$ (say)

Here, $\frac{L_1}{L_2}<0$

$\therefore$ Given, points lie on opposite side of the line $3x-2y+1=0$

Chemistry

13. **(B)** $\Delta x=\Delta v=a$

$\Delta x.m\Delta v \ge \frac{h}{4\pi}$

$a^2m=\frac{h}{4\pi}$ or $a=\sqrt{\frac{h}{4\pi m}}$

$\Delta x=\sqrt{\frac{h}{4\pi}\times\frac{1}{m}}$

$\Delta x=\sqrt{\frac{\hbar}{2m}}$

[Here $\hbar=\frac{h}{2\pi}$]

14. **(B)** For the same cation, larger the size of anion, larger is the polarisability and hence higher is the covalent character.

15. **(B)** Because the equilibrium constant is increasing with increase in temperature, the forward reaction is endothermic.

16. **(C)** Lower the gold number, higher is the protective power.

17. **(A)** Let the ratio be a : b

The fraction of $X=\frac{a}{a+b}$ and the fraction of $Y=\frac{b}{a+b}$.

$$\left(\frac{a}{a+b}\right)\times 30-\left(\frac{b}{a+b}\right)\times 30=10$$

$$30a-30b=10a+10b$$

$$20a=40b$$

$$\frac{a}{b}=2$$

$\Rightarrow$ a:b = 2:1

18. **(D)**