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JEE MAIN (JAN) 2023 (29-01-2023-Session-1)

Memory Based Question Paper

MATHEMATICS, PHYSICS & CHEMISTRY

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Jee Mains 2023 Memory based paper
29th Jan (MORNING SHIFT)
PHYSICS

1. A body is projected with an initial velocity 'u' with an angle of 30° with the horizontal. Find the ratio of kinetic energy at the highest point to the point of projection
    Ans: 1 : 4

2. A ball of mass 0.4kg fell from a height. The ball reaches ground in 8 seconds reaches ground. What is the loss of potential energy.
    Ans: 128J

3. A car is moving on a circular track of radius 50cm with coefficient of friction being 0.34. On this horizontal track the maximum safe speed for turning is equal to (Take g=10ms^{-2})
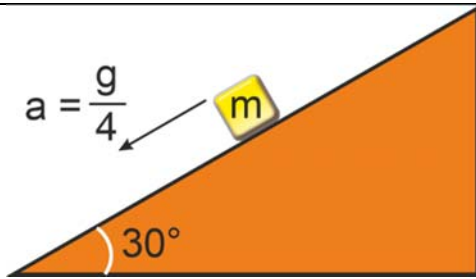   A) 1.03
    B) 1.7
    C) 1.3
    D) 1.8
    Ans(C)

4. A block is sliding down an inclined plane of inclination 30°, with an acceleration of g /4.
    Find the co-efficient of friction between the block and incline.
    A) $\frac{1}{\sqrt{3}}$
    B) $\frac{1}{2\sqrt{3}}$
    C) $\frac{1}{3}$
    D) $\frac{1}{4}$

Ans(B)

5. Find the ratio of maximum wavelength of Lymen series of Hydrogen atom to minimum wavelength of Balmer series of Helium atom.

A) 4/3
B) 1
C) 3/2
D) 3/4

Ans: (A)

6. Two particle masses of same mass 'm' revolving in a circular path of radius 'R' under mutual gravitational force. The speed at which the particles will revolve is (neglect any other forces between the particles).

A) $\sqrt{\dfrac{GM}{R}}$

B) $\sqrt{\dfrac{2GM}{R}}$

C) $\sqrt{\dfrac{GM}{2R}}$

D) $\sqrt{\dfrac{GM}{4R}}$

Ans(D)

7. A tennis ball is dropped from a height of 9.8m it hits the ground and rebounds to a height of 4.9m. Calculate the average acceleration of the ball while the ball is in contact with the ground is given by $n(\sqrt{2}+1)$. Then the value of n is _____ (Time of contact=0.2sec)

Ans:49

8. In YDSE, If the first minima is obtained at a distance of $\frac{d}{2}$ from the first central maxima. If the screen is at a distance of 5cm from the slits and wavelength of light used is 800nm. Find the distance between the slits?
   Ans: 0.2mm

9. Find the mutual inductance of the combination. If the current in the square shaped coil is changing varying.(r<<L)
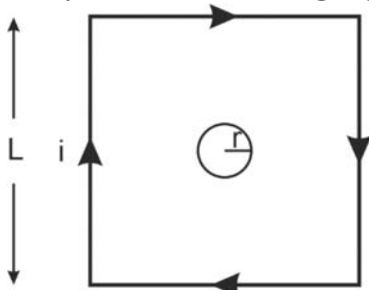
   **Ans:** $\frac{2\sqrt{2}\,\mu_o R^2}{L}$

10. If pressure gradient is given by X, Electric field is Y, Energy density is W and Latent heat is Z. Find the dimensional formula of $\frac{[X][Y]}{[Z][W]}$
    A) $[ML^{-2}T^{-1}A^{1}]$
    B) $[ML^{-2}T^{-1}A^{-1}]$
    C) $[M^{-1}L^{2}T^{-1}A^{-1}]$
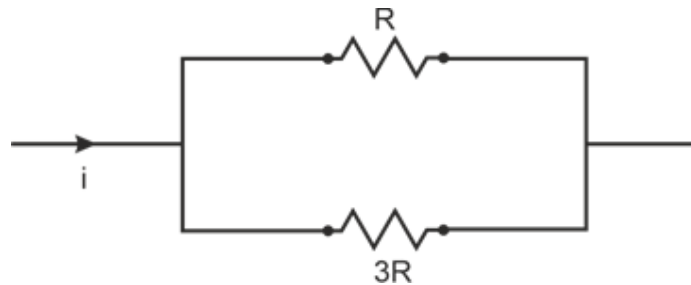   D) $[ML^{2}T^{-1}A^{-1}]$
    Ans: (B)

