JEE Main – 22nd January – 2025 (Shift -1)

[Memory Based Questions]

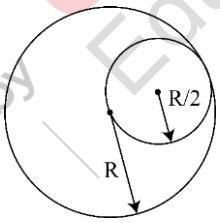
PHYSICS

1. A Parallel plate capacitor of capacitance 40μF is connected to a 100V power supply now the intermediate space between the plates is filled with a dielectric material of dielectric constant k=2. due to the introduction dielectric the extra charge and the change in electrostatic energy in the capacitor respectively of

a) 2 mC and 0.4J
b) 2 mC and 0.2 J
c) 4 mC and 0.2J
d) 8 mC and 2J

Ans: (c)

2. A uniform circular disc of radius 'R' and mass 'm' is rotating about an axis perpendicular to it's plane & passing through it's center. A small circular part of radius R/2 is removed from the original disc as shown in the figure. Find moment of inertia of the remaining part of the original disc about the axis as given above



a) $\frac{17}{32}mR^2$
b) $\frac{15}{32}mR^2$
c) $\frac{7}{32}mR^2$
d) $\frac{13}{32}mR^2$

Ans: (d)

3. An electron in the ground state of the hydrogen atom has the orbit, radius of 5.3×10^{-11} m while that for the electron in third excited state is $8.4\,8 \times 10^{-10}$ m. The ratio of the de-Broglie wavelength is of electron in the ground state to that in the excited state is

a) 9
b) 3
c) 4
d) 16

Ans: (c)

4. Find the dimensions of $\frac{B}{\mu_0}$

a) [AL] b) [AL-1] c) 3 [MAL] d) [MALT-1]

Ans: (b)

5. Solid sphere of mass M, radius R exerts force F on a point mass. Now a concentric spherical mass $\frac{M}{7}$ is removed. What is new force?

a) $\frac{F}{7}$ b) $\frac{6F}{7}$ c) $\frac{5F}{7}$ d) $\frac{3F}{7}$

Ans: (b)

6. Given below are two statements: one is labelled as Statement I and the other is labelled as Statement II.

Statement I- In a Vernier Caliper's, one Vernier scale division is smaller than one main scale division.

Statement II- The Vernier constant is given by one main scale division multiplied by the number of Vernier scale divisions.

In the light of the above statements, choose the correct answer from the options given below.

a) Statement I is false but Statement II is true.

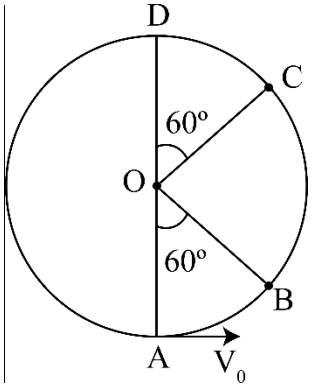
b) Both Statement I and Statement II are true and Statement II is the correct explanation of Statement I.

c) Both Statement I and Statement II are true but Statement II is not the correct explanation of Statement I.

d) Statement I is true but Statement II is false.

Ans: (d)

7. A bob of mass m is suspended at a point 'O' by a light string of length 'l' and left to perform vertical motion (circular) as shown in figure. Initially by applying horizontal velocity V_0 at the point 'A', the string becomes slack when the bob reaches at the point 'D'. The ratio of the K.E of the bob at the points B and C is



a) 2 b) 4 c) 1 d) 3

Ans: (a)

8. Ice at $-10°C$ is to be converted into steam at $110°C$. Mass of ice is 10^{-3} kg. What amount of heat is required?

a) $\Delta Q = 730cal$ b) $\Delta Q = 900cal$ c) $\Delta Q = 1210cal$ d) $\Delta Q = 870cal$

Ans: (a)

9. Given is a thin convex lens of glass (refractive index μ) and each slop having radius of carvature R. one side is polished for complete reflection. At what distance from the lens, an object be placed and the optic axis so that the image sets formed on the object itself?

a) μR b) $R/(2\mu - 3)$ c) $R/(2\mu - 1)$ d) R/μ

Ans: (c)

10. An electron is made to enter symmetrically b/w two parallel and equal oppositely charged metal plates, each of 10 cm length. The electron emerges out of the electric field region with a horizontal component of velocity 10^6m/s. if the magnitude of the electric field between the plates is 9.1V/cm, then the vertical component of velocity of electron is (mass of electron $= 9.1 \times 10^{-31}$ kg, and charge of electron $= 1.6 \times 10^{-19}$C).

a) 0 b) 16×10^6 m/s c) 16×10^4 m/s d) 1×10^6 m/s

Ans: (b)

