

## MATHS

### BOOKS - SAI MATHS (TELUGU ENGLISH)

### EAMCET -2016 (TS)

#### Mathematics

1. If  $f(x) = x^2 - 2x + 4$  then the set of values of  $x$  satisfying

$$f(x - 1) = f(x + 1) \text{ is}$$

A.  $\{-1\}$

B.  $\{-1, 1\}$

C.  $\{1\}$

D.  $\{1, 2\}$

**Answer: C**



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2. The number of real linear functions  $f(x)$  satisfying

$$f(f(x)) = x + f(x) \text{ is}$$

A. 0

B. 4

C. 5

D. 2

**Answer: D**



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3. The remainder when  $7^n - 6n - 50 (n \in \mathbb{N})$  is divided by 36, is

A. 22

B. 23

C. 1

D. 21

**Answer: B**



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4. Consider the system of equations

$$ax + by + cz = 2$$

$$bx + cy + az = 2$$

$$cx + ay + bz = 2$$

Where  $a, b, c$  are real number such that  $a + b + c = 0$  Then the system

- A. has two solutions
- B. in inconsistant
- C. has unique solutions
- D. has infinitely many solutions

**Answer: B**



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5. Suppose  $A$  and  $B$  are two square matrices of same order. If  $A, B$  are symmetric matrices, then  $AB - BA$  is

- A. a symmetric matrix

B. a skew symmetric

C. a scalar matrix

D. a triangular matrix

**Answer: B**



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6. If  $A(x) = \begin{vmatrix} x + 1 & 2x + 1 & 3x + 1 \\ 2x + 1 & 3x + 1 & x + 1 \\ 3x + 1 & x + 1 & 2x + 1 \end{vmatrix}$  then  $\int_0^1 A(x) dx =$

A. 15

B.  $\frac{-15}{2}$

C. -30

D. -5

**Answer: B**



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7. If  $z = x + iy$  is a complex number such that  $z^{1/3} = a + ib$ ,

then the value of  $\frac{1}{a^2 + b^2} \left( \frac{x}{a} + \frac{y}{b} \right) =$

A. -1

B. -2

C. 0

D. 2

**Answer: B**



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8. The locus of  $z$ , satisfying  $|z| + |z - 1| = 3$  is

- A. a circle
- B. a pair of straight lines
- C. an ellipse
- D. a parabola

**Answer: C**



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9. If the point  $z = (1 + i)(1 + 2i)(1 + 3i) \dots (1 + 10i)$  lies on a circle

- A.  $10!$
- B.  $2 \times 3 \times 4 \times \dots \times 10$

C.  $2 \times 5 \times 10 \times \dots \times 101$

D.  $11!$

**Answer: C**



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**10.** The minimum value of  $|z - 1| + |z - 5|$  is

A. 5

B. 4

C. 3

D. 2

**Answer: B**



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11. The number of real roots of  $|x^2| - 5|x| + 6 = 0$  is

A. 2

B. 3

C. 4

D. 1

**Answer: C**



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12. If  $\alpha, \beta$  are the roots of  $x^2 - x + 1 = 0$  then the quadratic equation whose roots are  $\alpha^{2015}, \beta^{2015}$  is

A.  $x^2 - x + 1 = 0$

B.  $x^2 + x + 1 = 0$

C.  $x^2 + x - 1 = 0$

D.  $x^2 - x - 1 = 0$

**Answer: A**



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**13.** If  $\alpha, \beta, \gamma$  are roots of  $x^3 - 5x + 4 = 0$  then the quadratic equation whose roots are  $\alpha^{2015}, \beta^{2015}$  is

A. 12

B. 13

C. 169

D. 144

**Answer: D**



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14. Suppose  $\alpha, \beta, \gamma$  are roots  $x^3 + x^2 + 2x + 3 = 0$ . If  $f(x) = 0$  is a cubic polynomial equation whose roots are  $\alpha + \beta, \beta + \gamma, \gamma + \alpha$  then  $f(x) =$

A.  $x^3 + 2x^2 - 3x - 1$

B.  $x^3 + 2x^2 - 3x + 1$

C.  $x^3 + 2x^2 + 3x - 1$

D.  $x^3 + 2x^2 + 3x + 1$

**Answer: C**



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15. The number of 4 letter words that can be formed with the letters in the word EQUATION with at least one letter repeated is

- A. 2400
- B. 2408
- C. 2416
- D. 2432

**Answer: C**



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16. The number of divisors of  $7!$  is

- A. 24

B. 72

C. 64

D. 60

**Answer: D**



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17. The sum of the series

$$1 + \frac{2}{3} \left( \frac{1}{8} \right) + \frac{2 \times 5}{3 \times 6} \left( \frac{1}{8} \right)^2 + \frac{2 \times 5 \times 8}{3 \times 6 \times 9} \left( \frac{1}{8} \right)^2 + \dots$$

is

A.  $\frac{4}{3\sqrt{49}}$

B.  $\frac{3\sqrt{49}}{4}$

C.  $\frac{4}{3\sqrt{81}}$

D.  $\frac{3\sqrt{81}}{4}$

**Answer: A**



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18. If  $C$  denotes the binomial coefficient  ${}^n C_r$  then

$$(-1)C_0^2 + 2C_1^2 + 5C_2^2 + \dots + (3n - 1)C_n^2 =$$

A.  $(3n - 2)2nC_n$

B.  $\left(\frac{3n - n}{2}\right)2nC_n$

C.  $(5 + 3n)2nC_n$

D.  $\left(\frac{3n - 5}{2}\right)2nC_n$

**Answer: B**



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19.

$$\frac{x+1}{x^4(x+2)} = \frac{A}{x} + \frac{B}{x^2} + \frac{C}{x^3} + \frac{D}{x^4} + \frac{E}{x+2} \Rightarrow B + D + E =$$

A.  $A + C$

B.  $A - C$

C.  $2A + C$

D.  $2A + 2C$

**Answer: A**



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20. If  $\cos^3 \theta + \cos^3 \left( \frac{2\pi}{3} + \theta \right) + \cos^3 \left( \frac{4\pi}{3} + \theta \right) = a \cos 3\theta$ ,

then  $a =$

A.  $\frac{1}{4}$

B.  $\frac{3}{4}$

C.  $\frac{5}{4}$

D.  $\frac{7}{4}$

**Answer: B**



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21. 
$$\frac{\cos 13^\circ - \sin 13^\circ}{\cos 13^\circ + \sin 13^\circ} + \frac{1}{\cot 148^\circ} =$$

