

## MET 2024 Memory Based Question Paper PDF

### Physics

1. If  $E$  = energy,  $G$  = gravitational constant,  $I$  = impulse and  $M$  = mass, then dimensions of  $\frac{GIM^2}{E^2}$  are same as that of

- A. time
- B. mass
- C. length
- D. force

2. Two points move in the same straight line starting at the same moment from the same point in it. The first moves with constant velocity  $u$  and the second with constant acceleration  $f$ . During the time elapses before the second catches, the first greatest distance between the particle is

- A.  $u/f$
- B.  $u^2/2f$
- C.  $f/2u^2$
- D.  $f/u^2$

3. A car turns on a banked road of radius 300 m . If the coefficient of friction between the tyres and the road is 0.3 , then maximum speed of the car on the turn is

[ Take ,  $g = 10 \text{ m/s}^2$  ]

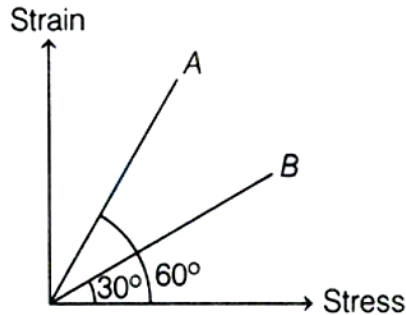
- A. 10 m/s
- B. 30 m/s
- C. 40 m/s
- D. 50 m/s

4. A particle is projected from the surface of the earth with an initial speed of  $4.0 \text{ km s}^{-1}$ . The maximum height (in km) attained by the particle is \_\_\_\_

[Radius of earth = 6400 km and  $g = 9.8 \text{ ms}^{-2}$ ]

### Numerical

5. The stress versus strain graphs for wires of two materials A and B are as shown in the figure. If  $Y_A$  and  $Y_B$  are the Young's moduli of the materials, then



A.  $Y_B = 2Y_A$

B.  $Y_A = Y_B$

C.  $Y_B = 3Y_A$

D.  $Y_A = 3Y_B$

6. Two pendulums of time periods 3 s and 7 s, respectively start oscillating simultaneously from two opposite extreme positions. After how much time they will be in same phase?

A.  $21/8$  s

B.  $21/4$  s

C.  $21/2$  s

D.  $21/10$  s

7. Fundamental frequency of a sonometer wire is  $n$ , if the tension is made 3 times and length and diameter are also increased 3 times, what is the new frequency?

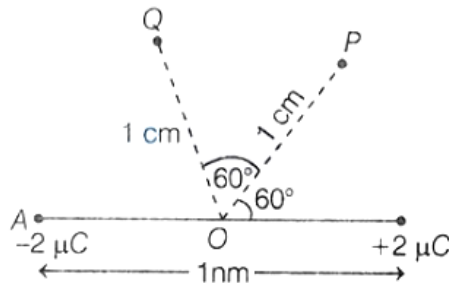
A.  $\frac{n}{3\sqrt{3}}$

B.  $3n$

C.  $\sqrt{3}n$

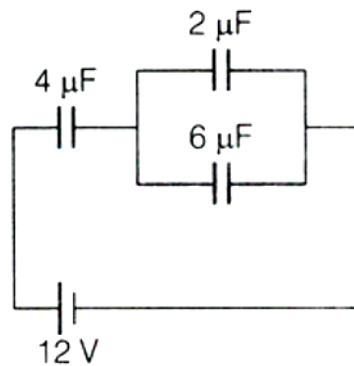
D.  $n/\sqrt{3}$

8. An electric dipole shown in the figure. Work done to move a charge particle of  $1\mu\text{C}$  from point Q to P is  $x \times 10^{-7}$  J, then the value of  $x$  is .....