11. A solid sphere is released from point O at the top of an incline with sufficient friction to avoid slipping as shown. Find the value of velocity of center of mass of sphere when it reaches the bottom most point on the incline (Take g=10ms^{-2})
    A) 3m/s
    B) 7m/s
    C) 10m/s
    D) 0.7 m/s

7 m
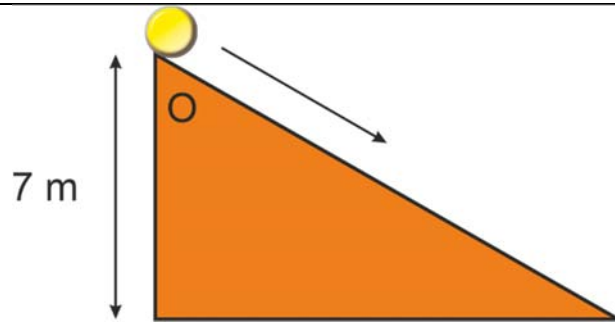
Ans: (C)

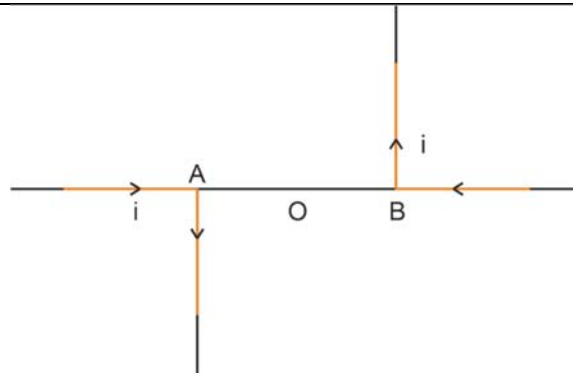12. In the part of a circuit shown, find the ratio of rate of heat produced in R and 3R.

R

3R

i

A) 1 : 9

B) 1 : 3

C) 3 : 1

D) 9 : 1

Ans: (C)

13. Point O and two long wires are kept in same plane such that point O lies middle of the line. Then magnetic field at point O due to the current i flowing both the wires is equal to

(a) $\frac{\mu_o i}{2\pi l}$

(b) $\frac{\mu_o i}{\pi l}$

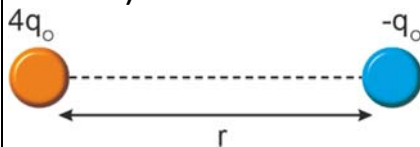(c) $\frac{2\pi \mu_o i}{l}$

(d) $\frac{\mu_o i}{2l}$

Ans: (B)

14. A disc of radius R is given by ωo angular speed and placed gently on a rough horizontal surface. Find the velocity of centre of disc when pure rolling starts.
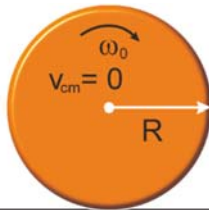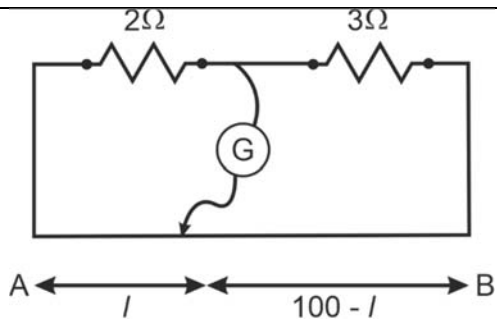

Ans: $\dfrac{R\omega_0}{3}$

15. Two point charges are arranged as shown in the figure. Find the distance from $4q_o$ where net electric field is zero.

