JEE Main 2024 Solutions April 4 Shift 2 (B.E./B.Tech)

JEE Main Physics Questions

Ques 1. A massless rod has a point mass attached to one end while the other end is hinged. The rod is released from the position shown. The speed of the mass at the bottom most point is (R = 14 m, g = 10 m/s^2)

    A. $\sqrt{560}$ m/s
    B. $\sqrt{280}$ (1 + 1/$\sqrt{2}$) m/s
    C. $\sqrt{280}$ m/s
    D. $\sqrt{280}$ (1 + 1/$\sqrt{3}$) m/s

Ans. B

Solution. Conserving energy,
v= $\sqrt{(2g(R+R\sin45))}$
=$\sqrt{(20* 14(1+1/\sqrt{2}))}$
=$\sqrt{(280(1+1/\sqrt{2})}$ m/s

Ques 2. P, Q, R, S are 4 symmetric points on a horizontal circle of radius of 4 km. What is the displacement when a car moves from P to R along the given circular path.

    A. 4$\sqrt{2}$ km
    B. 4 π km
    C. 8 km
    D. 4 km

Ans. C

Solution . To find the displacement when a car moves from point P to point R along the given circular path, we need to understand that displacement is the shortest distance between the initial and final points.

Since P and R are symmetric points on a horizontal circle, they are diametrically opposite each other. Therefore, the displacement when moving from P to R would be equal to the diameter of the circle.

Given that the radius of the circle is 4 km, the diameter is twice the radius, which is
2×4 km = 8 km.
So, the displacement when moving from P to R along the circular path is 8 km.
Therefore, the correct answer is: 8 km.

Ques 3. One mole of an ideal monatomic gas compressed adiabatically from volume 2 V to V . If initially temperature of gas was T then the magnitude of work done in this process is

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

Ans. B
Solu. W= -nRΔT/(p-1)
=> T_i =T
=> T_f = T$(2)^{2/3}$
ΔT=T $(2^{2/3}$ -1)

W= RT$(2^{2/3}$ -1)/ (5/3-1)
=3/2RT $(2^{2/3}$-1)

Ques 4. A 2 kg brick is placed on an inclined plane of inclination 45°. The brick is at rest. The minimum coefficient of static friction is:

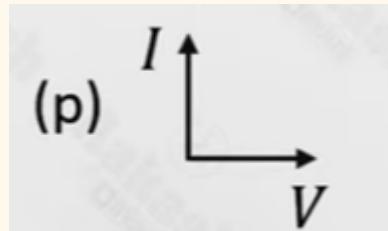 A. 0.5
  B. $\sqrt{3}$
  C. 1
  D. $1/\sqrt{3}$
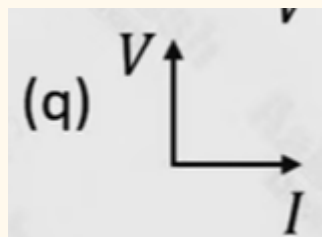
Ans. C
Solu. N = mgcos45°
f_s = mgsin45°
=> mgsin45° <=µ mgcos45°
µ>= 1.

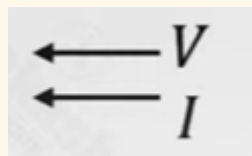**Ques 5. Correct match for phasors of voltage and current for given elements is**

a. Inductive

b. Capacitive

C. Resistive

  A. a → p,b → q,c→r
  B. a → q,b → p,c→r

C. a $\rightarrow$ p, b $\rightarrow$ p, c $\rightarrow$ r
D. a $\rightarrow$ q, b $\rightarrow$ q, c $\rightarrow$ r

Ans. B

Ques 6. Assertion (A) : The contact angle depends on material of solid and liquid.
Reason (R) : Height of the liquid in a capillary tube is independent of the radius of the tube.
(1) Both (A) and (R) are true and (R) is the correct explanation of (A)
(2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
(3) (A) is true but (R) is false
(4) (A) is false but (R) is true

Ans. C

Solution Assertion (A): The contact angle depends on the material of the solid and liquid.

This assertion is true. The contact angle, which is the angle formed between the tangent to the liquid surface and the solid surface at the point of contact, depends on the surface tensions of the liquid and solid. It varies with the nature of both the liquid and the solid.

Reason (R): Height of the liquid in a capillary tube is independent of the radius of the tube.

