

# JEE Main 2024 Question Paper Jan 30 Shift 2 (B.E./B.Tech)

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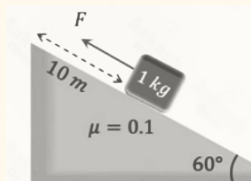
## JEE Main Physics Questions

**Ques 1.** Two particles are projected from a tower of height 400 m & angles  $45^\circ$  &  $60^\circ$  horizontally. If they have the same time of flight, find the ratio of their velocities.

- A.  $\sqrt{3}/\sqrt{2}$
- B.  $\sqrt{5}/\sqrt{2}$
- C.  $\sqrt{3}/\sqrt{4}$
- D. 1

**Ans.** A

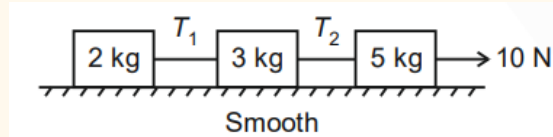
**Ques 2.** A block of mass 1 kg is ascended on an inclined plane by a distance of 10 m as shown in diagram, with the help of force of 10 N along the incline. Find work done against the friction.



- A. 10 J
- B.  $5\sqrt{3}$  J
- C. 5J
- D.  $(10 - 5\sqrt{3})$  J

**Ans.** C

**Ques 3.** A force of 10 N is applied on a three block system as shown. Find the two tensions  $T_1$  and  $T_2$ .



- A. 2N,5 N
- B. 5N, 2 N
- C. 3N, 4 N
- D. 4N,3 N

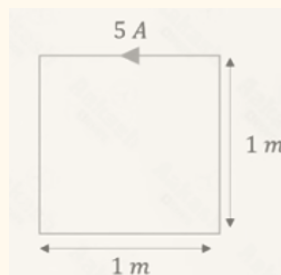
Ans. A

Ques 4. The slope of graph between stopping potential ( $V_0$ ) and Frequency of incident photon ( $f$ ) in photoelectric effect is ( $h$  = Plank's Constant,  $e$  = charge on electron)

- A.  $h/e$
- B.  $h/2e$
- C.  $2h/e$
- D.  $e/h$

Ans. A

Ques 5. A square loop of side 1 m is carrying a current of 5 A as shown. If the magnetic field at the center is  $x\sqrt{2} * 10^{-7}$  find  $x$ .



Ans. 40

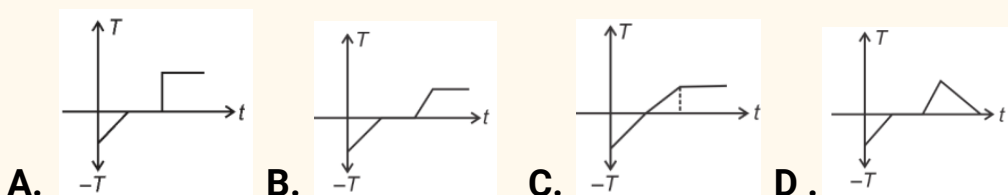
Ques 6. A planet exists of mass  $1^{th}/6$  of the earth's mass and radius  $1^{rd}/3$  of the earth's radius. If the escape speed for earth is 11.2km / s then the escape speed for the planet shall be km/s. (nearest integer)

Ans. 8

Ques 7. An electron in the 5th excited state of  $\text{He}^+$  atom moves to the 1st excited state. Find the number of possible spectral lines formed.

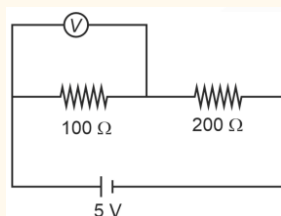
Ans. 10

Ques 8. Ice at temperature  $-10^\circ\text{C}$  is converted to steam at  $100^\circ\text{C}$ , the curve plotted between temperature ( $T$ ) and time ( $t$ ) when it is being heated by constant power source is