11. The work functions of cesium (Cs) and lithium (Li) metals are 1.9eV & 2.5 CV, respectively. If we incident a light of wave length 550 nm on these two metal surface, then photo-electric effect is possible for the case of

a) Cs only b) Both Cs and Li c) Li only d) Neither Cs nor Li

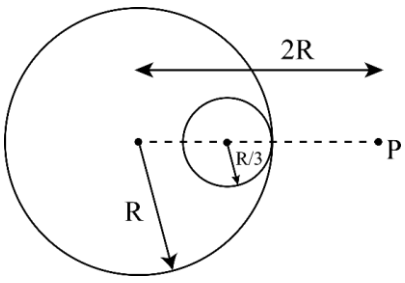
Ans: (a)

12. A closed organ and an open organ tube are filled by two different gases having same bulk modulus but different densities ρ1 and ρ2, respectively. The frequency of 9^{th} harmonic of closed tube is identical with 4th harmonic of open tube. If the length of the closed tube is 10cm and the density ratio of the gases is $\rho 1 : \rho 2 = 1 : 16$, then the length of the open tube is:

a) $\frac{15}{7}$ cm b) $\frac{20}{7}$ cm c) $\frac{15}{9}$ cm d) $\frac{20}{9}$ cm

Ans: (d)

13. A small point of mass m is placed at a distance 2R from the center of a big uniform solid sphere of mass 'm' and radius R. The gravitational force on 'm' due to 'm' is F1. A spherical part of radius R/3 is removed from big sphere as shown in the figure and the gravitational force on m due to remaining part of m is found to be F2. The value of ratio F1: F2 is



a) 16:9 b) 12:11 c) 11:10 d) 12:9

Ans: (b)

14. Two spherical black bodies of the radii 0.2cm and 0.4cm are at temperature 400K and 800K respectively. If the energy radiator by small body is E then energy radiated by large body is

a) E b) 16E c) 64E d) 4E

Ans: (c)

15. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: If young's double slit experiment is performed in an optically denser medium than air, then the consecutive fringes come closer.

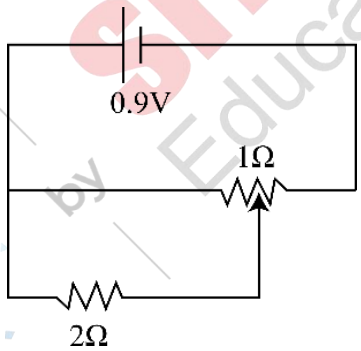
Reason R: The speed of light reduces in an optically denser medium than air while its frequency does not change.

In the light of the above statements, choose the correct answer from the options given below.

a) A is false but R is true.
b) Both A and R are true.
c) Both A and R are false.
d) A is true but R is false.

Ans: (b)

16. Find current in the circuit. Jockey is at middle point on 1Ω



Ans: 1A

CHEMISTRY

1. Which of the following lanthanide ion as 7 electrons in the outer most shell

   a) Eu^{+3} b) Gd^{+3} c) Eu^{+4} d) Gd^{+2}

   Ans: (b)

2. Number of linear compounds ?

   $I_3^-, NO_2, O_3, OF_2, NO_2^+, BeCl_2, N_3^-, SO_3, CO_2, XeF_2$

   a) 5 b) 2 c) 4 d) 3

   Ans: (c)

3. Given the weight of the organic compound. 180 g and the weight of the AgCl precipitated 143.5 g. Calculate the percentage of Cl in the organic compound ? [wt of Cl = 35.5 g, wt of Ag = 108 g].

   a) 13.20% b) 22.20% c) 35.20% d) 19.72%

   Ans: (d)

4. Electrolysis of which compound give $H_2S_2O_8$

   a) Electrolysis of Conc.Na_2SO_4 b) Electrolysis of Dil.Na_2SO_4

   c) Electrolysis of Conc.H_2SO_4 d) Electrolysis of Dil.H_2SO_4

   Ans: (c)

5. Which of the following electronegativity order is **incorrect**?

   a) Mg < Be < B < N b) Al < Si < C < N

   c) S < Cl < O < F d) Al < Mg < B < N

   Ans: (d)

6. Which of the following statement is not true for radioactive decay?

   a) Decay constant does not depend upon temperature

   b) Decay constant increases with increase in temperature

   c) Half life is In 2 times of $\frac{1}{\text{rate constant}}$

   d) Amount of radioactive substance remained after three half lives is 1/8th of original amount

   Ans: (a)

7. (I) 10^{-4}NaCl, (II) 10^{-3}NaCl, (III) 10^{-2}NaCl, (IV) 10^{-4} Urea order of increasing B.P.