This reason is false. The height of the liquid in a capillary tube, as per Jurin's Law, is inversely proportional to the radius of the tube

Ques 7. A metallic rod of length 4 m is rotating about perpendicular bisector of the rod with angular velocity of 2 rad/s in presence of

transverse magnetic field of 0.5 T. Potential difference developed across ends of rod is

    A. 16 V
    B. 8 V
    C. 0 V
    D. 32 V

Ans. C
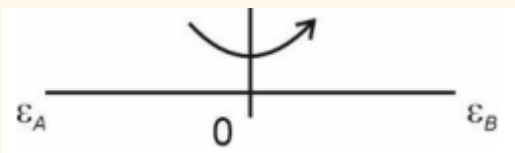
Solu.

$\varepsilon_A = \varepsilon_B$

$\Delta V_{AB} = 0$

Ques 8. Statement 1 : In photoelectric effect, number of photoelectrons emitted are proportional to frequency of incident light. Statement 2 : Maximum kinetic energy of photoelectrons is proportional to frequency of incident light.

    A. Statement 1 is true and Statement 2 is true and correct explanation of 1
    B. Statement 1 is true and Statement 2 is true and not correct explanation of 1
    C. Statement 1 is true and Statement 2 is false
    D. Statement 1 is false and Statement 2 is true

Ans. D

Solution Statement 1: Maximum kinetic energy of photoelectrons is proportional to the frequency of incident light.

This statement is in accordance with the photoelectric effect. According to Einstein's photoelectric equation, the maximum kinetic energy of photoelectrons is directly proportional to the frequency of the incident light, and it can be expressed as:

K. $E_{MAX} = hf - \phi$

Statement 2: Maximum kinetic energy of photoelectrons is proportional to the frequency of incident light.

This statement is true and aligns with the photoelectric effect, as described by Einstein's photoelectric equation.

Now, let's analyze the relationship between the two statements. Statement 2 provides the correct explanation for Statement 1, as it directly refers to the underlying principle of the photoelectric effect.

Therefore, the correct option is:

Statement 1 is true and Statement 2 is true and the correct explanation of 1.

Ques 9. The circuit diagram shown is equivalent to
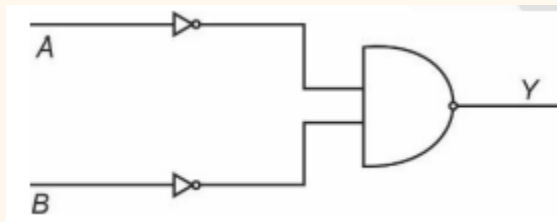
    A. OR
    B. NOR
    C. AND
    D. NAND

Ans. A

Solu. $Y = \overline{\overline{A} \cdot \overline{B}} = A + B$

Ques 10. The width of the one slit in YDSE is four times the other slit. Then ratio of maximum to the minimum intensity at screen is

    A. 9 : 1

    B. 16 : 1

    C. 4 : 1

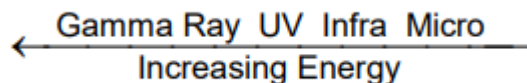   D. 1 : 1

Ans. A

Solu. $I_1 = I_0$

$I_2 = 4I_0$

$I_{max} = [\sqrt{I_0} + \sqrt{4I_0}]^2 = 9I_0$

$I_{min} = I_0$

Ques 11. Wavelengths assigned to gamma rays, infra-red rays, UV rays and microwaves are 1 , 2 , 3 & 4 respectively. Then :

    A. $\lambda 1 < \lambda 2 < \lambda 3 < \lambda 4$

    B. $\lambda 1 < \lambda 3 < \lambda 2 < \lambda 4$

    C. $\lambda 1 > \lambda 2 > \lambda 3 > \lambda 4$

    D. $\lambda 2 < \lambda 3 < \lambda 1 < 4$

Ans. B

Gamma Ray UV Infra Micro

Increasing Energy

Solu.