Ans. B

Ques 9. In given circuit, reading of voltmeter is 1 V, then resistance of

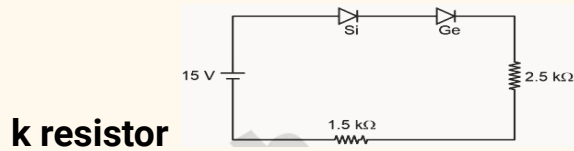


voltmeter is

- A.  $100 \Omega$
- B.  $200 \Omega$
- C.  $200\sqrt{5} \Omega$
- D.  $50 \Omega$

Ans. A

**Ques 10.** In the circuit shown if the potential drop in forward bias across Si and Ge diodes are 0.7 V and 0.3 V, find the potential difference across 2.5 k resistor



- A. 9.25 V
- B. 6.25 V
- C. 8.75 V
- D. 9.75 V

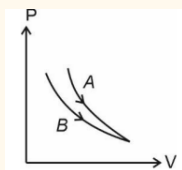
**Ans. C**

**Ques 11.** A point source is placed at origin. Its intensity at distance of 2 cm from source is  $I$  then intensity at distance 4 cm from the source shall be.

- A.  $I/2$
- B.  $I/16$
- C.  $I/4$
- D.  $I$

**Ans. C**

**Ques 12.** The Pressure ( $P$ ) versus volume ( $V$ ) of thermodynamic process shown in figure. The select the correct options (Take  $\gamma = 1.1$ )



- A. For process A :  $PV^\gamma = \text{constant}$ , For process B :  $PV^\gamma = \text{constant}$
- B. For process A :  $PV^{1/\gamma} = \text{constant}$  For process B :  $PV = \text{constant}$
- C. For process A :  $PV^{1.05} = \text{constant}$  For process B :  $PV^\gamma = \text{constant}$
- D. For process A :  $PV^{1.2} = \text{constant}$  For process B :  $PV = \text{constant}$

**Ans. D**

**Ques 13. Voltage across a  $5\Omega$  resistor is given as  $V = 200 \sin(100\pi t)$ . Find out time required for current through it to change from  $i_0/2$  to  $i_0$  [ $i_0$  is peak current]**

- A.  $1/300$  s**
- B.  $1/600$  s**
- C.  $1/150$  s**
- D.  $1/1200$  s**

**Ans. A**

**Ques 14. A nucleus of mass  $M$  breaks into 3 nuclei with a mass defect of  $\Delta m$ . Find the speed of each daughter nuclei if they have equal mass.**

- A.  $c \sqrt{6\Delta m/(M-\Delta m)}$**
- B.  $c \sqrt{2\Delta m/(M-\Delta m)}$**
- C.  $c \sqrt{3\Delta m/(M-\Delta m)}$**
- D.  $c \sqrt{\Delta m/(M-\Delta m)}$**

**Ans. B**

**Ques 15. In a vernier caliper 49 main scale divisions are equal to 50 vernier scale divisions. If one main scale division is 0.5 mm, then the vernier constant is**

- A. 0.01 mm**
- B. 0.1 mm**
- C. 0.1 cm**
- D. 0.01 cm**

**Ans. A**

Ques 16.  $6 \times 10^5$  J of electromagnetic energy is incident on a surface in time  $t_0$ . Find the total momentum imparted if the surface is completely absorbing.

- A.  $2 \times 10^{-3}$  kgm / s
- B.  $10^{-3}$  kgm / s
- C.  $10^{-2}$  kgm / s
- D.  $2 \times 10^{-4}$  kgm / s

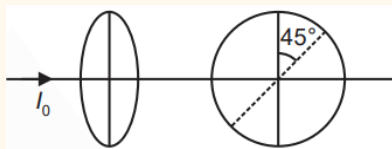
Ans. A

Ques 17. A particle is placed on upward parabolic curve  $y = x^2/4$  having co-efficient of friction ( $\mu$ ) = 0.5. What should be maximum height above x-axis so that it does not slip.

- A.  $\frac{1}{4}$  m
- B.  $\frac{1}{2}$  m
- C.  $\frac{1}{3}$  m
- D.  $\frac{3}{4}$  m

Ans. A

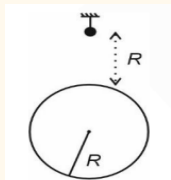
Ques 18. Two polaroids are placed at angle of  $45^\circ$  to each other. If unpolarized light of intensity  $I_0$  falls as one polaroid, then intensity of light leaving second polaroid.