A. 1

B. -1

C. 0

D.  $\frac{1}{2}$



**Answer: C**



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**22.** If  $\cos x + \cos y + \cos \alpha = 0$  and  $\sin x + \sin y + \sin \alpha = 0$ ,

then  $\cot\left(\frac{x+y}{2}\right) =$

A.  $\sin \alpha$

B.  $\cos \alpha$

C.  $\tan \alpha$

D.  $\cot \alpha$

**Answer: D**



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23. If  $f(x) = \cos^2 x + \cos^2 2x + \cos^2 3x$ , then the number of values of  $x \in [0, 2\pi]$  for which  $f(x) = 1$  is `

A. 4

B. 6

C. 8

D. 10

**Answer: D**



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24. The value of  $x$  which satisfies

$$\sin(\cot^{-1} x) = \cos(\tan^{-1} + (1 + x))$$

A.  $-\frac{1}{2}$

B.  $\frac{1}{2}$

C.  $-1$

D.  $1$

**Answer: A**



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25. For  $\theta \in \left(0, \frac{\pi}{2}\right)$ ,  $\operatorname{sech}^{-1}(\cos \theta) =$

A.  $\log \left| \tan \left( \frac{\pi}{6} + \frac{\theta}{2} \right) \right|$

B.  $\log \left| \tan \left( \frac{\pi}{3} + \frac{\theta}{2} \right) \right|$

C.  $\log \left| \tan \left( \frac{\pi}{4} + \frac{\theta}{2} \right) \right|$

D.  $\log \left| \tan \left( \frac{\pi}{4} - \frac{\theta}{2} \right) \right|$

**Answer: C**



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26. If  $\triangle ABC$  is such that  $\angle A = 90^\circ$ ,  $\angle B \neq \angle C$ , then

$$\frac{b^2 + c^2}{b^2 - c^2} \sin(B - C) = .$$

A.  $\frac{1}{3}$

B.  $\frac{1}{2}$

C. 1

D.  $\frac{3}{2}$

**Answer: C**



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27. In  $\triangle ABC$ , if  $a^2 + b^2 + c^2 = 8R^2$ , then the triangle is

- A. right angled triangle
- B. equilateral triangle
- C. scalence triangle
- D. obtuse angled triangle

**Answer: A**



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**28.** In  $\triangle ABC$ , is  $2R + r = r_2$  then  $\angle B =$

- A.  $\frac{\pi}{3}$
- B.  $\frac{\pi}{4}$
- C.  $\frac{\pi}{6}$
- D.  $\frac{\pi}{2}$

Answer: D



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29.  $\Delta ABCFEF$  is a regular hexagon whose centre is O. Then

$$\overline{AB} + \overline{AC} + \overline{AD} + \overline{AE} + \overline{AF} =$$

A.  $2\overline{AO}$

B.  $3\overline{AO}$

C.  $5\overline{AO}$

D.  $6\overline{AO}$

Answer: D



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30. ABCD is a parallelogram and P is the mid point of the side AD. The line BP meets the diagonal AC in Q. Then the ratio  $AQ:QC=$ .

A. 1 : 2

B. 2 : 1

C. 1 : 3

D. 3 : 1

**Answer: A**



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31. The vectors

$$overl \in (2i) - \overline{3j} + \overline{k}, i - \overline{2j} + \overline{3k}, \overline{3i} + \overline{j} - \overline{2k}$$

A. are linearly dependent

B. are linearly independent

C. form sides of a triangle

D. are coplanar

**Answer: B**



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32.  $\bar{a}$ ,  $\bar{b}$ ,  $\bar{c}$  are three vectors such that  $|\bar{a}| = 1$ ,  $|\bar{b}| = 2$ ,  $|\bar{c}| = 3$  and  $\bar{b}$ ,  $\bar{c}$  are perpendicular. If projection of  $\bar{b}$  on  $\bar{a}$  is the same as the projection of  $\bar{c}$  on  $\bar{a}$ , then  $|\bar{a} - \bar{b} + \bar{c}| =$

A.  $\sqrt{2}$

B.  $\sqrt{7}$

C.  $\sqrt{14}$



D.  $\sqrt{21}$

**Answer: C**



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**33.** If  $\bar{a}, \bar{b}, \bar{c}$  are unit vectors satisfying the relation

$\bar{a} + \bar{b} + \sqrt{3}\bar{c} = 0$ , then the angle between  $\bar{a}$  and  $\bar{b}$  is

A.  $\frac{\pi}{6}$

B.  $\frac{\pi}{4}$

C.  $\frac{\pi}{3}$

D.  $\frac{\pi}{2}$

**Answer: C**



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34.  $\vec{a}$  is perpendicular to both  $\vec{b}$  and  $\vec{c}$ . The angle between  $\vec{b}$  and  $\vec{c}$  is  $\frac{2\pi}{3}$ . If  $|\vec{a}| = 2$ ,  $|\vec{b}| = 3$ ,  $|\vec{c}| = 4$ , then  $\vec{c} \cdot (\vec{a} \times \vec{b}) =$

A.  $18\sqrt{3}$

B.  $12\sqrt{3}$

C.  $8\sqrt{3}$

D.  $6\sqrt{3}$

**Answer: B**



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35. If the average of the first  $n$  numbers in the sequence 148, 146, 144,....., is 125, then  $n =$

A. 18

B. 25

C. 30

D. 36

**Answer: B**



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**36.** The standard deviation of  $a, a + d, a + 2d, \dots, a + 2nd$  is

A.  $nd$

B.  $n^2d$

C.  $\sqrt{\frac{n(n+1)}{3}}d$

$$D. \sqrt{\frac{n(n+3)}{3}}d$$

**Answer: C**



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**37.** Two events  $A$  and  $B$  are such that

$P(A) = \frac{1}{4}$ ,  $P(A | B) = \frac{1}{4}$  and  $P(B | A) = \frac{1}{2}$  Consider the

following statements :

(I)  $P(\bar{A} | \bar{B}) = \frac{3}{4}$

(II)  $A$  and  $B$  are mutually exclusive

(III)  $P(A | B) + P(A | \bar{B}) = 1$

Then

A. Only (I) is correct.

B. Only (I) and (II) are correct.

C. Only (I) and (III) are correct.

D. Only (II) and (III) are correct.

**Answer: A**



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**38.** A five digit number is formed by the digits 1,2,3,4, 5 with no digit being repeated. The probability that the number is divisible by 4, is

A.  $\frac{1}{5}$

B.  $\frac{2}{5}$

C.  $\frac{3}{5}$

D.  $\frac{4}{5}$

**Answer: A**



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**39.** When a pair of six faced fair dice are thrown, the probability that the sum of the numbers on the two dice is greater than 7, is

A.  $\frac{1}{3}$

B.  $\frac{5}{12}$

C.  $\frac{1}{2}$

D.  $\frac{1}{4}$

**Answer: B**



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40. In a family with 4 children, the probability that there are at least two girls is

A.  $\frac{1}{2}$

B.  $\frac{9}{16}$

C.  $\frac{3}{4}$

D.  $\frac{11}{16}$

**Answer: D**



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41. If on an average, out of 10 ships, one is drowned, then what is the probability that out of 5 ships atleast 4 reach safely ?