Ques 12. A heater of rating of 50 W – 200 V is connected with source voltage of 100 V. Power consumed by heater is

    A. 100 W

    B. 25 W

    C. 50 W

    D. 12.5 W

Ans. D

Solu. $R = V_r^2/P_r = 200 * 200/50 = 800 \ \Omega$

$P = V^2/R = 100*100 /800 = 12.5 \ W$

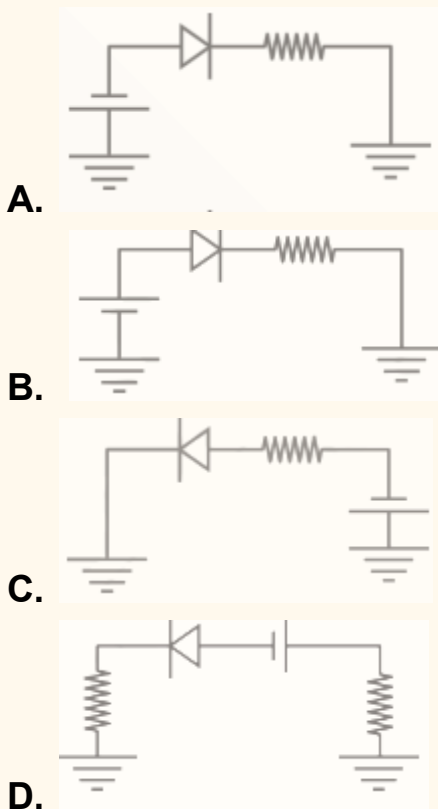**Ques 13. With regard to gravitation parameters, the dimensions of T^2 are same as that of**

    A. r^3/GM

    B. GM/r^3

    C. $r^{3/2}/GM$

    D. r^2/GM

Ans. A

Solu.
$$T^2 = \frac{4\pi^2}{GM}r^3$$

Ques 14. Which of the following circuits would have the diode in conducting state?

A.

B.

C.

D.

Ans. B

Solu. For conducting state : Vp > Vn.

Ques 15. Two point mass m and 2m are on straight line. If mass m moves toward centre of mass by distance 2 cm, then the distance must mass 2m should move so that centre of mass does not change _____ cm.

Ans. 1
Solu. m(2m) = 2m(x)
x = 1 cm

Ques 16. A body of mass 4 kg is at a height of R (radius of earth) from surface of earth. The weight of the body is _____ N.

Ans. 10
Solu. g' = g/4 =5/2
=> Weight = mg' = 10N

Ques 17. A bar magnet of magnetic moment M = 0.5A m2 is under the influence of a magnetic field 8 T. Find the work done (J) to move the magnet from stable to unstable equilibrium position.

Ans. 8
Solu. W = ΔU
=> W = 2 × M × B = 8 J

Ques 18. For methane, translation degrees of freedom is f1 while rotational degrees of freedom is f2 . Find f1 + f2 .
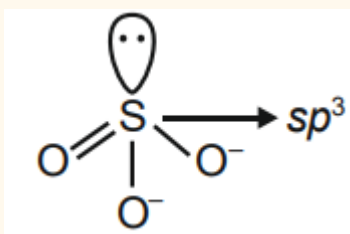
Ans. 6
Solu. f_1 = 3
f_2 = 3 [∵ Non-linear]

Ques 1. Which of the following have a pyramidal shape ?