- A.  $I_0 / 2$
- B.  $I_0 / 2\sqrt{2}$
- C.  $I_0 / 4$
- D.  $I_0 / 8$

Ans. C

**Ques 19.** A simple pendulum of length 4 m is located at a height R above the surface of earth. The time period of the simple pendulum is  $2\pi \sqrt{(8/x)}$



seconds. Find x.

**Ans.** 5

**Ques 20.** Mass can be expressed as  $M = C^p G^{-1/2} h^{1/2}$ , where C is speed of light, G is gravitational constant and h is Planck's constant. Find p.

- A. 1
- B. 0.5
- C. -1
- D. -0.5

**Ans.** B

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### JEE Main Chemistry Questions

**Ques 1.** Why does  $\text{KMnO}_4$  show colour?

- A. Due to d-d transition
- B. Due to metal to ligand charge transfer
- C. Due to ligand to metal charge transfer
- D. Due to F-center

**Ans.** C

**Ques 2.** C is added to solution of A and B, find mole fraction of C

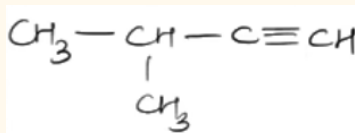
- A.  $n_c / (n_A + n_B + n_c)$
- B.  $n_c / (n_A \cdot n_B + n_c)$
- C.  $n_c / (n_A \cdot n_c + n_B)$
- D.  $n_c / (n_A + n_B)$

Ans. A

Ques 3. Which of the following solution will have lowest freezing point

- A. 180 g of glucose in 1 L solution
- B. 180 g of benzoic acid in 1 L solution
- C. 180 g of CH<sub>3</sub>COOH in 1 L solution
- D. 180 g of sucrose in 1 L solution

Ans. C



Ques 4. IUPAC name of compound

- A. 2-Methylbutane
- B. 3-Methylbut-1-yne
- C. 2-Methylbutene
- D. 3-Methylbutane

Ans. B

Ques 5. Which reagent on reacting with phenol gives salicylaldehyde?

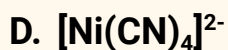
- A. CO<sub>2</sub>, NaOH
- B. CHCl<sub>3</sub>, NaOH
- C. CCl<sub>4</sub>, NaOH
- D. H<sub>2</sub>O, H<sup>+</sup>

Ans. B

Ques 6. Which of the following has a square pyramidal shape?

- A. PCI<sub>5</sub>
- B. BrF<sub>5</sub>
- C. PF<sub>5</sub>





Ans. B

Ques 7. Consider the following statements:

Statement I: Since electronegativity of F > H, so dipole moment of  $\text{NF}_3 > \text{NH}_3$

Statement II: Lone pair dipole in  $\text{NH}_3$  is not in the direction of resultant bond dipole while in case of  $\text{NF}_3$  the lone pair dipole is in the direction of resultant bond dipole

- A. Statement I: True Statement II: False
- B. Statement I: True Statement II: True
- C. Statement I: False Statement II: False
- D. Statement I: False Statement II: True

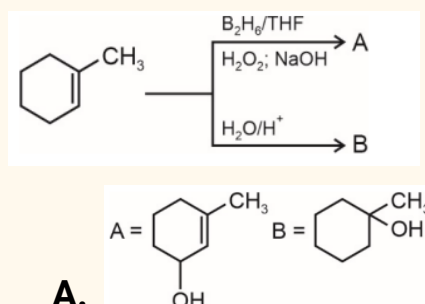
Ans. C

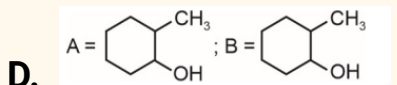
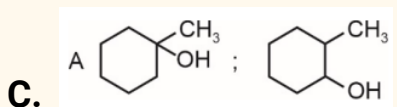
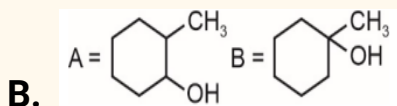
Ques 8. Arrange the following according to their decreasing oxidizing power  $\text{BrO}_4^-$ ,  $\text{IO}_4^-$ ,  $\text{ClO}_4^-$