   A)   4r
   B)   3r
   C)   r/2
   D)   2r

Ans: (D)

16.   Consider the meter bridge setup shown :

   If a shunt resistance x Ω is added to 3 Ω, the balance point is shifted by 22.5cm. Find 'x'

Ans: 2

17. A soap bubble of radius R and surface tension S is blown to double the radius. The change in surface energy is

A) 24 SR^2
B) 12 SR^2
C) 6 SR^2
D) 3 SR^2

Ans: (A)

18. A nucleus $^{236}_{92}$X undergoes two alpha decays and one beta decay. Find the atomic number and mass number of the final daughter nuclei

A) Z=88, A= 227
B) Z= 90, A=225
C) Z=89, A=228
D) Z=81, A=210

Ans: (C)

CHEMISTRY

1. Write order of hydration energy?
   - i) Mg^{+2}
   - ii) CS^+
   - iii) K^+
   - iv) Ca^{+2}
   - v) Rb^+

   Ans. $Mg^{2+} > Ca^{2+} > K^+ > Rb^+ > Cs^+$

2. Which of the following compounds is/are paramagnetic: NO_2 NO K_2O Na_2O_2
   a) NO_2 and NO
   b) NO_2, NO and K_2O
   c) NO_2, NO, K_2O and Na_2O_2
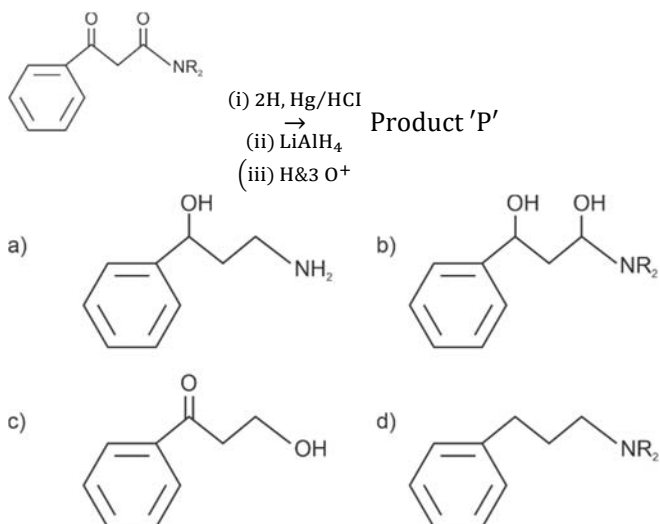   d) NO_2, NO and Na_2O_2
   Ans. (a)

3. Which of the following has the highest bond dissociation energy?
   (a) I_2
   (b) F_2
   (c) Cl_2
   (d) Br_2
   Ans. (c)

4. Consider the following sequence of reactions :-

Ans. (d)

5. X : No. of bridge bonds present in compound $Mn_2(CO)_{10}$

Y : No. of bridge bonds present in compound $W(CO)_6$

Find out (X+Y)

Ans. 1

6. Find out the magnetic character of Li_2O, KO_2 and MgO in that order.

(a) Diamagnetic, paramagnetic, and diamagnetic

(b) paramagnetic and paramagnetic and diamagnetic

(c) Diamagnetic, paramagnetic and paramagnetic

(d) Diamagnetic, diamagnetic and diamagnetic
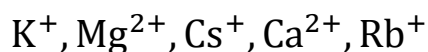
Ans. (a)

7. For the hypothetical reaction :

$A \leftrightharpoons B; K_{eq} = 10^2$

Use $T = 27°C, R = 8.3 \, J \, K^{-1} \, mol^{-1}$; If the value of $\Delta G°$ for the above reaction is xkJ, Find the value of 2x (round off to nearest integer)

Ans. (23)

8. Select the correct statement among the following

a) Photochemical smog has high concentration of oxidising agent

b) Classical smog has high concentration of oxidising agent

c) Classical smog contains NO_2

d) None of these

Ans. (a)

9. Which of the following option contains the correct decreasing order of hydration energy of the following ions?

$K^+, Mg^{2+}, Cs^+, Ca^{2+}, Rb^+$

a) $Mg^{2+} > Ca^{2+} > K^+ > Rb^+ > Cs^+$

b) $Ca^{2+} > Mg^{2+} > Cs^+ > Rb^+ > K^+$

c) $Mg^{2+} > Ca^{2+} > Cs^+ > Rb^+ > K^+$

d $Cs^+ > Rb^+ > K^+ > Ca^{2+} > Mg^{2+}$

Ans. (a)

10. A radioactive substance decays into products with half-life of 30 minutes. The fraction left after 90 minutes is given by $\frac{1}{2t}$. Find out the " t ".