A. a) $S_2O_3^{2-}$
B. SO_4^{2-}
C. SO_3^{2-}
D. $S_2O_7^{2-}$

Ans. D

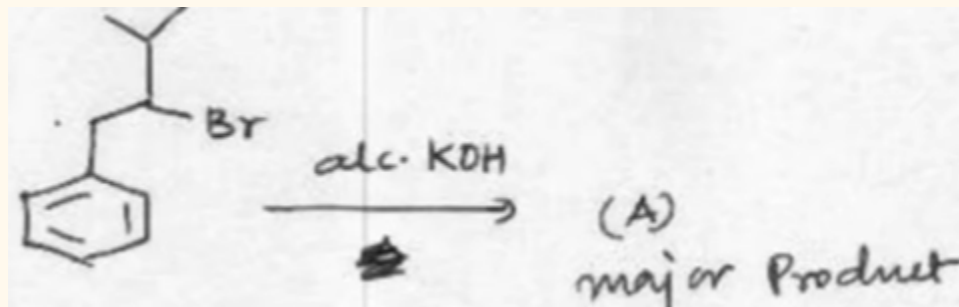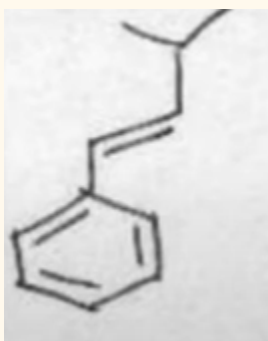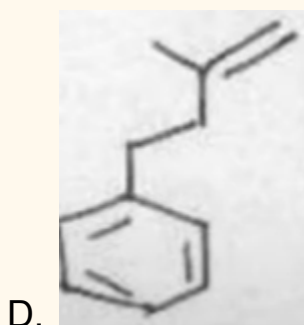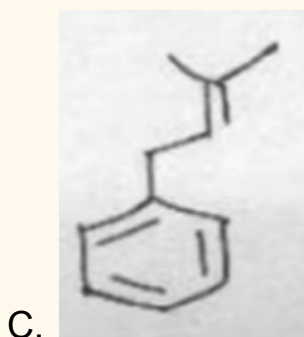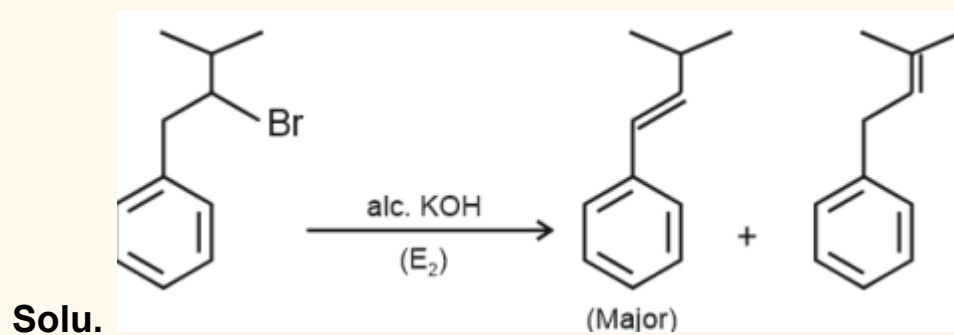**Solu.**

Pyramidal shape

Ques 2. Major product A is
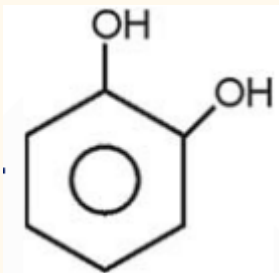

A.

B.

C.

D.
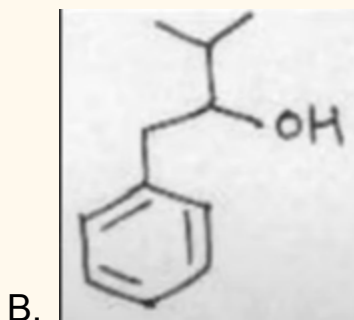
Ans. A

Solu.

Ques 3. IUPAC name of Catechol is-

A. Benzene, 1,2-diol
B. Benzene-1,3-diol

C. Benzene -1,4-diol

D. 3-Hydroxyphenol

Ans. A

Solu.
Benzene, 1,2-diol

Ques 4. The correct order of ionisation enthalpy for Li, Na, Cl, F is:

    A. Na < Li < Cl < F

    B. Li < Na < Cl < F

    C. Na < Li < F < Cl

    D. F < Cl < Li < Na

Ans. A

Solu. The ionization energy (ionization enthalpy) is the energy required to remove an electron from a neutral atom in its gaseous state.

The general trend for ionization energy in a period of the periodic table is that it increases from left to right. This is because, as you move from left to right across a period, the effective nuclear charge increases, leading to a stronger attraction between the nucleus and the valence electrons, making it harder to remove an electron.
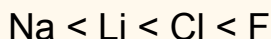
Let's analyze the given elements:
- Li (Lithium) has 3 electrons.
- Na (Sodium) has 11 electrons.
- Cl (Chlorine) has 17 electrons.
- F (Fluorine) has 9 electrons.