   a) I > II > III > IV b) III > II > I > IV c) II > I > III > IV d) III > I > II > IV

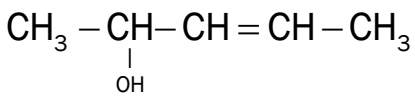
   Ans: (b)

8. Which of the following acids is a Vitamin.

a) Saccharic acid b) Aspartic acid c) Adipic acid d) Ascorbic acid

Ans: (d)

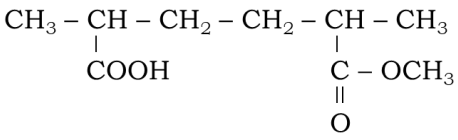
9. How many different stereoisomers are Possible for the given molecule?



a) 4 b) 3 c) 2 d) 1

Ans: (a)

10. IUPAC name?



a) 6-methoxy-2, 5-dimethyl-6-oxohexanoic acid

b) 7-methoxy-3-methyl hexanoic acid

c) 3-methoxy-5-methyl hexanoic acid

d) 3-methoxy-5, 6-dimethyl-2-hexanoic acid

Ans: (a)

11. Incorrect statement.

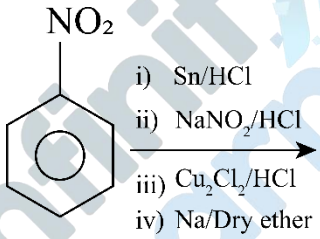
a) Melting point of Cis 2-butene is greater than trans 2-butene

b) 2-butene can have two geometrical isomers

c) Dipole moment of cis 2-butene is greater than trans 2-butene

d) In trans isomer identical groups are opposite direction

Ans: (a)

12. 

Find molecular weight of A

a) 123 b) 115 c) 215 d) 154

Ans: (d)

13. For $[NiCl_4]^{2-}$ what is the charge on metal and shape of complex respectively?

a) +2, Tetrahedral b) +2, Square planar c) +4, Tetrahedral d) +4, Square Planar

Ans: (a)

14. The correct decreasing order of electronegativity is

a) $F > Cl > I > Br$ b) $Cl > F > Br > I$ c) $F > Cl > Br > I$ d) $Br > F > I > Cl$

Ans: (c)

15. Which of the following has maximum size out of $Al^{3+}, Mg^{2+}, F^{-}, Na^{+}$

a) Al^{3+} b) Mg^{2+} c) F^{-} d) Na^{+}

Ans: (c)

16. $CO_2(g) + C(s) \rightleftharpoons 2CO(g)$. If initial pressure of CO_2 is 0.6 atm and after equilibrium is established, total pressure is 0.8 atm. Then, find K_p.

a) 0.4 b) 0.2 c) 0.6 d) 0.8

Ans: (a)

17. **Statement-I:** $CH_3 - O - CH_2 - Cl$ will show nucleophilic substitution by S_N1 mechanism in protic medium.

Statement-II: $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}} - CH_2 - Cl$ will not undergo nucleophilic substitution via S_N2 mechanism easily.

a) Statement-I and statement-II both are correct

b) Statement-I and statement-II both are incorrect

c) Statement-I is correct but statement-II is incorrect

d) Statement-I is incorrect but statement-II is correct

Ans: (a)

18. An electron of He^{+} is present in 3^{rd} excited state. Find its de-Broglie wave length.

a) 6.64Å b) 1.66Å c) 3.32Å d) 13.28Å

Ans: (a)

19. Given : $NH_2COONH_4(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$. If the partial pressure of CO_2 gas at equilibrium is 0.4 atm and the total pressure is 1 atm, the value of K_p at the same temperature is

a) 0.027 atm^3 b) 0.064 atm^3 c) 0.144 atm^3 d) 0.216 atm^3

Ans: (c)

20. In a closed insulated container, a liquid is stirred with a paddle to increase the temperature which of the following is true?

a) $w = 0, \Delta E = q \neq 0$ b) $\Delta E = w \neq 0, q = 0$

c) $\Delta E = w = 0, q \neq 0$ d) $\Delta E = 0, w = q \neq 0$

Ans: (b)

21. Match the column and choose the correct option

	Column-I (Properties)		**Column-II (Order)**
(A)	Electronegativity	(1)	$B < C < N < O$
(B)	Cationic size	(2)	$Li > Mg > Be$
(C)	Metallic Character	(3)	$K > Mg > Al$
(D)	Electron affinity	(4)	$Cl > F > Br > I$

a) $A-1, B-2, C-3, D-4$ b) $A-4, B-3, C-2, D-1$

c) $A-2, B-3, C-4, D-1$ d) $A-3, B-2, C-4, D-1$

Ans: (a)