- A.  $\text{ClO}_4^- > \text{IO}_4^- > \text{BrO}_4^-$
- B.  $\text{BrO}_4^- > \text{IO}_4^- > \text{ClO}_4^-$
- C.  $\text{IO}_4^- > \text{BrO}_4^- > \text{ClO}_4^-$
- D.  $\text{BrO}_4^- > \text{ClO}_4^- > \text{IO}_4^-$

Ans. B

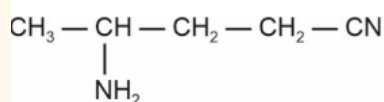
Ques 9. Complete the following reactions and find major products A and B





Ans. B

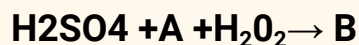
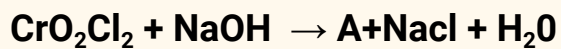
Ques 10. What is the correct IUPAC name of the given compound?



- A. 4-Aminopentanenitile
- B. 2-Aminopentanenitile
- C. 3-Aminobutanenitile
- D. 2-Aminobutanenitrile

Ans. A

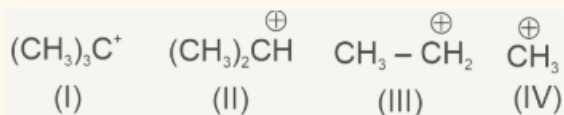
Ques 11. In the given reactions A and B respectively are:



- A.  $\text{Na}_2\text{CrO}_4$  and  $\text{CrO}_5$
- B.  $\text{CrO}_5$  and  $\text{Na}_2\text{CrO}_4$
- C.  $\text{Na}_2\text{CrO}_4$  and  $\text{CrO}_3$
- D.  $\text{Na}_2\text{Cr}_2\text{O}_7$  and  $\text{Na}_2\text{CrO}_4$

Ans. A

Ques 12. Find out correct order of stability for given carbocations



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

Ans. B

Ques 13. Statement I : Halogen attached to bulky group undergo SN2 reaction.

Statement II : Secondary alkyl halide react with excess C<sub>2</sub>H<sub>5</sub>OH undergo SN1 reaction.

- A. Both statements are true
- B. Statement I is true, II is false
- C. Both statements are false
- D. Statement I is false, Statement II is true

Ans. D

Ques 14. Magnetic moment due to the motion of the electron in n<sup>th</sup> orbit of Bohr atom is proportional to n<sup>x</sup>. The value of x is

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

Ans. B

Ques 15. What is the structure of Mn<sub>2</sub>(CO)<sub>10</sub>?

- A. Two square pyramidal units joined by bridging CO ligands
- B. Two square pyramidal units joined by Mn-Mn bond
- C. Two tetrahedral units joined by Mn-Mn bond
- D. Two square planar units joined by Mn-Mn bond

Ans. B

**Ques 16. Which of the following is a purification method which is based on solubility of compound.**

- A. Distillation**
- B. Sublimation**
- C. Crystallization**
- D. Column Chromatography**

**Ans. C**

**Ques 17. Statement 1 :  $H_2Te$  is more acidic than  $H_2S$  Statement 2 :  $H_2Te$  has more B.D.E than  $H_2S$**

- A. Statement 1 and 2 both are correct**
- B. Statement 1 and 2 both are incorrect**
- C. Statement 1 is incorrect and statement 2 is correct**
- D. Statement 1 is correct and statement 2 is incorrect**

**Ans. D**

**Ques 18. Number of elements which give flame test from following Sr, Cu, Co, Ca, Ni, Fe**

**Ans. 4**

**Ques 19. Statement-I: There is regular increase in chemical reactivity from group 1 to group 18.**

**Statement-II: Oxides of group-1 elements are basic and oxide of group 17 are acidic**

- A. Both statement-I and statement-II are true**
- B. Statement-I is true and statement-II is false**
- C. Statement-I is false and statement-II is true**
- D. Statement-I and statement-II both are false**