Comparing ionization enthalpy:

1. Sodium (Na) has the lowest ionization energy because it is farthest to the left among the given elements. It has one electron in its valence shell which is easier to remove compared to the other elements.
2. Lithium (Li) comes next because it is to the left of chlorine and fluorine. It requires more energy to remove an electron compared to sodium but less than chlorine and fluorine.
3. Chlorine (Cl) follows lithium. It is to the right of sodium and lithium. Removing an electron from chlorine requires more energy compared to sodium and lithium.
4. Fluorine (F) has the highest ionization energy among the given elements because it is the farthest to the right. It requires the most energy to remove an electron due to the increased effective nuclear charge.
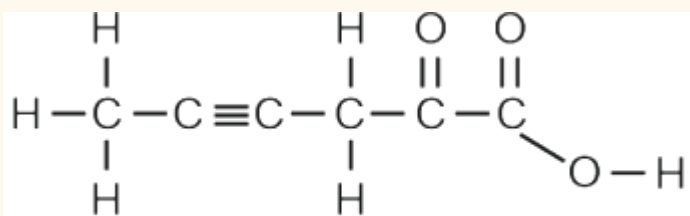
So, the correct order of ionization enthalpy for Li, Na, Cl, F is:
    Na < Li < Cl < F
Which matches option A.

Ques 5. What is the sum of number of σ and π bonds present in 2-oxo-hex-4-yne-oic acid ?

Ans. 18

Solu.
Number of σ bonds : 14
Number of π bonds = 4
Total σ+π bonds = 14 + 4 = 18

Ques 6. Consider the following statements:

Statement I: The number of emitted photoelectrons Increases with increase in frequency of incident light.

Statement II: Kinetic energy of emitted photoelectrons increases with increase in frequency of incident light

   A. Statement I is true but statement II is false
   B. Statement I is false but statement II is true
   C. Both Statement I and statement II are true
   D. Both Statement I and statement II are false

Ans. B

Solution The number of emitted photoelectrons increases with an increase in the frequency of incident light.

This statement is false. According to the photoelectric effect, the number of emitted photoelectrons does not depend on the frequency of incident light. Instead, it depends on the intensity of the incident light. Higher intensity light leads to more photoelectrons being emitted, regardless of the frequency.

Statement II: Kinetic energy of emitted photoelectrons increases with an increase in the frequency of incident light.

This statement is true. According to the photoelectric effect, the kinetic energy of emitted photoelectrons is directly proportional to the frequency of the incident light. This relationship is described by Einstein's photoelectric equation:
K. $E_{MAX} = hf - \phi$

Ques 7. Which of the following is used as adsorbent in adsorption chromatography?

A. Silica Gel
B. Alumina
C. Benzene
D. Both A and B

Ans. D

Solution Adsorption chromatography is a type of chromatography where separation of components occurs based on the differential adsorption of components onto the stationary phase. The stationary phase in adsorption chromatography is typically an adsorbent material.

Both silica gel and alumina are commonly used as adsorbents in adsorption chromatography:
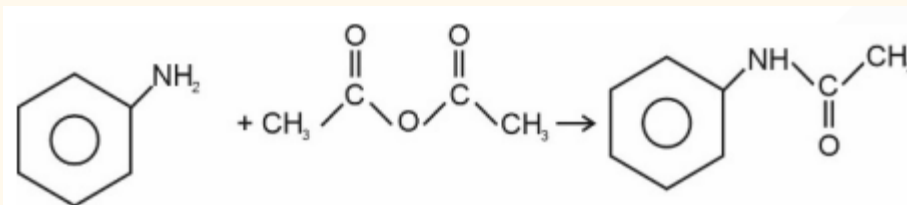
A. Silica Gel
B. Alumina

These materials have surface properties that allow them to adsorb different components of the sample at varying degrees, leading to separation.

Therefore, the correct answer is:

D. Both A and B

Ques 8. What is the maximum amount of acetanilide formed when acetic anhydride in excess is treated with 18 gm of aniline. (nearest integer)
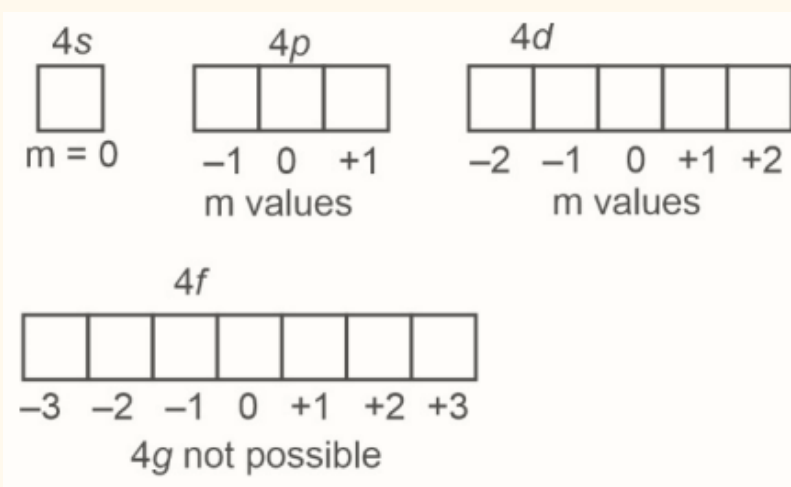
Ans. 26

Solu.

moles of aniline = 18/93

mass of acetanilide formed = 18/93*135 = 26.129 = 26

Ques 9. Maximum number of orbitals possible when n = 4 and m = 0?

