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## ALL INDIA RANKS IN JEE-ADV 2022



**JEE MAIN (JAN) 2023 (25-01-2023-Session-1)**

*Memory Based Question Paper*

## JEE Mains 2023 Memory based paper 25<sup>th</sup> Jan (Morning Shift)

### PHYSICS

1. A car covers a distance with velocity  $v_1$  and also cover same distance with velocity  $v_2$ . Find average velocity of car.  
**Ans.**  $\left(\frac{2v_1v_2}{v_1+v_2}\right)$
2. A car is moving with a constant speed of 2 m/s in circle having radius R. A pendulum is suspended from the ceiling of the car. Find the angle made by the pendulum with the vertical. Take  $R = \frac{8}{15}$  m &  $g = 10 \text{ m/s}^2$   
(a)  $30^\circ$   
(b)  $53^\circ$   
(c)  $37^\circ$   
(d)  $60^\circ$   
**Ans.** (C)
3. A particle is dropped inside tunnel of earth about any diameter. Particle starts oscillating, with time period T. ( R = Radius of earth, g = acceleration due to gravity on earth's surface). Then find T  
(a)  $T = 2\pi\sqrt{\frac{R}{g}}$       (b)  $T = \pi\sqrt{\frac{R}{g}}$   
(c)  $T = 2\pi\sqrt{\frac{2R}{g}}$       (d)  $T = 2\pi\sqrt{\frac{3R}{g}}$   
**Ans.** (A)
4. If T is the temperature of a gas then RMS velocity of gas molecules is proportional to  
A)  $T^{1/2}$   
B)  $T^{-1/2}$   
C) T  
D)  $T^2$   
**Ans.** (A)
5. The period of a pendulum at earth's surface is T. Find the time period of the pendulum at distance ( from center ) which is twice the radius of earth  
A) T/4  
B) 4T

C)  $T/2$

D)  $2T$

**Ans. (D)**

6. Value of resonant frequency when a capacitor of capacitance  $C$  and inductance  $L$  is  $\omega_1$ . When capacitance becomes  $2C$  and inductance becomes  $8L$  the value of resonant frequency becomes  $\omega_2$ . The ratio of  $\omega_2$  to  $\omega_1$  is

A) 1 : 4

B) 4 : 1

C) 1 : 8

D) 8 : 1

**Ans. (A)**

7. A: Photodiode is used in forward bias to measure light intensity.

B: Forward biased current is more than reverse biased.

a) Both A and B are correct and B is the correct explanation of A.

b) Both A and B are correct and B is the incorrect explanation of A.

c) A is correct and B is incorrect.

d) A is incorrect and B is correct

**Ans. ( )**

8. Ratio of density of nucleus of oxygen to hydrogen is

a) 1 : 1

b) 1 : 8

c) 2 : 1

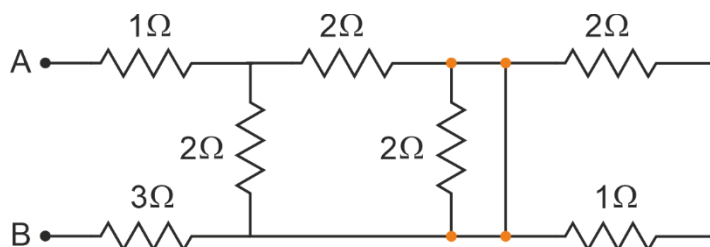
d) 1 : 2

**Ans. (2)**

9. A solenoid of length 2m, has 1200 turns. The magnetic field inside the solenoid, when 2 A current is passed through it is  $N\pi \times 10^{-8}$  T. find the value of N. (Diameter of solenoid is 4mm)

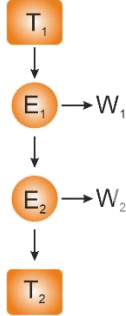
**Ans. ( 48)**

10. Consider a network resistors as shown. Find the effective (in  $\Omega$ ) across A and B



**Ans. (5)**

11. In the series sequence of two engines  $E_1$  and  $E_2$  as shown.  $T_1 = 600\text{K}$  and  $T_2 = 300\text{K}$ . It is given that both the engine working on Carnot principle have same efficiency, then temperature  $T$  at which exhaust of  $E_1$  is fed into  $E_2$  is equal to  $300\sqrt{n}$  K. Value of  $n$  is equal to



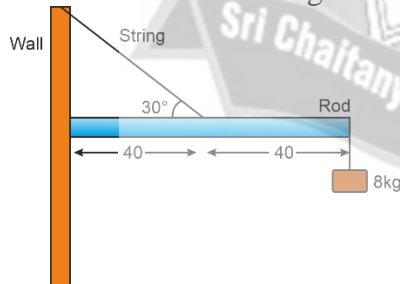
**Ans. (2)**

12. Find the de-Broglie wavelength when a charge is accelerated through potential  $2V$ , if it was  $\lambda_0$  when the charge was accelerated through potential ' $V$ '.

