

DAILY TEST SERIES FOR IIT-JEE 2009 FROM VIDYA DRISHTI

31.03.2009

Total time: 20 min

Multiple choice questions (one or more options may correct)

Physics

1. Coherent light consisting of two wavelengths $\lambda_1 = 4500 \text{ \AA}$ and $\lambda_2 = 6200 \text{ \AA}$ is sent through both slits of a Young's double slit apparatus. Then
 - (a) Central maxima for both wavelength will coincide
 - (b) The third order bright fringe of λ_1 will coincide with the fourth order bright fringe of λ_2 .
 - (c) The third order bright fringe of λ_2 will coincide with the fourth order bright fringe of λ_1 .
 - (d) The fringes of wavelength λ_1 will be wider than the fringes of wavelength λ_2 .
2. An X-ray tube operates at an accelerating potential of 20 kV. Which of the following wavelengths will be absent in the continuous spectrum of X-rays?
 - (a) 12 pm
 - (b) 75 pm
 - (c) 65 pm
 - (d) 95 pm

Chemistry

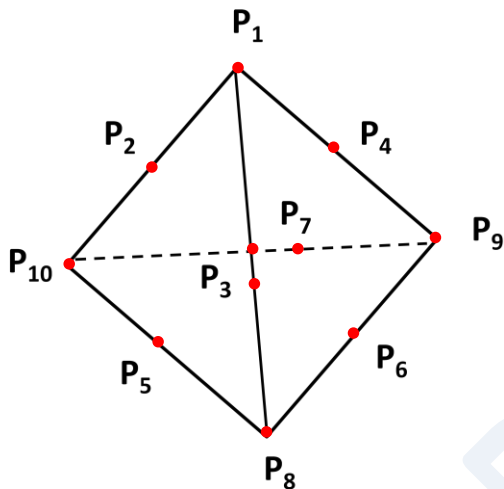
3. Potassium chromate solution is added to aqueous solutions of metal nitrate. The yellow precipitates thus obtained are insoluble in acetic acid. These are subjected to flame test, flame colour of individual ppt. is/are
 - (a) lilac
 - (b) apple green
 - (c) crimson red
 - (d) blue
4. Select the correct statement(s)
 - (a) In an ionic compound $AB (A^{2+}B^{2-})$ in the crystalline state, the coordination number of A^{2+} (present in void) will be 4 when the radius ratio $\frac{r_{B^{2-}}}{r_{A^{2+}}}$ is approximately in the range 0.225 to 0.414.
 - (b) The coordination number of each cation and anion in Aniflorite (A_2B type) are 4 and 8 respectively.
 - (c) Three radial nodes are present in $5p_x$ orbital.
 - (d) Solutions show larger negative deviations from ideality have a minimum in their vapour pressure curve as well as minimum in boiling curve.

DAILY TEST SERIES FOR IIT-JEE 2009 FROM VIDYA DRISHTI

31.03.2009

Mathematics

5. As shown in the diagram points P_1, P_2, \dots, P_{10} are either the vertices or the midpoints of the edges of a tetrahedron. Then the number of groups of four points (P_i, P_j, P_k, P_l) ($1 < i < j < k < l \leq 10$) on the same plane are
- (a) 30 (b) 33 (c) 36 (5) 39



6. If a, b, c be non-zero real roots such that

$$\int_0^1 (1 + \cos^8 x)(ax^2 + bx + c)dx = \int_0^2 (1 + \cos^8 x)(ax^2 + bx + c)dx = 0,$$

then equation $ax^2 + bx + c = 0$ has

- a) one root in $(1, 2)$
b) one root in $(0, 1)$
c) one root in $(-\infty, 1)$
d) one root in $(2, \infty)$

DAILY TEST SERIES FOR IIT-JEE 2009 FROM VIDYA DRISHTI

31.03.2009

SOLUTION:

Physics

1. (a), (c)

$$\Delta x = \frac{yd}{D}$$

For central maxima $\Delta x = 0$ and hence, $y = 0$. Does not depend on λ .

$$B = \frac{\lambda d}{D}$$

$$\frac{n\lambda_1 d}{D} = \frac{m\lambda_2 d}{D}$$

$$\Rightarrow n \times 4500 = m \times 6000$$

$$\Rightarrow 3n = 4m$$

$$\therefore n = 4, m = 3$$

2. (a)

For cutoff wavelength, we have

$$\frac{hc}{\lambda} = eV$$

$$\Rightarrow \lambda = \frac{hc}{eV} = 62 \text{ pm}$$

Thus minimum wavelength = 62 pm.

Clearly, 12 pm < 62 pm

Hence (a) is correct option.

Chemistry

3. (b), (d)

4. (a), (c)

Try to solve yourself.

Mathematics

5. (b)

DAILY TEST SERIES FOR IIT-JEE 2009 FROM VIDYA DRISHTI

31.03.2009

On each lateral face of the tetrahedron other than P_1 there are five points. Take any 3 out of these 5 and add P_1 to it (e.g., $P_1P_3P_4P_6$). So, there are in all $3 \times {}^5C_3$ groups of lateral faces. Apart from these, there are 3 points on each edge containing P_1 . When we add a midpoint taking from the edge on the base which is not on the same plane with the edge above, we obtain another required group (e.g. $P_1P_2P_6P_{10}$). There are three groups like these. So, total required groups = $3 \times {}^5C_3 + 3 = 33$

6. (a), (b)

Let

$$F(x) = \int (1 + \cos^8 x)(ax^2 + bx + c) dx$$

$$\Rightarrow F'(x) = (1 + \cos^8 x)(ax^2 + bx + c) \quad \dots(1)$$

According to given condition,

$$\int_0^1 (1 + \cos^8 x)(ax^2 + bx + c) dx = \int_0^2 (1 + \cos^8 x)(ax^2 + bx + c) dx = 0$$

$$\therefore F(1) - F(0) = 0 \Leftrightarrow F(1) = F(0)$$

$$\& F(2) - F(0) = 0 \Leftrightarrow F(2) = F(0)$$

$$\text{Hence, } F(1) = F(2) = F(0) \quad \dots(2)$$

By Rolle's theorem for $F(x)$ in $[0, 1]$

$$F'(\alpha) = 0 \text{ for atleast one } \alpha, 0 < \alpha < 1$$

& by Rolle's theorem for $F(x)$ in $[1, 2]$

$$F'(\beta) = 0 \text{ for atleast one } \beta, 1 < \beta < 2$$

Now,

$$F'(\alpha) = 0$$

$$\Rightarrow (1 + \cos^8 x)(ax^2 + bx + c) = 0$$

$$\Rightarrow 1 + \cos^8 x = 0$$

which is not possible.

DAILY TEST SERIES FOR IIT-JEE 2009 FROM VIDYA DRISHTI

31.03.2009

Therefore, $ax^2 + bx + c = 0$ which means α is a root of the equation $ax^2 + bx + c = 0$ so $a\alpha^2 + b\alpha + c = 0$.

Similarly, $F(\beta) = 0 \Leftrightarrow a\beta^2 + b\beta + c = 0$.

But, the equation $ax^2 + bx + c = 0$, being quadratic equation cannot have more than two roots.

Therefore equation $ax^2 + bx + c = 0$ has one root $0 < \alpha < 1$ and other root $1 < \beta < 2$.