A.  $14(0.9)^5$

B.  $1.4(0.9)^5$

C.  $0.14(0.9)^4$

D.  $1.4(0.0)^4$

**Answer: D**



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**42.** If  $A(5, -4)$  and  $B(7, 6)$  are points in a plane, then the set of all points  $P(x,y)$  in the plane such that  $AP:PB = 2:3$  is

.

A. a circle

B. a hyperbola

C. an ellipse



D. a parabola

**Answer: A**



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**43.** If the axes are rotated anticlockwise through an angle  $90^\circ$  then the equation  $x^2 = 4ay$  is changed to the equation

A.  $y^2 = 4ax$

B.  $x^2 = -4ay$

C.  $y^2 = 4ax$

D.  $x^2 = 4ay$

**Answer: A**



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**44.** The combined equation of the straight lines of the form  $y = kx + 1$  (where  $k$  is an integer) such that the point of intersection of each with the line  $3x + 4y = 9$  has an integer as its  $x$  - coordinate is

A.  $(y + x + 1)(y + 2x - 1) = 0$

B.  $(y + x - 1)(y + 2x + 1) = 0$

C.  $(y + x + 1)(y + 2x + 1) = 0$

D.  $(y + x - 1)(y + 2x - 1) = 0$

**Answer: D**



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45. A value of  $k$  such that the straight lines  $y - 3kx + 4 = 0$  and  $(2k - 1)x - (8k - 1)y - 6 = 0$  are perpendicular is

A.  $\frac{1}{6}$

B.  $-\frac{1}{6}$

C. 1

D. 0

**Answer: A**



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46. The length of the segment of the straight line passing through  $(3,3)$  and  $(7,6)$  cut off by the coordinate axes is

A.  $\frac{4}{5}$

B.  $\frac{5}{4}$

C.  $\frac{7}{4}$

D.  $\frac{4}{7}$

**Answer: B**



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**47.** The equation of the pair of straight lines through the point (1,1) and perpendicular to the pair of straight lines

$$3x^2 - 8xy + 5y^2 = 0 \text{ is}$$

A.  $5x^2 + 8xy + 3y^2 - 14x - 18y + 16 = 0$

B.  $5x^2 + 8xy + 3y^2 - 18x - 14y + 16 = 0$

C.  $5x^2 - 8xy + 3y^2 - 18x - 14y + 32 = 0$

$$D. 5x^2 - 8xy + 3y^2 - 14x - 18 + 32 = 0$$

**Answer: B**



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**48.** The combined equation of the three sides of a triangle is  $(x^2 - y^2)(2x + 3y - 6) = 0$ . If the point  $(0, \alpha)$  lies in the interior of this triangle then

A.  $-2 < \alpha < 0$

B.  $-2 < \alpha < 2$

C.  $0 < \alpha < 2$

D.  $\alpha \geq 2$ .

**Answer: C**

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49. The point where the line  $4x - 3y + 7 = 0$  touches the circle  $x^2 + y^2 - 6x + 4y - 12 = 0$  is

A.  $(1, 1)$

B.  $(1, -1)$

C.  $(-1, 1)$

D.  $(-1, -1)$

**Answer: C**

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50. The normal to the circle given by  $x^2 + y^2 - 6x + 8y - 144 = 0$  at  $(8,0)$  meets the circle again at

the point

A.  $(2, -16)$

B.  $(2, 16)$

C.  $(-2, 16)$

D.  $(-2, -16)$

**Answer: D**



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**51.** For all real value of  $k$ , the polar of the point  $(2k, k - 4)$  with respect to  $x^2 + y^2 - 4x - 6y + 1 = 0$  passes through the point

A.  $(1,1)$

B. (1,-1)

C. (-3,1)

D. (3,1)

**Answer: D**



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52. If the circles  $x^2 + y^2 - 2\lambda x - 2y - 7 = 0$  and  $3(x^2 + y^2) - 8x + 29y = 0$  are orthogonal then  $\lambda =$

A. 4

B. 3

C. 2

D. 1



**Answer: D**



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**53.** The radical centre of the circles

$x^2 + y^2 = 1$ ,  $x^2 + y^2 - 2x - 3 = 0$  and

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

A. (1,1)

B. (1,-1)

C. (-1,1)

D. (-1,-1)

**Answer: D**



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54. From a point  $(C,0)$  three normals are drawn to the parabola  $y^2 = x$ . Then

A.  $C < \frac{1}{2}$

B.  $C = \frac{1}{2}$

C.  $C > \frac{1}{2}$

D.  $\frac{1}{2} > C > \frac{1}{4}$

**Answer: C**



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55. The point of intersection of the parabolas  $y^2 = 5x$  and  $x^2 = 5y$  lie on the line

A.  $x + y = 10$

B.  $x - 2y = 0$

C.  $x - y = 0$

D.  $2x - y = 0$

**Answer: C**



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56. If  $S$  and  $S'$  are the foci of the ellipse  $\frac{x^2}{25} + \frac{y^2}{16} = 1$  and if  $PSP'$  is a focal chord with  $SP = 8$  then  $SS' =$

A.  $4 + S'P$

B.  $S'P - 1$

C.  $4 + SP$

D.  $SP - 1$

**Answer: A**



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57. Let  $A(2 \sec \theta, 3 \tan \theta)$  and  $B(2 \sec \phi, 3 \tan \phi)$  where  $\theta + \phi = \frac{\pi}{2}$ , be two points on the hyperbola  $\frac{x^2}{4} - \frac{y^2}{9} = 1$ . If  $(\alpha, \beta)$  is the point of intersection of normals to the hyperbola at A and B, then  $\beta =$

A.  $\frac{-13}{3}$

B.  $\frac{13}{3}$

C.  $\frac{3}{13}$

D.  $\frac{-3}{13}$

**Answer: A**



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58. Point  $A(3, 2, 4)$ ,  $B\left(\frac{33}{5}, \frac{28}{5}, \frac{38}{5}\right)$ , and  $(9, 8, 10)$  are given.