22. If work function of Cs and Fr is 1.9 and 2.5 eV. It the light $= 500$ nm. which element will have have Photoelectric effect.

a) Only Cs b) Only Fr c) Both Cs and Fr d) None of these

Ans: (a)

MATHEMATICS

1. Let the triangle PQR be the image of the triangle with vertices $(1,3),(3,1),(2,4)$ in the line $x+2y=2$. If the centroid of ΔPQR is the point (α,β) then $15(\alpha-\beta)$ is equal to

a) 10 b) 15 c) 25 d) 22

Ans: (d)

2. Two balls are selected at random one by one without replacement from the bag containing 4 white and 6 black balls. If the probability that the first selected ball is black given that the second selected is also black, is m/n where $\gcd(m,n)=1$, then $m+n=?$

a) 11 b) 14 c) 6 d) 27

Ans: (b)

3. From the English alphabets, 5 letters are chosen and are arranged in alphabetical order. The total number of ways in which the middle letter is **M**.

a) 2167 b) 1276 c) 5148 d) 2053

Ans: (c)

4. $\sum_{r=1}^{n} T_r = \frac{(2n-1)(2n+1)(2n+3)(2n+5)}{64}$, then $\lim_{n\to\infty} \sum_{r=1}^{n} \left(\frac{1}{T_r}\right) =$

a) $\frac{2}{3}$ b) $\frac{3}{4}$ c) $\frac{1}{5}$ d) $\frac{2}{5}$

Ans: (a)

5. Let $f(x)$ be a real differentiable function such that $f(0)=1$ and $f(x+y)=f(x)f'(y)+f(y)f'(x)$ for all $x,y\in R$. Then $\sum_{n=1}^{100}\log_e f(n)=$

a)1212 b) 2312 c) 2050 d) 2525

Ans: (d)

6. The Product of all solutions of the equation $e^{5(\log_e x)^2+3}=x^8, x>0$ is

a) $e^{\frac{1}{3}}$ b) $e^{\frac{1}{5}}$ c) $e^{\frac{8}{5}}$ d) $e^{\frac{2}{3}}$

Ans: (c)

7. Let the foci of the hyperbola be $(1,14)$ and $(1,-12)$. It passes through the point $(1,6)$ then length of its latus rectum is?

a) 22/7 b) 2/3 c) 288/5 d) 1/13

Ans: (c)

8. The number of non empty equivalence relations on the set {1,2,3} is

a) 6 b) 4 c) 5 d) 7

Ans: (c)

9. $a_1, a_2, a_3 \ldots \ldots \ldots$ are positive terms of increasing GP if $a_1 a_5 = 28$ & $a_2 + a_6 = 29$ then find a_3 =?

a) 246 b) 325 c) 125 d) 784

Ans: (d)

10. Using the principle values of the inverse trigonometric functions, the sum of maximum and minimum values of $16[(\sec^{-1} x)^2] + (\text{cosec}^{-1} x)^2]$

a) $17\pi^2$ b) $22\pi^2$ c) $13\pi^2$ d) $35\pi^2$

Ans: (b)

11. Find the area inside the circle $(x - 2\sqrt{3})^2 + y^2 = 12$ and parabola $y^2 = 2\sqrt{3}x$

a) $16\sqrt[4]{3} - 5\pi$ b) $16\sqrt[4]{11} - 4\pi$ c) $3\sqrt[4]{11} - 5\pi$ d) $16 + 6\pi$

Ans: (d)

12. Let x = x(y) be the solution of the differential equation $y^2 dx + \left(x - \frac{1}{y}\right) dy = 0$. If $x(1) = 1$ then $x\left(\frac{1}{2}\right)$ is equal to

a) $3 + e$ b) $\frac{1}{2} + e$ c) 3-e d) $\frac{-3}{2} + e$

Ans: (c)

13. Let $A = \{1,2,3,4,5,6,7,8,9,10\}$ and $B = \{m/n : m, n \in A\}, m < n$ and $\gcd(m, n) = 1$. then $n(B)$ is equal to

a) 29 b) 36 c) 31 d) 37

Ans: (c)

14. $\sum_{r=0}^{5} \frac{^{11}C_{2r+1}}{2r+2} =$

a) $\frac{2^{11} - 1}{12}$ b) $\frac{2^{11} - 1}{3}$ c) $\frac{2^{13} - 3}{5}$ d) $\frac{2^{13} - 5}{7}$

Ans: (a)

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