JEE Main 2024 Question Paper Jan 30 Shift 1 (B.E./B.Tech)

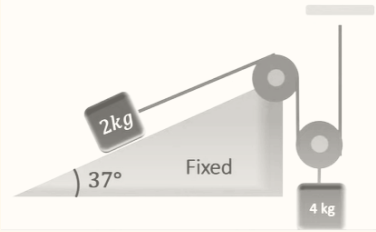
JEE Main Physics Questions

Ques 1. Two rings of equal radius R arranged perpendicular to each other with common center at C, carrying equal current I. Find magnetic field at C.

A. $\mu_0 I/2R$
B. $\mu_0 I/R$
C. $\sqrt{2}\mu_0 I/R$
D. $\mu_0 I/\sqrt{2}R$

Ans. D

Ques 2. Find the acceleration of 2 kg block shown in the diagram (neglect friction)



A. 4g/15
B. 2g/15
C. g/15
D. 2g/3

Ans. A

Ques 3. A particle of mass m is projected from ground with speed u at an angle of 30° with the horizontal. Find its angular momentum about the point of projection when it reaches its maximum height.

- **A. $mv^3/16g$**
- **B. $\sqrt{mv^3/16g}$**
- **C. $mv^3/3g$**
- **D. $\sqrt{3mv^3/16g}$**

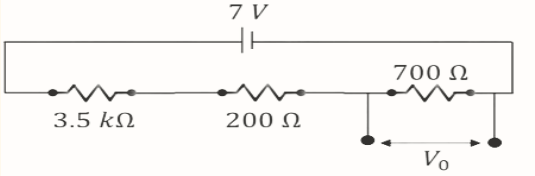
Ans. B

Ques 4. The ratio of KE : PE IN 5th excited state of hydrogen atom is

- **A. -2**
- **B. 2**
- **C. -½**
- **D. 1/2**

Ans. -½

Ques 5. Find the potential difference across 700 Ω resistance (i.e. Vo)



- **A. 2V**
- **B. 0.5V**
- **C. 1.1V**
- **D. Zero**

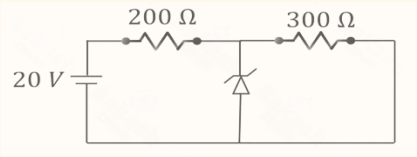
Ans. C

Ques 6. A ball is released from a height of 1 m on a fixed smooth hemispherical surface as shown. Find its velocity when it is at a height of 0.5 m from ground. (take g = 10m / s^2)

A. 20 m/s
B. 10 m/s
C. √10 m/s
D. 5 m/s

Ans. C

Ques 7. Find the current through Zener diode if its breakdown voltage is 5 V.



A. 58.33 mA
B. 25 mA
C. 28.33 mA
D. 20.23 mA

Ans. A

Ques 8. A ball released from a height of 10 m strikes the ground and rebounds to height 5 m. Find impulse imparted by the ground while collision, given mass of the ball is 100 g (take g = 10m / (s ^ 2))

A. (√2 - 1) Ns
B. (√2 + 2) Ns
C. (2√2 - 1) Ns
D. (√2 + 1) Ns

Ans. D

Ques 9. Electric potential due to short electric dipole on axial position at distance r from dipole is proportional to (assume r >> length of dipole)

A. 1/r
B. 1/r3
C. 1/r2
D. R

Ans. C

Ques 10. A block of mass 2kg is placed on a disc which is rotating at constant angular velocity 4 rad/sec. Find the friction force in (N) between block and disc if block is not sliding.

A. 32
B. 34
C. 36
D. 38

Ans. A

Ques 11. Distance between virtual image, which is twice the size of object placed in front of mirror and object is 45 cm. The magnitude of focal length of the mirror is _____cm.

Ans. 30

Ques 12. A particle is having uniform acceleration. If its displacement from t to (t + 1) second is 120 m and change in velocity is 50 m/s. Find its displacement (in m) in $(t + 2)^{th}$ second

Ans. 170

Ques 13. A uniform disc of mass 5 kg and radius 2 m is rotating with 10 rad/s. Now another identical disc is gently placed on first disc. Because of

friction both disc acquire common angular velocity. Loss of kinetic energy in process is _____J.