The ratio in which B divides  $\overline{AC}$  is

A. 5 : 3

B. 2 : 1

C. 1 : 3

D. 3 : 2

**Answer: D**



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59. If the angle between the lines whose direction cosines are

$-\frac{2}{\sqrt{21}}, \frac{C}{\sqrt{21}}, \frac{1}{\sqrt{21}}$  and  $\frac{3}{\sqrt{54}}, \frac{3}{\sqrt{54}}, \frac{6}{\sqrt{54}}$  is  $\frac{\pi}{2}$ , then the

value of C is

A. 6

B. 4

C. -4

D. 2

**Answer: B**



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**60.** The image of the point  $(5,2,6)$  with respect to the plane

$$x + y + z = 9 \text{ is}$$

A.  $(3, -5, 2)$

B.  $\left(\frac{7}{2}, -1, 5\right)$

C.  $\left(\frac{7}{3}, -\frac{2}{3}, \frac{10}{3}\right)$

D.  $\left(\frac{7}{3}, \frac{2}{3}, -\frac{5}{3}\right)$ .

**Answer: C**



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61.  $\lim_{x \rightarrow \infty} \left[ \frac{x^2 + x + 3}{x^2 - x + 2} \right]^x =$

A.  $\infty$

B.  $c$

C.  $e^4$

D.  $e^2$

**Answer: D**



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62. The values of  $p$  and  $q$  so that the function

$$f(x) = \begin{cases} (1 + |\sin x|) \frac{p}{\sin x}, & \frac{\pi}{6} < x < 0 \\ q, & x = 0 \\ e^{\frac{\sin 2x}{\sin 3x}}, & 0 < x < \frac{\pi}{6} \end{cases} \text{ is continuous at}$$

$x = 0$  is

A.  $p = \frac{1}{3}, q = e^{2/3}$

B.  $p = 0, q = e^{2/3}$

C.  $p = \frac{2}{3}, q = e^{2/3}$

D.  $p = -\frac{2}{3}, q = e^{2/3}$

**Answer: D**



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63. If  $y = \tan^{-1} \left[ \frac{5 \cos x - 12 \sin x}{12 \cos x + 5 \sin x} \right]$ , then  $\frac{dy}{dx} =$

A. 1

B. -1

C. -2

D.  $\frac{1}{2}$

**Answer: B**



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64.  $\frac{d}{dx} y = \tan^{-1} \left[ \frac{\sqrt{1 + \sin x} - \sqrt{1 - \sin x}}{\sqrt{1 + \sin x} + (\sqrt{1 - \sin x})} \right] =$

A. 1

B.  $-\frac{1}{2}$

C.  $\frac{1}{2}$

D. -1

**Answer: C**



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65. If  $y = a \cos(\sin 2x) + b \sin(\sin 2x)$ , then  $y^n + (2 \tan 2x)y =$

A. 0

B.  $4(\cos^2 2x)y$

C.  $-4(\cos^2 2x)y$

D.  $(\cos^2 2x)y$

**Answer: C**



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**66.** The length of the segment of the tangent line to the curve  $x = a \cos^3 t, y = a \sin^3 t$ , at any point on the curve cut off by the coordinate axes is

A.  $4a$

B.  $a$

C.  $a^2$

D.  $2a$

**Answer: B**



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67. The area of the triangle formed by the positive  $x$ -axis, the tangent and normal to the curve  $x^2 + y^2 = 16a^2$  at the point  $(2\sqrt{2a}, 2\sqrt{2a})$  is

A.  $a^2$

B.  $16a^2$

C.  $4a^2$

D.  $8a$

**Answer: D**



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68. Define  $f(x) = \frac{1}{2}[|\sin x| + \sin x]$ ,  $0 < x \leq 2\pi$ . Then,  $f$  is

A. increasing in  $\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$

B. decreasing in  $\left(0, \frac{\pi}{2}\right)$  and decreasing in  $\left(\frac{\pi}{2}, \pi\right)$

C. increasing in  $\left(0, \frac{\pi}{2}\right)$  and decreasing in  $\left(\frac{\pi}{2}, \pi\right)$

D. increasing in  $\left(0, \frac{\pi}{4}\right)$  and decreasing in  $\left(\frac{\pi}{4}, \pi\right)$ .

**Answer: C**



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**69.** The smallest value of the constant  $m > 0$  for which

$$f(x) = 9mx - 1 + \frac{1}{x} \geq 0 \text{ for all } x > 0, \text{ is}$$

A.  $\frac{1}{9}$

B.  $\frac{1}{16}$

C.  $\frac{1}{36}$

D.  $\frac{1}{81}$

Answer: C



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$$70. \int \frac{(x^2 + 1)}{x^2 + 7x^2 + 1} dx =$$

A.  $\frac{1}{3} \tan^{-1} \left( \frac{x^2 - 1}{3x} \right) + c$

B.  $\tan^{-1} \left( \frac{x^2 - 1}{x} \right) + c$

C.  $\frac{1}{3} \tan^{-1} \left( \frac{x^2 - 1}{x} \right) + c$

D.  $\frac{1}{\sqrt{3}} \tan^{-1} \left( \frac{x^2 - 1}{x} \right) + c$

Answer: A



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$$71. \int \frac{x^3}{\sqrt{1+x}} dx =$$

$$A. \sqrt{1+x^2} - \frac{x}{3}(1+x^2)^{3/2} + c$$

$$B. x\sqrt{1+x^2} + \frac{2}{3}(1+x^2)^{3/2} + c$$

$$C. x^2\sqrt{1+x^2} - \frac{2}{3}(1+x^2)^{3/2} + c$$

$$D. x^2\sqrt{1+x^2} - \frac{1}{3}(1+x^2)^{1/2} + c.$$

**Answer: C**



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$$72. \int \frac{dx}{\cos(x+4)\cos(x+2)} =$$

$$A. \frac{1}{\sin 2} \log |\cos(x+4)^2| + c$$

$$B. \frac{1}{2} \log \left| \frac{\sec(x+2)}{\sec(x+4)} \right| + c$$

$$\text{C. } \frac{1}{\sin 2} \log \left| \frac{\sec(x+4)}{\sec(x+2)} \right| + c$$

$$\text{D. } \log \left| \frac{\sec(x+4)}{\sec(x+2)} \right| + c$$

**Answer: C**



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$$73. \int \frac{2x+2}{\sqrt{x^2-4x-5}} dx =$$

$$\text{A. } \sqrt{x^2-4x-5} + \log \left| x + \sqrt{x^2-4x-5} \right| + c$$

$$\text{B. } \log \left| \sqrt{x^2-4x-5} \right| + \sqrt{x^2-4x-5} + c$$

$$\text{C. } \sqrt{x^2-4x-5} + 6 \log \left| (x-2) + \sqrt{x^2-4x-5} \right| + c$$

$$\text{D. } 2\sqrt{x^2-4x-5} + 6 \log \left| (x-2) + \sqrt{x^2-4x-5} \right| + c$$