**Answer C**

Ques 20. How many of the following shows disproportionation reactions?  
 $\text{H}_2\text{O}_2$ , Ag,  $\text{Cu}^+$ ,  $\text{K}^+$ ,  $\text{F}_2$ ,  $\text{Cl}_2$ ,  $\text{ClO}_3^-$

Ans. 4

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### JEE Main Mathematics Questions

Ques 1. Bag A contains 7 white balls & 3 red balls. Bag B contains 3 white balls & 2 red balls. A ball is chosen randomly & found to be red then find the probability that it is taken from bag A.

- A.  $7/20$
- B.  $\frac{1}{2}$
- C.  $3/7$
- D.  $\frac{1}{5}$

Ans. C

Ques 2. Given  $|\vec{b}| = 2$ ,  $|\vec{b} \times \vec{a}| = 2$ , then the value of  $|\vec{b} \times \vec{a} - \vec{b}|^2$  is

- A. 0
- B. 8
- C. 1
- D. 10

Ans. B

Ques 3. If  $f(x) = \ln(2x/(4x^2-x-3)) + \cos^{-1}((2x+1)/(x+2))$  if domain of  $f(x)$  is  $[\alpha, \beta]$ , then  $5\alpha - 4\beta$  is:

- A. -2
- B. 3
- C. -4

D. 1

Ans. A

Ques 4. If  $f(x) = (x - 2)^2 (x - 3)^3$  and  $x \in [1, 4]$  If M and m denotes maximum and minimum values respectively, then  $M - m$  is

Ans. 12

Ques 5.  $f * (y - 2)^2 = (x - 1)$  and  $x - 2y + 4 = 0$  then find the area bounded by the curves between the coordinate axis in first quadra (in sq. units)

Ans. 3

Ques 6. If 1st term of a GP is 'a' and 3rd term is 'b' and in 2nd GP 1st term is 'a' and 5th term is 'b' and 11th term of 1st GP common to which term of 2nd GP

- A. 24
- B. 25
- C. 21
- D. 18

Ans. C

Ques 7.  $z^{1985} + z^{100} + 1 = 0$  and  $z^3 + 2z^2 + 2z + 1 = 0$  then number of common roots of equation is

- A. 1
- B. 2
- C. 3
- D. 4

Ans. B

Ques 8. If  $x^2 - y^2 + 2hxy + 2gx + 2fy + c = 0$  is the locus of points such that it is equidistant from the lines  $x + 2y - 8 = 0$  and  $2x + y + 7 = 0$  then value of  $h + g + f + c$  is

- A. 15
- B. -15
- C. 20
- D. -20

Ans. C

$$A = \begin{bmatrix} x & 0 & 0 \\ 0 & y & 0 \\ 0 & 0 & z \end{bmatrix}$$

$$\frac{x}{\sin \theta} = \frac{y}{\sin\left(\theta + \frac{2\pi}{3}\right)} = \frac{z}{\sin\left(\theta + \frac{4\pi}{3}\right)}$$

Ques 9.

Then

Statement 1:  $\text{Tr}(A) = 0$

Statement 2:  $\text{Tr}(\text{adj}(\text{adj } A))$

- A. Statement 1 & 2 are true
- B. Statement 1 is true
- C. Statement 2 is true
- D. None of these

Ans. A

Ques 10. If  $S_n = 3 + 7 + 11 + \dots$  upto  $n$  terms And then  $n$  is

$$40 < \frac{6}{n(n+1)} \sum_{k=1}^n S_k < 45,$$

- A. 9
- B. 10
- C. 11
- D. 12

**Ans. A**

**Ques 11. In a paper there are 3 sections A, B and C which have 8, 6 and 6 questions each. A student have to attempt 15 questions such that they have to attempt at least 4 questions out of each sections, then number of ways of attempting these questions are**

- A. 11,300
- B. 11,376
- C. 12,576
- D. 13,372

**Ans. B**