A. 125
B. 250
C. 62.5
D. 500

Ans. B

Ques 14. Maximum wavelength of the light source such that photo electrons can be ejected from material of work-function 3 eV is

A. 2133.3 Å
B. 3133.3 Å
C. 4133.3 A
D. 313.3 Å

Ans. C

Ques 15. A long wire carrying current sqrt(2)A is placed in a uniform magnetic field of 3 x 10^{-5} T. If the magnetic field is perpendicular to wire, find magnetic force on the length of wire.

A. 3 *10^{-4} N
B. 3sqrt(2) * 10^{-5} N
C. 3 * 10^{-3}* N
D. Zero

Ans. B

Ques 16. The electric field in an electromagnetic wave is moving in a free space given as vec E =E_0 sin(ωt - kz) i The corresponding magnetic field will be:

A. E_0 c sin(ωt - kz) hat j
B. E_0/c sin(ωt - kz) hat j

C. $E_0/c \cos(\omega t - kz)$ hat i
D. $E_0/c \sin(\omega t - kz)$ hat i

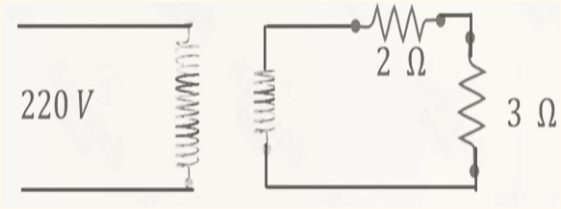
Ans. B

Ques 17. If the area of cross-section is halved and length of a wire having Young's modulus Y is doubled, then its new Young's modulus will be

A. Y
B. 4Y
C. Y/2
D. Y/4

Ans. A

Ques 18. In an electric transformer, 220 V is applied on primary coil having number of turns 100. Find output current through 3 Ω resistance if number of turns in secondary coil is 10.



A. 4 A
B. 4.4 A
C. 2 A
D. 2.2 A

Ans. B

Ques 19. Find the temperature of H_2 gas at which its rms speed is equal to that of 02 at 47°C.

A. 20°C
B. -20°C
C. -253°C

D. 17°C

Ans. C

Ques 20. In AC circuit with source voltage E = 20 sin 1000 t is connected to series L-R circuit whose power factor is 1/(sqrt(2)) If E = 25 sin 2000 t, the new power factor is :

A. 2/(sqrt(5))
B. 1/(sqrt(5))
C. 1/(sqrt(3))
D. sqrt(3/5)

Ans. B

Ques 21. At P, a point away from planet of radius 6400 km, the gravitational potential and field are -6.4×10^7 SI units and 6.4 SI units, respectively. Find hight of that point above surface of planet?

A. 3000 km
B. 6400 km
C. 3600 km
D. 9400 km

Ans. C

Ques 22. A wire has resistance of 60 Ω at temperature 27°C. When it is connected to a 220 V dc supply, a current 2.75 A flows through it at a certain temperature. Find the value of the temperature, if coefficient of thermal resistance (α) is 2×10^{-4}/°C.

A. 1694°C
B. 1500°C
C. 1000°C
D. 1200°C

Ans. A

JEE Main Chemistry Questions

Ques 1. Rms velocity of hydrogen at which temperature is equal to that of the oxygen molecule at 47 degree

Ans. 20

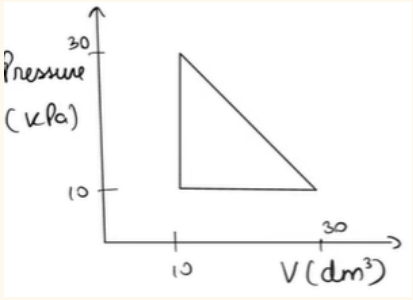
Ques 2. Find out sum of the coefficients of all the species involved in the balanced equation: $2MnO_4 + I^- \xrightarrow[\text{medium}]{\text{Alkaline}}$

Ans. 9

Ques 3. Find out the maximum number of hybrid orbitals formed when 2s and 2p orbitals are mixed.