**Answer: D**



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74.  $\int_0^{\pi/4} \frac{\sin x + \cos x}{7 + 9 \sin 2x} dx =$

A.  $\frac{\log 3}{4}$

B.  $\frac{\log 3}{36}$

C.  $\frac{\log 7}{12}$

D.  $\frac{\log 7}{24}$

**Answer: D**



**View Text Solution**

75.  $\int_0^{\pi/4} [\sqrt{\tan x} + \sqrt{\cot x}] dx =$

A.  $\frac{\pi}{\sqrt{2}}$

B.  $\frac{\pi}{2}$

C.  $\frac{3\pi}{\sqrt{2}}$

D.  $\pi$

**Answer: A**



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**76.** If the area bounded by the curves  $y = ax^2$  and  $x = ay^2$ , ( $a > 0$ ) is 3 sq. units then the value of  $a$  is

A.  $\frac{2}{3}$

B.  $\frac{1}{3}$

C. 1

D. 4

**Answer: B**



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77. Let  $p \in IR$ , then the differential equation of the family of curves  $y = (\alpha + \beta x)3e^{px}$ , where  $\alpha, \beta$  are arbitrary constants, is

A.  $y^n + 4py^1 + p^2y =$

B.  $y^n - 2py^1 + p^2y = 0$

C.  $y^n + 2py^1 - p^2y = 0$

D.  $2^\epsilon + 2py^1 + p^2y = 0.$

**Answer: B**

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78. The solution of the differential equation  $3xy' - 3y + (x^2 - y^2)^{1/2} = 0$ , satisfying the condition  $y(1) = 1$  is

A.  $3 \cos^{-1}\left(\frac{y}{x}\right) = \ln|x|$

B.  $3 \cos\left(\frac{y}{x}\right) = \ln|x|$

C.  $3 \cos^{-1}\left(\frac{y}{x}\right) = 2 \ln|x|$

D.  $3 \sin^{-1}\left(\frac{y}{x}\right) = \ln|x|$

**Answer: A**

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79. The solution of the differential equation  $y^{-1} = \frac{1}{e^{-y} - x}$ ,  
is

A.  $x = e^{-y}(y + c)$

B.  $y + e^{-y} = x + c$

C.  $x = e^y(y + c)$

D.  $x + y = e^{-y} + c$

**Answer: A**



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Physics

1. Electron microscope is based on the principle of

- A. Photoelectric effect
- B. Wave nature of electron
- C. Superconductivity
- D. Laws of electromagnetic induction

**Answer: B**



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2. Force is given by the expression  $F = A \cos (Bx) + C \cos (Dt)$ , where  $x$  is displacement and  $t$  is time. The dimension of  $\frac{D}{R}$  is same as that of

- A. Velocity
- B. Velocity gradient

C. Angular momentum

D.

**Answer: A**



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3. A car accelerates from rest with  $2m/s^2$  on a straight line path and then comes to rest after applying brakes. Total distance travelled by the car is 100 m in 20 seconds. Then, the maximum velocity attained by the car is

A. 10m/s

B. 20m/s

C. 15m/s

D. 5m/s

**Answer: A**



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4. A body is falling freely from a point A at a certain height from the ground and passes through points, B,C and D (vertically as shown below) so that  $BC = CD$ . The time taken by the particle to move from B to C is 2 seconds and from C to D 1 second. Time taken to move from A to B in seconds is



A. 0.6

B. 0.5

C. 0.2

D. 0.4



**Answer: B**



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5. A particle moves from (1,0,3) to the point (-3,4,5) when a force  $F = \hat{i} + 5\hat{k}$  acts on it. Amount of work done in joules is

A. 14

B. 10

C. 6

D. 15

**Answer: C**



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6. A particle is projected with velocity  $2\sqrt{gh}$  and at an angle  $60^\circ$  to the horizontal so that it just clears two walls of equal height  $h$  which are at a distance  $2h$  from each other. The time taken by the particle to travel between these two walls is

A.  $2\frac{\sqrt{(2h)}}{g}$

B.  $\frac{\sqrt{(h)}}{2g}$

C.  $2\frac{\sqrt{(h)}}{g}$

D.  $\frac{\sqrt{(h)}}{g}$

**Answer: C**



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7. A body of mass 20kg is moving on a rough horizontal plane. A block of mass 3kg is connected to the 20kg mass by a string

of negligible mass through a smooth pulley as shown in the figure. The tension in the string is 27N. The coefficient of kinetic friction between the heavier mass and the surface is  $(g = 10\text{m/s}^2)$



- A. 0.025
- B. 0.035
- C. 0.35
- D. 0.25

**Answer: B**



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8. Two masses  $m_1$  and  $m_2$  are placed on a smooth horizontal surface and are connected by a string of negligible mass. A horizontal force  $F$  is applied on the mass  $m_2$  as shown in the figure. The tension in the string is



A.  $\left(\frac{m_1}{m_1 + m_2}\right)F$

B.  $\frac{m_2 F}{m_1 + m_2}$

C.  $\left(\frac{m_1}{m_2}\right)F$

D.  $\frac{m_2 F}{m_1}$

**Answer: A**



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9. A body of mass 3kg moving with a velocity  $(2\hat{i} + 2\hat{j} + 3\hat{k})$  m/s collides with another body of mass 4kg moving with a velocity  $(3\hat{i} + 2\hat{j} - 3\hat{k})$  m/s. The two bodies stick together after collision. The velocity of the composite body is

A.  $\frac{1}{7}(4\hat{i} + 6\hat{j} - 3\hat{k})$

B.  $\frac{1}{7}(18\hat{i} + 17\hat{j} - 3\hat{k})$

C.  $\frac{1}{7}(6\hat{i} + 4\hat{j} - 6\hat{k})$

D.  $\frac{1}{7}(9\hat{i} + 8\hat{j} - 6\hat{k})$

**Answer: B**



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10. A simple pendulum of length  $L$  carries a bob of mass  $m$ . when the bob is at its lowest position, it is given that the minimum horizontal speed necessary for it to move in a vertical circle about the point of suspension. When the string is horizontal, the net force on the bob is

A.  $\sqrt{10}mg$

B.  $\sqrt{5}mg$

C.  $4mg$

D.  $1mg$

**Answer: A**



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11. A system of two particles is having masses  $m_1$  and  $m_2$ . If the particle of mass  $m_1$  is pushed towards the centre of mass of particles through a distance  $d$ , by what distance the particle of mass  $m_2$  should be moved so as to keep the centre of mass of particles at the original position ?