Numerical

9. In the following circuit diagram, potential difference across  $4 \mu\text{F}$  capacitor is



- A.  $19 \text{ V}$
- B.  $14 \text{ V}$
- C.  $16 \text{ V}$
- D.  $8 \text{ V}$

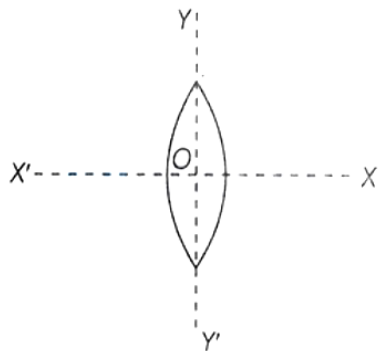
10. An electric kettle has two coils. When one coil is switched on, it takes  $10 \text{ min}$  to boil water and when the second coil is switched on it takes  $20 \text{ min}$  to boil same amount of water. The time taken by electric kettle to boil water when both coil are used in parallel, is found to be  $n$  second. Find the value of  $n$ .

Numerical

11. When  $100 \text{ V DC}$  is applied across a solenoid, a current of  $1 \text{ A}$  flows in it. When  $100 \text{ VAC}$  is applied across the same coil, the current drop is  $0.5 \text{ A}$ . If the frequency of the AC source is  $50 \text{ Hz}$ , then inductance of solenoid is found to be  $x \text{ mH}$ , then find the value of  $x$ .

Numerical

12. When a lens is cut into two halves along  $XOX'$ , then focal length of each half lens



- A. increases
- B. decreases
- C. remains same
- D. None of the above

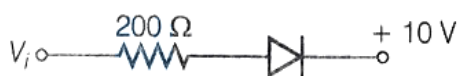
**13.** If the frequency of incident photon on metal surface is doubled, then stopping potential will become

- A. doubled
- B. less than double
- C. more than double
- D. less than existing value

**14.** If an electron in  $n = 4$  orbit of hydrogen atom jumps down to  $n = 3$  orbit, the amount of energy released and the wavelength of radiation emitted are

- A.  $0.66\text{eV}$ ,  $1.88 \times 10^{-6} \text{ m}$
- B.  $1.89\text{eV}$ ,  $1.98 \times 10^{-7} \text{ m}$
- C.  $0.29\text{eV}$ ,  $1.78 \times 10^{-5} \text{ m}$
- D.  $0.98\text{eV}$ ,  $0.93 \times 10^{-6} \text{ m}$

**15.** In the circuit shown below, the diode has  $20\Omega$  in forward bias resistance. When  $V_i$  increases from  $8 \text{ V}$  to  $12 \text{ V}$ , then change in the current is found to be  $x \text{ mA}$ . Find the value of  $x$ .



Numerical

## Chemistry

1. The wave number of the shortest wavelength of absorption spectrum of hydrogen atom is \_\_\_\_ (Rydberg constant =  $109700 \text{ cm}^{-1}$ ).

Numerical

2. Electronegativity of the following elements increases in the order

A. C, N, Si, P

B. N, Si, C, P

C. Si, P, C, N

D. P, Si, N, C

3. Match List-I with List-II.

| List-I<br>(Compound)        | List-II<br>(Hybridisation) |
|-----------------------------|----------------------------|
| A. $\text{CuCl}_5^{3-}$     | I. $sp^3d^2$               |
| B. $\text{MnCl}_5^{3-}$     | II. $d^2 sp^3$             |
| C. $\text{XeOF}_4$          | III. $dsp^3$               |
| D. $\text{Fe}(\text{CO})_5$ | IV. $sp^3d$                |

Choose the correct match from the options given below

A. A-IV, B-III, C-I, D-II

B. A-IV, B-III, C-II, D-I

C. A-IV, B-I, C-III, D-II

D. A-IV, B-II, C-III, D-I

4. The spin only magnetic moment of  $[\text{NiCl}_4]^{2-}$  is \_\_\_\_ (Nearest integer)

Numerical

5. The maximum work obtained from a reversible process is given as

A.  $-\Delta A$

B.  $\Delta A$

C.  $-\Delta G$

D.  $\Delta G$

6. If  $K_p$  for a reaction,

$A(g) + 2B(g) \rightleftharpoons 3C(g) + D(g)$  is 0.05 atm at 1000 K. Its  $K_c$  in term of  $R$  is  $\frac{x \times 10^{-5}}{R}$ . The value of  $x$  is \_\_\_\_\_

Numerical

7. Boiling point of water at 750 mm Hg is  $99.63^\circ\text{C}$ . The amount of sucrose that should be added to 500 g of water such that it boil at  $100^\circ\text{C}$  is \_\_\_\_\_ g. (nearest integer)

(Molar elevation constant for water =  $0.5 \text{ K kg/mol}$ )

Numerical

8. For the cell reaction,

$\text{Cu(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{Ag(s)}$   $E^\circ_{\text{cell}}$  is 0.46 V. The equilibrium constant of the reaction is

A.  $3.92 \times 10^{12}$

B.  $3.92 \times 10^{15}$

C.  $8.92 \times 10^{17}$

D.  $8.92 \times 10^{10}$

9. For a first order reaction, time required for 99% completion of a reaction is  $x$  times the time required for completion of 90%. The value of  $x$  is .....