- A)  $\lambda_0/\sqrt{2}$   
 B)  $\sqrt{2}\lambda_0$   
 C)  $2\lambda$   
 D)  $\lambda$

**Ans. (A)**

13. A massless rod is arranged as shown: Find the tension in the string.



- (a) 320 N  
 (b) 640 N  
 (c) 160 N  
 (d) 480 N

**Ans. (A)**

14. In YDSE 5<sup>th</sup> bright fringe is at 5 cm from the central maximum, ( $D = 1\text{ m}$ ,  $\lambda = 300\text{ nm}$ ) Separation between slits is  $n \times 10^{-5}\text{ m}$ . The value of  $n$  is \_\_\_\_

**Ans. (3)**

15. An EM wave transport energy in negative z at a point and certain time the direction of electric field of the wave is along positive y what will be the direction of the magnetic field of the wave at the point and instant

- (1) +x direction
- (2) -x direction
- (3) +y direction
- (4) +z direction

**Ans. (1)**

16. LIST-I ( Physical quantity )

LIST-II ( Units )

A) Surface tension

I)  $\text{kgm}^{-1} \text{s}^{-1}$

B) Pressure

II)  $\text{kgms}^{-1}$

C) Viscosity

III)  $\text{kgm}^{-1} \text{s}^{-2}$

D) Impulse

IV)  $\text{kgs}^{-2}$

**Ans. (A-IV B-III C-I D-II)**

17. The modulation frequency of a wave is given by 5kHz. Carrier wave frequency is 2 MHz. Band width of wave is.

- 1. 5kHz
- 2. 20kHz
- 3. 12MHz
- 4. 10kHz

**Ans. (D)**

## Maths

1. If  $y = f(x) = (1+x)(1+x^2)(1+x^4)(1+x^{16})$  then find  $y'(-1) - y''(-1)$

**Ans. 96**

2. If  $\tan^{-1}\left(\frac{2x}{1-x^2}\right) + \cot^{-1}\left(\frac{1-x^2}{2x}\right) = \frac{\pi}{3}$ ,  $x \in (-1, 1)$  then sum of all solutions is  $\alpha - \frac{4}{\sqrt{3}}$  then  $\alpha$  is

**Ans. 2**

3. If  $a_r$  is the coefficient of  $x^{10-r}$  in the expansion of  $(1+x)^{10}$  then  $\sum_{r=1}^{10} r^3 \left(\frac{a_r}{a_{r-1}}\right)^2$  is :

a) 390

**b) 1210**

c) 485

d) 220

**Ans. b**

4.  $\lim_{n \rightarrow \infty} \frac{1+2-3+4+5-6+\dots+(3n-2)+(3n-1)-3n}{\sqrt{2n^4+3n+1}-\sqrt{n^4+n+3}}$

a)  $\frac{3}{2}(\sqrt{2} + 1)$

**b)  $\frac{2}{3}(\sqrt{2} + 1)$**

c)  $\frac{2}{3\sqrt{2}}$

d)  $2\sqrt{2}$

**Ans. a**

5.  $\int_0^2 \frac{2x dx}{(x^2+1)(x^2+3)} =$

**Ans.  $\frac{1}{2}(\log 15/7)$**

6. The logical statement  $(p) (p \wedge \sim q) \rightarrow (p \rightarrow \sim q)$  is a:

**a) Tautology**

b) Fallacy

c) Equivalent to  $p \vee \sim q$

d) Equivalent to  $p \wedge \sim q$

**Ans: a**

7.  $f(x) = \int_0^2 e^{|x-t|} dt$  then find  $f_{\min} =$

**Ans.**  $2e^{-2}$

8.  $\lim_{x \rightarrow \infty} \frac{\cot^{-1}(x^{-a} \log_a x)}{\sec^{-1}(a^x \log_x a)}$  such that  $a > 1$

a) 2

**b) 1**

c) -1

d)  $\log_a 2$

**Ans. b**

9. A wire of length 1 is cut into 3 pieces then the probability that the three pieces forms a triangle is

a)  $\frac{1}{2}$

**b)  $\frac{1}{4}$**

c)  $\frac{2}{3}$

d) None

**Ans. b**

10. Assertion: The function  $\frac{1}{1-e^{-x}}$  is monotonically increasing in (0,1)

Reason:  $\frac{1}{1-e^{-x}}$  is one-one function in the interval (0, 1)