A.  $\frac{m_1}{m_1 + m_2}d$

B.  $d$

C.  $\frac{m_1}{m_2}d$

D.  $\frac{m_2}{m_1}d$

**Answer: C**



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12. A thin uniform circular disc of mass  $M$  and radius  $R$  is rotating in a horizontal plane about an axis passing through its centre and perpendicular to its plane with an angular velocity  $\omega$ . Another disc of same thickness and radius but of mass  $\frac{1}{8} M$  is placed gently on the first disc coaxially. The angular velocity of the system is now

A.  $\frac{9}{8}\omega$

B.  $\frac{5}{9}\omega$

C.  $\frac{1}{3}\omega$

D.  $\frac{2}{9}\omega$

**Answer: A**



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13. 9 kg solution is poured into a glass U-tube as shown in the figure below. The tube's inner diameter is  $2\frac{\sqrt{\pi}}{5}m$  and the solution oscillates freely up and down about its position of equilibrium ( $x = 0$ ). The period of oscillation in seconds is (1  $m^3$  of solution has a mass  $\mu = 900kg$ .  $g = 10m/s^2$ , ignore frictional and surface tension effects).



A. 0.1

B. 10

C.  $\sqrt{\pi}$

D. 1

**Answer: A**



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14. The bodies of masses 100 kg and 8100 kg are held at a distance of 1 m. The gravitational field at a point on the line joining them is zero. The gravitational potential at the point in J/kg is  $\left(G = 6.67 \times 10^{-11} Nm^2/kg^2\right)$

A.  $-6.67 \times 10^{-7}$

B.  $-6.67 \times 10^{-10}$

C.  $-13.34 \times 10^{-7}$

D.  $-6.67 \times 10^{-9}$

**Answer: A**



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15. Uranium has two isotopes of masses 235 and 238 units. If both of them are present in uranium hexafluoride gas, find the

percentage ratio of difference in rms velocities of two isotopes to the rms velocity of heavier isotope.

- A. 1.64
- B. 0.064
- C. 0.64
- D. 6.4

**Answer: C**



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**16.** A source of frequency 340 Hz is kept above a vertical cylindrical tube closed at lower end. The length of the tube is 120 cm. Water is slowly poured in just enough to produce

resonance. Then, the minimum height (velocity of sound = 340 m/s) of the water level in the tube for that resonance is

A. 0.75m

B. 0.25m

C. 0.95m

D. 0.45m

**Answer: D**



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17. A thin convex lens of focal length  $f$  made of crown glass is immersed in a liquid of refractive index  $\mu_1$  ( $\mu_1 > \mu_c$ ) where  $\mu_c$  is the refractive index of the crown glass.

The convex lens now is

- A. A convex lens of longer focal length
- B. A convex lens of shorter focal length
- C. A divergent lens
- D. A convex lens of focal length  $(\mu_c - \mu_1)f$

**Answer: C**



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**18.** Two convex lenses of focal lengths  $f_1$  and  $f_2$  form images with magnification  $m_1$  and  $m_2$  when used individually for an object kept at the same distance from the lenses. Then  $f_1 / f_2$  is

- A.  $\frac{m_1(1 + m_1)}{m_2(1 + m_2)}$
- B.  $\frac{m_1(1 + m_2)}{m_2(1 + m_1)}$

C.  $\frac{m_2(1 + m_2)}{m_1(1 + m_2)}$

D.  $\frac{m_2(1 + m_2)}{m_1(1 + m_1)}$

**Answer:**



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**19.** With the help of telescope that has an objective of diameter 200 cm. it is proved that ligh of wavelengths of the order of 6400 Å coming from a star can be easily resolved. Then, the limit of resolution is

A.  $39 \times 10^{-4} deg$

B.  $39 \times 10^{-8} rad$

C.  $19.5 \times 10^{-8} rad$

D.  $19.5 \times 10^{-8} deg$

**Answer: B**



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**20.** Two charged identical metal spheres A and B repel each other with a force of  $3 \times 10^{-8} N$ . Another identical uncharged sphere C is touched with sphere A and then it is placed midway between A and B. Then the magnitude of net force on C is

A.  $1 \times 10^{-5} N$

B.  $3 \times 10^{-5} N$

C.  $2 \times 10^{-5} N$

D.  $5 \times 10^{-5} N$

**Answer: B**



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21. The electrostatic potential inside a charged sphere is given as  $V = Ar^2 + B$ , where  $r$  is the distance from the centre of the sphere,  $A$  and  $B$  are constant. Then, the charge density in the sphere is

A.  $16A \epsilon_0$

B.  $-6A \epsilon_0$

C.  $20A \epsilon_0$

D.  $-15A \epsilon_0$

**Answer: B**



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22. Two electric resistors have equal values of resistance  $R$ . Each can be operated with a power of 320 watts [w] at 220 volts. If the two resistors are connected in series to a 110 volts electric supply, then the power generated in each resistor is

A. 90 watts

B. 80watts

C. 60watts

D. 20watts

**Answer: D**



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23. A current of 1 A is flowing along the side of an equilateral triangle of side  $4.5 \times 10^{-2}$  m. the magnetic field at the centroid of the triangle is ( $\mu_0 = 4\pi \times 10^{-7} \text{H/m}$ )

A.  $4 \times 10^{-5} T$

B.  $2 \times 10^{-5} T$

C.  $4 \times 10^{-4} T$

D.  $2 \times 10^{-4} T$

**Answer: B**



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24. A charged particle (charges = q, mass = m) is rotating in a circle of radius R with uniform speed V ratio of its magnetic

moment ( $\mu$ ) to the angular momentum (L) is

A.  $\frac{q}{2m}$

B.  $\frac{q}{m}$

C.  $\frac{q}{4m}$

D.  $\frac{2q}{m}$

**Answer: A**



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**25.** Two small magnets have their masses and lengths in the ratio 1 : 2. the maximum torques experienced by them in a uniform magnetic field are the same. For small oscillations, the ratio of their time periods is