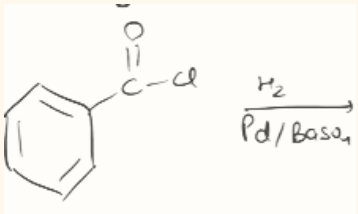
Ans. 4

Ques 4. Find the work done in the following cyclic process (in J)



Ans. 200J

Ques 5. What is the name of a given reaction?



A. Etard Reaction
B. Stephen's Reaction
C. Wolff Kishner Reduction
D. Rosenmund Reaction

Ans. D

Ques 6. Which of the given compounds will not give the Fehling test?

A. Lactose
B. Maltose
C. Sucrose
D. Glucose

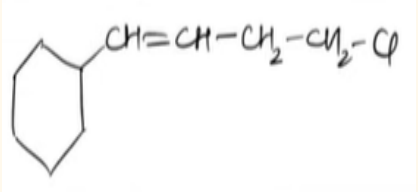
Ans. C

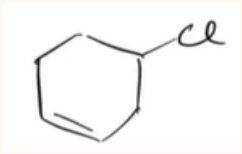
Ques 7. Which of the following set contains both diamagnetic ions

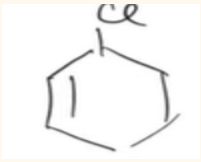
A. Ni2+, Cu2+
B. Eu3+, Gd3+
C. Cu+, Zn2+
D. Ce4+, Pm3+

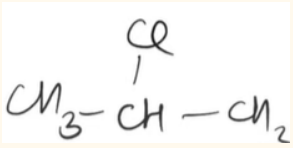
Ans. C

Ques 8. Which of the following has allylic halogen?

A. 

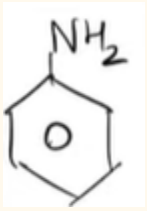
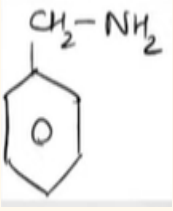
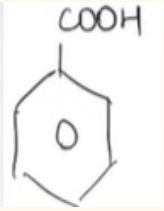
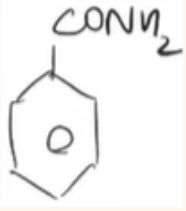
B. 

C. 

D. 

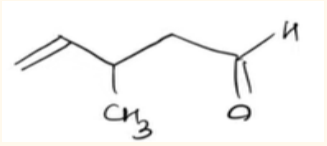
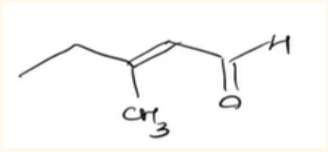
Ans. C

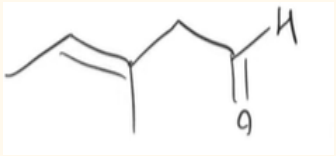
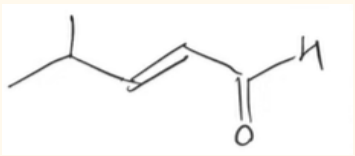
Ques 9. Find the final product of reaction given below

A.  B.  C.  D. 

Ans. A

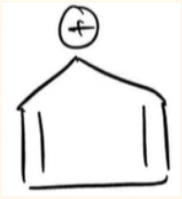
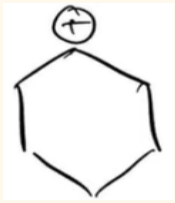
Ques 10. Which of the following is the correct structure for the given IUPAC name?
3-Methylpent-2-enal

A.  B. 

C.  D. 

Ans. B

Ques 11. Which of the following compound or ion is most stable?

A.  B.  C.  D. 

Ans. C

Ques 12. Statement I: For hydrogen atom, 3p and 3d are degenerate
Statement II: Degenerate orbitals have the same energy.