Ans. 4

MATHS

1. Ratio of coefficient of three consecutive terms in $(1+2x)^n$ is $2:5:8$ then find the middle term of the $(1+2x)^n$

   Ans: $^8C_4(2x)^4$

2. A function $f(x)$ is such that $f(x+y) = f(x)+f(y)-1 \; \forall \; x,y \in R$. $f'(0) = 2$, then $|f(-2)| = ?$

   Ans:3

3. Tangents at $A(4, -11)$ and $B(8,-5)$ to the circle $x^2+y^2-3x+10y-15=0$ intersect at C. Then find radius of circle with centre C and touching the line AB is

   Ans: $\dfrac{2\sqrt{13}}{3}$

4. If real Part of the product of $z_1 \& z_2$ is zero i.e. $Re(z_1 z_2) = 0$ & $Re(z_1+z_2)=0$ then $Im(z_1)$ and $Im(z_2)$ is?

   a) $(+, +)$
   b) $(+, -)$
   c) $(-, -)$
   d) None

   Ans: b

5. Consider $y = f(x)$ such that $(1,1)$ satisfying the following differential equation

   $y(x + 1)dx + x^2 \cdot dy = 0$ then $y = f(x)$ is given by.

   a) $\ln xy = \dfrac{1}{x} - 1$
   b) $\ln xy = 1, y$
   c) $\ln xy = \dfrac{1}{x} + 1$
   d) $\ln xy = \dfrac{1}{x}$

   Ans: (a)

6. If $a_1, a_2, a_3 \dots$ are +ve numbers forming G.P. such that $a_5 + a_7 = 12 \, \& a_4 \cdot a_6 = 9$ then $a_7 + a_9 = ?$

   Ans: 36

7. Consider a function $f(x) = \dfrac{2x^2+x+1}{x^2+1}$, which of the following options is correct

a) $f(x)$ is one to one $\forall x \in (0,2)$

b) $f(x)$ many to one, $\forall x \in (0,2)$

c) $f(x)$ is one to one $x \in (0,\infty)$

d) $f(x)$ is one to one $x \in (1,\infty)$

Ans: (a)

8. Consider $(\alpha x - 1/\beta x)^{11}$

Where Coeff of x^9 = coeff. Of x^{-9} then find $(\alpha\beta)^2$

Ans:1

9. If $[A]$ is 3×3 matrix and $A^2 = 3A + aI$, $A^4 = 21A + bI$, then $a + b$ is:

(a) -9

(b) -10

(c) 9

(d) 10

Ans (a)

10. Domain of $f(x) = \dfrac{\log_x(x-1)}{\log_{x-1}(x-4)}$ is:

(a) $(0,1)$

(b) $(4,\infty)$

(C) $[1,4]$

(d) $(4,\infty) - \{5\}$

Ans(d)

11. Find the area common to following region $x^2 + y^2 \leq 21, x \geq 1 \, \& \, y^2 \leq 4x$.

(a) $8\sqrt{3} - \dfrac{8}{3} + \dfrac{21}{2} - \dfrac{21}{2}\sin^{-1}\left(\sqrt{\dfrac{3}{7}}\right)$

(b) $2\sqrt{3} + \dfrac{21\pi}{2} - \dfrac{8}{3} - 21\sin^{-1}\left(\sqrt{\dfrac{3}{7}}\right)$

(c) $8\sqrt{3} + \dfrac{21\pi}{2} - \dfrac{8}{3}$

(d) $8\sqrt{3} + \dfrac{21\pi}{2} - \dfrac{8}{3} - 21\sin^{-1}\left(\sqrt{\dfrac{3}{11}}\right)$

Ans: (b)

12. Consider $f(x) = \max\{x^2, 1 + [x]\}$, where $[x]$ is greatest integer function. Then the value of $\int_0^2 f(x)dx$ is:

(a) $\frac{4\sqrt{2}+5}{3}$

(b) $\frac{6\sqrt{2}+5}{3}$

(C) $\frac{8\sqrt{2}+5}{3}$

(d) $\frac{8\sqrt{2}+3}{5}$

Ans(a)

13. In a football club there are 15 players, each player has a T-shirt of their own name. Find the number of ways such that at least thirteen players pick the correct T-shirt of their own name.

a) 107

b) 106

c) 108

d) 109

Ans(b)

14. If $f(x + y) = f(x) + f(y), f(1) = \frac{1}{5}$ and $\sum_{n=1}^{N} \frac{f(n)}{n(n+1)(n+2)} = \frac{1}{12}$ then the value of N is _____.

Ans:10

15. Consider 3 coplanar vectors (integer)
$\vec{a} = 3\hat{i} - 4\hat{j} + \lambda\hat{k}, \vec{b} = 4\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{c} = \hat{i} + 3\hat{j} - 4\hat{k}$. Then 9λ is

Ans:87