A.  $\frac{1}{2\sqrt{2}}$

B.  $\frac{1}{\sqrt{2}}$

C.  $\left(\frac{1}{2}\right)$

D.  $2\sqrt{2}$

**Answer: A**



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**26.** Two coils have mutual inductance  $0.005 \text{ H}$ . The current changes in the first coil according to equation  $I = I_0 \sin \omega t$ , where  $I_0 = 10 \text{ A}$  and  $\omega = 100\pi \text{ rad s}^{-1}$ . The maximum value of induced emf in the second coil is

A.  $5$

B.  $5\pi$

C.  $0.5\pi$

D.  $\pi$

**Answer: B**



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27. A capacitance of  $\left(\frac{10^{-3}}{2\pi}\right)$  F and an inductance of  $\left(\frac{100}{\pi}\right)$  mH and a resistance of  $10\Omega$  are connected in series with an AC voltage source of 220 V, 50 Hz. The phase angle of the circuit is  $60^\circ$

A.  $60^\circ$

B.  $30^\circ$

C.  $45^\circ$

D.  $90^\circ$

**Answer: C**



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**28.** Two equations are given below:

$$(A) \int E \cdot dA = \frac{Q}{\epsilon_0}$$

$$(B) \int B \cdot dA = 0$$

They are

A. (A)-Ampere's law

(B)-Gauss law for electricity

B. (A)-Gauss law for electric fields

(B)-Gauss law for magnetic fields

C. (A)-Faraday law

(B) - Gauss law for electric fields

D. Both (A) and (B) Faraday law

**Answer: B**



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**29.** A charged particle is accelerated from rest through a certain potential difference. The de-Broglie wavelength is  $\lambda_1$  when it is accelerated through  $V_1$  and is  $\lambda_2$  when accelerated through  $V_2$ . Then ratio  $\lambda_1 / \lambda_2$  is

A.  $V_1^{3/2} : V_2^{3/2}$

B.  $V_2^{1/2} : V_1^{1/2}$

C.  $V_1^{1/2} : V_2^{1/2}$

D.  $V_1^2 : V_2^2$

**Answer: B**



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**30.** If the first line of Lyman series has a wavelength  $1215.4 \text{ \AA}$ , the first line of Balmer series is approximately

A.  $4864 \text{ \AA}$

B.  $1025.5 \text{ \AA}$

C.  $6563 \text{ \AA}$

D.  $6400 \text{ \AA}$

**Answer: C**



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31. A certain radioactive element disintegrates with a decay constant of  $7.9 \times 10^{-10} / s$ . At a given instant of time, if the activity of the sample is equal to  $55.3 \times 10^{11}$  disintegration/second then number of nuclei at that instant of time is

A.  $7.0 \times 10^{21}$

B.  $4.27 \times 10^{13}$

C.  $4.27 \times 10^3$

D.  $6 \times 10^{23}$

**Answer: A**



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32. A semiconductor has equal electron and hole concentration of  $2 \times 10^8 m^{-3}$ . On doping with a certain impurity, the electron concentration increases to  $4 \times 10^{10} m^{-3}$ , then the new hole concentration of the semiconductor is

A.  $10^6 m^{-3}$

B.  $10^8 m^{-3}$

C.  $10^{10} m^{-3}$

D.  $10^{12} m^{-3}$

**Answer: A**



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33. A message signal of 12 kHz and peak voltage 20 V is used to modulate a carrier wave frequency 12 MHz and peak voltage 30 V. then, the modulation index is

A. 0.32

B. 6.7

C. 0.67

D. 67

**Answer: C**



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1. Assertion (A) Atoms with completely filled and half-filled subshells are stable.

Reason (R ) Completely filled and half filled subshells have symmetrical distribution of electrons and have maximum exchange energy.

The correct answers is

A. (A) and ( R) are correct , ( R) is the correct explanation of

(A)

B. (A) and ( R) are correct , ( R) is not correct explanation of

(A).

C. (A) is correct , but ( R ) is correct

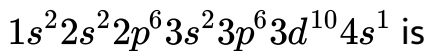
D. (A) is not correct, but ( R) is correct

**Answer: A**



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2. The element with the electronic configuration



A. Cu

B. Ca

C. Cr

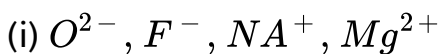
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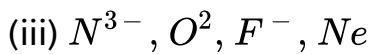
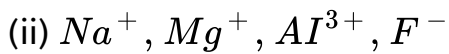
**Answer: A**



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3. Among the following the isoelectronic specie (S) is/are





A. (i) & (ii)

B. (i), (ii) & (iii)

C. (ii) & (iii)

D. (i) & (iii)

**Answer: D**



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**4. What is the atomic number of the element with symbol Uus?**

A. 117

B. 116

C. 115

D. 114

**Answer: A**



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5. 



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6. The order of covalent character of KF, KI

A.  $KCl < KF < KI$

B.  $KI < KCl < KF$

C.  $KF < KI < KCl$

D.  $KF < KCl < KI$

**Answer: D**



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7. If the kinetic energy in J, of  $CH_4$  (molar mass =  $16\text{g mol}^{-1}$ ) at T (K) is X, the kinetic energy in J, of  $O_2$  (molar mass =  $32\text{ g mol}^{-1}$ ) at the same temperature is

A. X

B. 2X

C.  $X^2$

D.  $\frac{X}{2}$

**Answer: A**



8. The given figure shows the Maxwell distribution of molecular speeds of a gas at three different temperatures  $T_1$ ,  $T_2$  and  $T_3$ . The correct order of temperature is :



A.  $T_1 > T_2 > T_3$

B.  $T_1 > T_3 > T_2$

C.  $T_3 > T_2 > T_1$

D.  $T_2 > T_3 > T_1$ .

**Answer: D**

9. In Haber's process 50.0g of  $N_2$  [g] and 10.0 g of  $H_2$  [g] are mixed to produce  $NH_3$  [g]. What is the number of moles of  $NH_3$  [g] formed?

A. 3.33

B. 2.36

C. 2.01

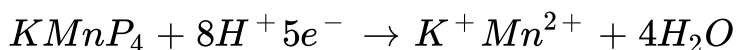
D. 5.36

**Answer: A**



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10. The following reaction occurs in acidic medium



what is the equivalent weight of  $KMnO_4$ ?