A. Both statements I and II are correct.
B. Both statements I and II are incorrect.
C. Statement I is correct, statement II is incorrect.
D. Statement I is incorrect, statement II is correct.

Ans. A

Ques 13. What is the geometry of Aluminium chloride in aqueous solution

A. Square planar
B. Octahedral
C. Tetrahedral
D. Square pyramidal

Ans. B

Ques 14. The number of atoms in the silver plate having area 0.05 cm^2, and thickness 0.05 cm is …….. x 10^{19}.
Density of silver is 7.9 g/cm^3

Ans. 11

Ques 15. The group number of unununnium is:

A. 11
B. 12
C. 6
D. 14

Ans. A

Ques 16. The ratio of magnitude of potential energy and kinetic energy for 5th excited state of hydrogen atom is

Ans. 2

Ques 17. Choose the correct option

Molecule	Shape
(a) BrF_5	(i) Sea-saw
(b) H_2O	(ii) T-Shape
(c) ClF_3	(iii) Bent
(d) SF_4	(iv) Square Pyramidal

A. (A)- iv; (B) - iii; (C) - ii; (D) - i
B. (A)-iv; (B) - iii; (C) - i; (D) - ii
C. (A)-iii; (B)-iv; (C) - ii; (D) - i
D. (A)-iii; (B) - iv; (C) - i; (D) - ii

Ans. A

Ques 18. 250 mL solution of CH3COONa of molarity 0.35 M is prepared. What is the mass of CH3COONa required in grams (Nearest Integer)

Ans. 7

Ques 19. Consider the following sequence of reactions:

$$CH_3-C\equiv CH \xrightarrow{Na} A \xrightarrow{B} CH_3-C\equiv C-CH_2-CH_2-CH_3$$

Select A and B respectively.

A. $CH_3 - CH = CH_2, CH_3 - CH_2 - Cl$

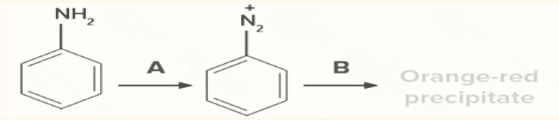
B. $CH_3 - C \equiv CNa, CH_3 - CH_2 - Cl$

C. $CH_3 - C \equiv CNa, CH_3 - CH_2 - CH_2 - Cl$

D. $CH_3 - C \equiv C - CH_3, CH_3 - CH_2 - CH_2 - Cl$

Ans. C

Ques 20. Consider the following sequence of reactions:



Select the option with correct A & B respectively.

A. HNO3, Phenol
B. $NaNO_2$/HCl, Phenol
C. HNO3, Aniline
D. $NaNO_2$/HCl, Aniline

Ans. B

JEE Main Mathematics Questions

Ques 1. If the length of the minor axis of an ellipse is equal to half of the distance between the foci, then the eccentricity of the ellipse is.

Ans. 2/√5

Ques 2. Let (α, β, y) be the foot of perpendicular form the point

(1,2,3) on the line (x + 3)/5 = (y - 1)/2 = (z + 4)/3 then 19 (α+ β+ y)

Ans. 101

Ques 3. If z = x + iy, xy ≠ 0 satisfies the equation $z^2 + iz = 0$, then $|z^2|$; equal to

Ans. 1

Ques 4. Let A(2,3,5) and C(- 3, 4, - 2) be 'opposite vertices of a Parallelogram ABCD. If the diagonal vec BD = hat i +2 hat j +3 hat k then the area of the Parallelogram is equal to.

Ans. √474/2

Ques 5. The value of $\lim_{n\to\infty}\sum_{k=1}^{n}\frac{n^3}{(n^2+k^2)(n^2+3k^2)}$ **is**

- **A. [π/2√3 -π/8]**
- **B. [π/2√3 +π/8]**
- **C. [π/2 -π/√3]**
- **D. [π/√3 -π/4]**

Ans. A

Ques 6. If the foot is perpendicular from (1, 2, 3) to the line (x+1)/2 = (y-2)/5 = (z-1)/1 is (a, β, γ), then find a + β + γ.