Numerical

10.  $\text{F}_2$  is formed by reacting  $\text{K}_2\text{MnF}_6$  with

A.  $\text{SbF}_5$

B.  $\text{MnF}_3$

C.  $\text{KSbF}_6$

D.  $\text{MnF}_4$

11. Which of the following ion is colourless inspite of the presence of unpaired electrons?

A.  $\text{La}^{3+}$

B.  $\text{Eu}^{3+}$

C.  $\text{Gd}^{3+}$

D.  $\text{Lu}^{3+}$

12. The oxidation state of Cr in  $[\text{Cr}(\text{H}_2\text{O})_6] \text{Cl}_3$ ,  $[\text{Cr}(\text{C}_6\text{H}_6)_2]$ ,  $\text{K}_2[\text{Cr}(\text{CN})_2(\text{O})_2(\text{O}_2)(\text{NH}_3)]$  respectively are

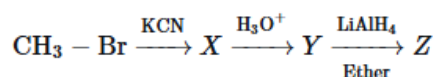
A. +3, +4, +6

B. +3, +2, +4

C. +3, 0, +6

D. +3, 0, +4

13. In the following sequence of reactions,



The final product Z is

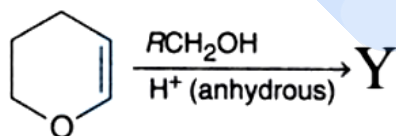
A. acetone

B. methane

C. acetaldehyde

D. ethyl alcohol

14. The major product Y in the following reaction is



A. hemiacetal

B. acetal

C. an ether

D. an ester

15. Consider the following amino acids.

(i) Lysine

(ii) Glutamine

(iii) Arginine

(iv) Leucine

(v) Serine

(vi) Proline

(vii) Valine

Which of the given amino acids are basic in nature?

A. (i) and (iii)

B. (i), (ii) and (iv)

C. (iii) and (vii)

D. (iii), (v) and (vi)

## Mathematics

1. The solution of the equation  $\log(\log_4(\sqrt{x+4} + \sqrt{x})) = 0$  is

- A. 2
- B. 4
- C. 9/4
- D. 8

2.  $\frac{a}{b} = \frac{1}{3}$  and  $\frac{b}{c} = \frac{3}{4}$ , then the value of  $\frac{a+2b}{b+2c}$  is

- A. 28/33
- B. 7/11
- C. 1/2
- D. None of these

3. Total number of even divisions of 2079000 which are divisible by 15 are

- A. 54
- B. 128
- C. 108
- D. 72

4. If N denotes number of 8 digit numbers that contains exactly four nines, then unit digit of N is

Numerical

5. If expression  $x + 1/x^2, |x| > 0$  attains its minimum value at  $x = \alpha$ , then  $\alpha^3$  is

Numerical

6. If the number of terms in the expansion of  $(x\sqrt{180} + \sqrt[3]{432})^{200}$  having integral coefficients is n, then the value of  $[n/6]$  is (where  $[.]$  denotes greater integer function)

- A. 4
- B. 5
- C. 6

D. 7

7. If the coefficient of  $x^m$ ,  $m \in \mathbb{N}$  in the expansion of  $\left(\sqrt{2x} + \sqrt[3]{\frac{3}{x^2}}\right)^9$  is equal to  $k$  ( $k \neq 0$ ), the  $k$  is equal to

A. 1008

B. 2016

C. 3024

D. 1016

8. If the angle between the pair of straight lines formed by joining the points of intersection of  $x^2 + y^2 = 4$  and  $y = 3x + c$  to the origin is a right angle, then  $c^2$  is