**Ans. A is false and R is true**

## Chemistry

1. Which of the following will give flame test?

a) Ca      Crimson Red

b) Be      Violet

c) K      Blue

d) Rb      Brick Red

**Ans. (d)**

2. Number of lone pair electrons on the oxygen atom of ozone

**Ans. (6)**

3. The electron gain enthalpy order of the inert gases is?

**Ans. ( $10^2$  kJ/mol)**

4. Thionyl chloride on reaction with white phosphorus gives compound A.

A on hydrolysis give compound B which is dibasic. Identity A and B

- (a) A –  $\text{PCl}_5$ ; B –  $\text{H}_3\text{PO}_4$   
(b) A –  $\text{P}_4\text{O}_{10}$ ; B –  $\text{H}_3\text{PO}_4$   
(c) A –  $\text{POCl}_3$ ; B –  $\text{H}_3\text{PO}_4$   
(d) A –  $\text{PCl}_3$ ; B –  $\text{H}_3\text{PO}_3$

**Ans. (d)**

5. For a first order reaction  $\text{A} \rightarrow \text{B}$ ,  $t_{1/2}$  is 30 minutes. Then find the time (in minutes) required for 75% completion of reaction?

**Ans. (60 min)**

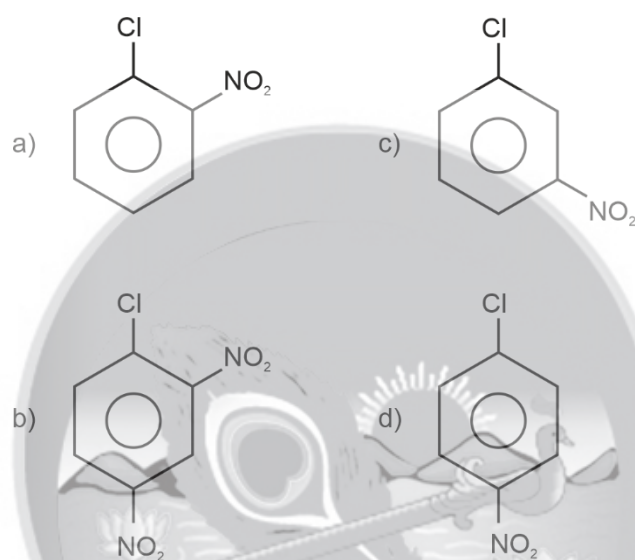
6. If X-atoms are present at alternate corners and at body centre of a cube and Y-atoms are present at  $1/3^{\text{rd}}$  of face centres then what will be the empirical formula?

- (a)  $\text{X}_{2.5}$   
(b)  $\text{X}_5\text{Y}_2$   
(c)  $\text{X}_{1.5}\text{Y}$   
(d)  $\text{X}_3\text{Y}_2$

**Ans. (d)**



7. Which of the following shows least reactivity towards SN reaction



**Ans. (c)**

8. Identify the correct sequence of reactants for the following conversion  
 $n - \text{Heptane} \longrightarrow \text{PhCOOH} + \text{PhCH}_2\text{OH}$

- (a)  $\text{Al}_2\text{O}_3/\text{Cr}_2\text{O}_3, \text{CrO}_2\text{Cl}_2/\text{H}_3\text{O}^+, \text{conc. NaOH}, \text{H}_3\text{O}^+$
- (b)  $\text{Al}_2\text{O}_3/\text{Cr}_2\text{O}_3, \text{CrO}_2\text{Cl}_2/\text{H}_3\text{O}^+, \text{H}_3\text{O}^+, \text{Conc. NaOH}$
- (c)  $\text{CrO}_2\text{Cl}_2, \text{Al}_2\text{O}_3, \text{Conc. NaOH}, \text{H}_3\text{O}^+$
- (d)  $\text{Sn}/\text{HCl}, \text{Conc. NaOH}, \text{CrO}_2\text{Cl}_2, \text{HNO}_3$

**Ans. (a)**

9. Arrange in order of stability. [Butane]

- (a) Fully eclipsed
- (b) Partially eclipsed
- (c) Anti eclipsed
- (d) Staggered

**Ans. (c > d > b > a)**

10. A Solid is made up of "x and y". X Forms Alternate Corners and Y occupies every face center. The formulae q Complex is

**Ans. (XY<sub>6</sub>)**

11.  $V^{+3}$ ,  $Ti^{+2}$ ,  $Cr^{+3}$ ,  $N^{+2}$   
Find paramagnetic

**Ans. (all are paramagnetic.)**

12. Ratio of Density of  ${}_8O^{18}$  and  $2He^4$

**Ans. (9:2; assuming same temperature and pressure)**