- **A. 6**
- **B. 5.8**
- **C. 4.8**
- **D. 5**

Ans. B

Ques 7. In an arithmetic progression if sum of 20 terms is 790 and sum of 10 terms is 145, then S15 - S5 is (when Sn denotes sum of n terms)

A. 400
B. 395
C. 285
D. 405

Ans. B

Ques 8. The value of maximum area possible of a A ABC such that A(0, 0), B(x, y) and C(-x, y) such that $y = -2x^2 + 54x$ is: (in sq. unit)

A. 5800
B. 5832
C. 5942
D. 6008

Ans. B

Ques 9. The range of r for which circles $(x + 1)^2 + (y + 2)^2 = r^2$ and $x^2 + y^2 - 4x - 4y + 4 = 0$ coincide at two distinct points.

A. $3 < r < 7$
B. $5 < r < 9$
C. $1/2 < r < 4$
D. $0 < r < 3$

Ans. A

Ques 10. An ellipse whose length of minor axis is equal to half of length between foci, then eccentricity is

A. 7/2
B. √17
C. 2/√5
D. 3/ √7

Ans. C

Ques 11. The domain of y= $\cos^{-1}\left|\frac{2-|x|}{4}\right|$ log(3 - x)$^{-1}$ is [α, β) - {y} then the value of α+β-y =?

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

Ans. C

Ques 12. Ify = f(x) is solution of differential equation
(x^2 - 1) dy = ((x^3 + 1) + sqrt(1 - x^2))dx and y(0) = 2 then find y(1/2)

A. 13/7 - pi/2 + ln(5)
B. 15/7 + pi/3 + ln(2)
C. 17/8 + pi/6 - ln(2)
D. 18/7 - pi/6 + ln(3)

Ans. C

Ques 13. Given x^2 - 70x + lambda = 0 with positive integral roots a and B where one of the root is less than 10, and lambda/2 * i lambda/3 are not integers, then find value of $\frac{\sqrt{\alpha-1}+\sqrt{\beta-1}}{|\alpha-\beta|}$

A. ⅙
B. 1/12
C. 1/12
D. 1/70

Ans. A

Ques 14. A line passes through (9,0), making angle 30° with positive direction of Xaxis. It is rotated by angle of 15" with respect to (9,0). Then, the equation of new line is

A. y = (2 + sqrt(3))(x - 9)
B. y = (2 - sqrt(3))(x - 9)
C. y = 2(x - 9)
D. y = - (x - 9)

Ans. B

Ques 15. If |vec | a =1,| vec b |=4, vec a * vec b = 2(vec a * vec b)-3 vec b Then the angle between vec b and vec c is

A. $\Theta = \cos^{-1}(-(\sqrt{3})/2)$
B. $\Theta = \cos^{-1}((\sqrt{3})/2)$
C. $\Theta = \cos^{-1}(1/2)$
D. $\Theta = \cos^{-1}(-1/2)$

Ans. A

Ques 16. Given set S = {0, 1, 2, 3, ..., 10}. If a random ordered pair (x, y) of elements of S is chosen, then find probability that |x - y| > 5

A. 30/121
B. 31/121
C. 62/121
D. 64/121

Ans. A

Ques 17. Number of integral terms in the binomial expansion of $(7^{1/2} + 11^{1/6})^{824}$ is_____.

Ans. 138

Ques 18. $9\int_0^9 \left[\sqrt{\frac{10x}{x+1}}\right] dx$ **is equal to (where [] represents greatest integer function)**

Ans. 155

Ques 19. In a class there are 40 students. 16 passed in Chemistry, 20 passed in Physics, 25 passed in Math. 15 students passed in both Math and Physics.15 students passed in both Math and Chemistry and 10 students passed in both Physics and Chemistry. Find the maximum number of students that passed in all the subjects.

Ans. 19

Ques 20. For the following data table

x_i	f_i
0 – 4	2
4 – 8	4
8 – 12	7
12 – 16	8
16 – 20	6

Find the value of 20M (where M is median of the data)

Ans. 245