[Molecular weight of  $KMnO_4 = 158$ ]

- A. 79.0
- B. 31.6
- C. 158.0
- D. 39.0

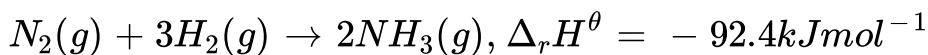
**Answer: B**



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11.

Given



What is the standard enthalpy of formation of  $NH_3$  gas ?

- A.  $-92$

B. + 46

C. + 92

D. - 46

**Answer: D**



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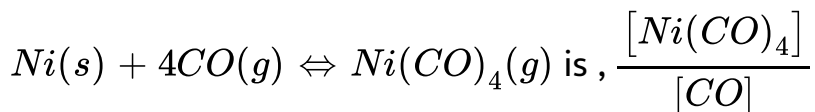
**12. Which one of the following is correct?**

A. The equilibrium constant ( $K_c$ ) is independent of temperature.

B. The value of  $K_c$  is independent of initial concentrations of reactants and products.

C. At equilibrium, the rate of the forward reaction is twice the rate of the backward reaction.

D. The equilibrium constant ( $K_c$ ) for the reaction



**Answer: A**



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**13.** pH of an aqueous solution of  $NH_4Cl$  is

A. 7

B.  $> 7$

C.  $< 7$

D. 1

**Answer: C**



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**14.** What is the change in the oxidation state of Mn in the reaction of  $MnO_4^-$  with  $H_2O_2$  in acidic medium?

A.  $7 \rightarrow 4$

B.  $6 \rightarrow 4$

C.  $7 \rightarrow 2$

D.  $6 \rightarrow 2$

**Answer: C**



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15. Which one of the following will not give flame test?

A. Ca

B. Ba

C. Sr

D. Be

**Answer: D**



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16. Which one of the following forms a basic oxide?

A. B

B. Tl

C. Al

D. Ga

**Answer: B**



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17. The gas produced by the passage of air over hot coke is

A. Carbon monoxide

B. Carbon dioxide

C. Producer gas

D. Water gas

**Answer: C**



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18. In environmental chemistry, the medium which is affected by a pollutant is called as the .....

A. Sink

B. Slag

C. Solvent

D. Receptor

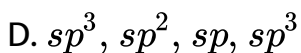
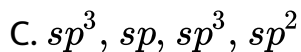
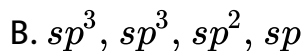
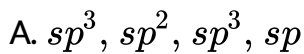
**Answer: D**



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19. The hybridisation of each carbon in the following compound is





**Answer: A**



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**20.** The product Z of the following reaction is





**Answer: B**

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21. The packing efficiency of simple cubic (sc.) body centred cubic (bcc) and cubic close packing (ccp) lattices follow the order

A.  $b < p < sc$

B.  $p < b < sc$

C.  $sc < p < b$

D.  $sc < b < p$

**Answer: D**

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22. The experimental depression in freezing point of a dilute solution is 0.025 K. if the van't hoff factor ( $i$ ) is 2.0 the calculated depression in freezing point (in K) is

A. 0.00125

B. 0.025

C. 0.0125

D. 0.05

**Answer: C**

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23. The molality of an aqueous dilute solution containing non-volatile solute is 0.1 m. What is the boiling temperature (in  $^{\circ}C$ ) of solution? (Boiling point elevation constant,  $k_b = 0.52 \text{ kg mol}^{-1} K$  boiling temperature of water =  $100.0^{\circ}C$ )

A. 100.0052

B. 100.052

C. 100.0

D. 100.52

**Answer: B**



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24. Which one of the following is an emulsion?

A. Milk

B. Soap lather

C. Butter

D. Vanishing Cream

**Answer: A**



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25. Copper matte contains

A.  $Cu_2O$ ,  $Cu_2S$

B.  $Cu_2O$ ,  $FeO$

C.  $Cu_2S, FeS$

D.  $Cu_2S, FeO$

**Answer: C**



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**26.** X reacts with dilute nitric acid to form laughing gas . What is X?

A. Cu

B.  $P_4$

C.  $S_8$

D. Zn

**Answer: D**



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27. Xenon reacts with fluorine at 873 K and 7 bar to form  $XeF_4$ .

In this reaction, the ratio of xenon and fluorine required is

A. 1 : 5

B. 10 : 1

C. 1 : 3

D. 5 : 1

**Answer: A**



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28. Which of the following metal ions has a calculated magnetic moment value of  $\sqrt{24}$  BM ?



**Answer: B**



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29. Which one of the following does not exhibit geometrical isomerism ?



B. Square planar complex with formula  $[MX_2L_2]$

C. Tetrahedral complex with formula  $[MABXL]$

D. Octahedral complex with formula  $[MX_2(L - L)_2]$

**Answer: C**



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**30.** The poly dispersity index (PDI) of a polymer is ( $\overline{M}_w$  = weight average molecular mass and  $\overline{M}_n$  number average molecular mass)

A. The product of  $\overline{M}_n$  and  $\overline{M}_w$

B. The sum of  $\overline{M}_n$  and  $\overline{M}_w$ .

C. The difference between  $\overline{M}_w$  and  $\overline{M}_n$

D. The ratio between  $\overline{M}_w$  and  $\overline{M}_w$ .

**Answer: D**



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**31.** Hormone that maintains the blood glucose level within the limit is

A. Thyroxine

B. Insulin

C. Testosterone

D. Epinephrine

**Answer: B**



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32. Chloroxylenol is an example of .....

- A. Antiseptic
- B. Antipyretic
- C. Analgesic
- D. Tranquilizer

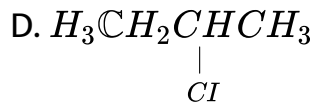
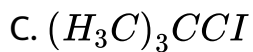
**Answer: A**



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33. Which one of the following has highest boiling point?

- A.  $H_3CCH_2CH_2CH_2Cl$
- B.  $(H_3C)_2CHCH_2Cl$



Answer: A



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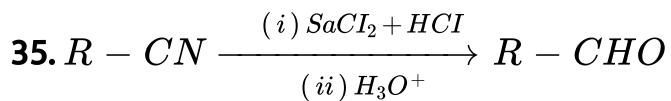
Identify X and Y from the following



Answer: B



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What is the name of the above reaction ?

- A. Rosenmund
- B. Williamson
- C. Stephen
- D. Kobe

**Answer: C**



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36. 

What are the structures of Y and Z ?

A. 

B. 

C. 

D. 

**Answer: D**



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