A. 20

B. 13

C.  $1/5$

D. 5

9. The equation of mirror image of the circle  $x^2 + y^2 - 6x - 10y + 33 = 0$  about the line mirror  $y = x$  is .....

A.  $x^2 + y^2 - 10x + 6y + 33 = 0$

B.  $x^2 + y^2 + 10x - 6y + 33 = 0$

C.  $x^2 + y^2 - 10x - 6y + 33 = 0$

D.  $x^2 + y^2 + 10x + 6y + 33 = 0$

10. If two tangents drawn from the point  $(h, k)$  to the parabola  $y^2 = 64x$  be such that the slope of one tangent is 8 times of the other, then the value of  $k^2/2h$  is

A. 9

B. 27

C. 81

D. 162

11. Let  $f(x) = \left[\frac{\sin x}{x}\right] + \left[\frac{2 \sin x}{x}\right] + \dots + \left[\frac{10 \sin x}{x}\right]$  (where  $[.]$  is the largest integer). then, find the value of  $\lim_{x \rightarrow 0} f(x)$ .

Numerical

12. If in a  $\triangle ABC$ ,  $\sin^2 A + \sin^2 B + \sin^2 C = 2$ , then the triangle is always:

- A. isosceles triangle
- B. right angled
- C. acute angled
- D. obtuse angled

13. triangle ABC,  $\sin A$ ,  $\sin B$  and  $\sin C$  are in AP ( $C > 90^\circ$ ), then  $\cos A$  is

- A.  $\frac{3c-4b}{2b}$
- B.  $\frac{3c-4b}{2c}$
- C.  $\frac{4c-3b}{2b}$
- D.  $\frac{4c-3b}{2c}$

14. Let  $D = \begin{vmatrix} n & n^2 & n^3 \\ n^2 & n^3 & n^5 \\ 1 & 2 & 3 \end{vmatrix}$ , then  $\lim_{n \rightarrow \infty} \frac{M_{11} + C_{33}}{(M_{13})^2}$  is equal to (where  $M_{ij}$  is the minor and  $C_{ij}$  is the cofactor of  $i^{\text{th}}$  row and  $j^{\text{th}}$  column's element)

- A. 0
- B. -1
- C. -2
- D. 3

15. If  $x = \sin(2 \tan^{-1} 2)$ ,  $y = \sin(\frac{1}{2} \tan^{-1} \frac{4}{3})$ , then

- A.  $x = 1 - y$
- B.  $x^2 = 1 - y$
- C.  $x^2 = 1 + y$
- D.  $y^2 = 1 - x$

Let:  $f : N \rightarrow N$  be defined as

$$f(n) = \begin{cases} \frac{n+1}{2}, & \text{if } n \text{ is odd} \\ \frac{n}{2}, & \text{if } n \text{ is even} \end{cases} \quad \text{for all } n \in N. \text{ Then } f \text{ is}$$

16.

- A. injective but not surjective
- B. surjective but not injective
- C. both injective and surjective
- D. neither injective nor surjective

17. Let  $f(x)$  is a polynomial function such that  $f(x) + f(1/x) = f(x) \cdot f(1/x)$ ,  $x > 0$  and  $f(3) = 10$ , if  $\int f(x)dx = g(x) + c$  and  $g(1) = 4/3$ , then the value of  $g(3)$  is

- A. 10
- B. 9
- C. 8
- D. 12

A real valued differentiable function  $f$  satisfies  $f(x) + f(y) + 2xy = f(x+y) \forall x, y \in R$ . Given

18.  $f^n(0) = 0$ , then value of  $\int_0^{\frac{\pi}{2}} f(\sin x)dx$  will be

- A. 0
- B.  $\pi/4$
- C.  $\pi/2$
- D.  $\pi$

19. Given  $dy/dx + 2y \tan x = \sin x$  and  $y = 0$  for  $x = \pi/3$ . If maximum value of  $y$  is  $1/k$ , then 'k' is equal to

Numerical

20. Given three vectors  $a$ ,  $b$  and  $c$  each two of which are non collinear. Further if  $(a + b)$  is collinear with  $c$ ,  $(b + c)$  is collinear with  $a$  and  $|a|=|b|=|c|=\sqrt{2}$ . Then, the value of  $|a \cdot b + b \cdot c + c \cdot a|$  is

Numerical