Ans. 4

Solu.

Ques 10. How many of the given statements are true for fuel cell?
   A. It is a type of Galvanic cell
   B. It is used for providing electrical power in space programmes.
   C. Hydrogen and oxygen are bubbled through porous carbon
      electrodes into concentrated NaOH solution
   D. It produces electricity with an efficiency of 40%
   E. It is pollution free cell

Ans. 4

Solution Four of the statements are true for fuel cells. Fuel cells are indeed a type of Galvanic cell, utilized widely in space programs for electrical power generation due to their reliability. However, the statement about

hydrogen and oxygen bubbling through porous carbon electrodes into a concentrated NaOH solution is inaccurate, as fuel cells typically operate with separate electrodes and electrolytes. Fuel cells are known for their high efficiency, often exceeding 40%, and they are considered relatively pollution-free compared to traditional combustion-based power generation methods due to their electrochemical process that produces electricity without emitting pollutants.

Ques 11. An element of d-block (Z) of 4th period has spin only magnetic moment of its Z^{3+} form is 3.9 BM, then find minimum atomic number of element (Z).

Ans. 24
Solu. μ= 3.9 BM
It means there must be 3 unpaired electrons in Z^{3+} ion
Cr^{+3} => [Ar] $3d^3 4s^0$

Ques 12. Which one of the following has the most negative (highest –ve) electron gain enthalpy?
   A. Li
   B. Na
   C. F
   D. Cl

Ans. D
Solu. Chlorine = –349 kJ mol–1
Sodium = –53 kJ mol–1
Fluorine = –328 kJ mol–1
Lithium = –60 kJ mol–1

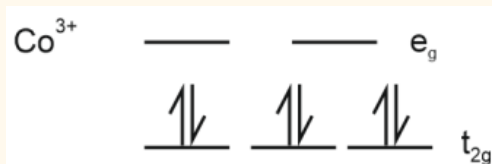**Ques 13. Find out number of unpaired electrons in d-subshell for $[Co(H2O)6]$ 3+.**
   A. 3
   B. 4
   C. 0

D. 2

Ans. C
Solu. $Co3+ : 3d^6 4s^0$
$Co3+$ in excited state will undergo pairing with H2O.

n =0
  Correct answer is option (3).

Ques 14. 9. Which of the following statement is INCORRECT
   A. In homogeneous mixture, Composition is uniform
   B. Compounds are formed when atoms of different elements combine together in any ratio
   C. Atoms of same element have identical atomic mass and properties
   D. In heterogeneous mixture, Composition is not uniform

Ans. B

Solution The incorrect statement is:

B. Compounds are formed when atoms of different elements combine together in any ratio.

In reality, compounds are formed when atoms of different elements combine together in fixed, definite ratios, governed by chemical laws such as the law of definite proportions. This statement incorrectly suggests that compounds can form in any ratio, which is not the case.

Therefore, the correct answer is B.

Ques 15. Arrange the following anions in the decreasing order of their stability.
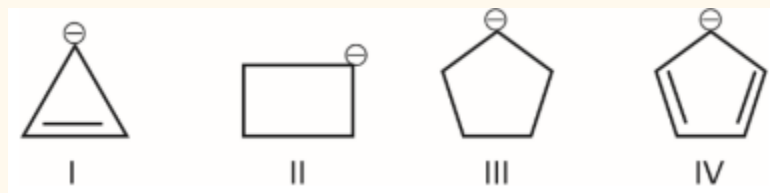
A. I > II > III > IV
B. IV > III > II > I
C. III > II > I > IV
D. II > IV > III > I

Ans. B
Solu. . Cyclopentadienyl anion (IV) is most stable and cyclopropenyl anion (I) is least stable as (IV) is aromatic and (I) is antiaromatic. Anion (II) is less stable than (III) due to higher angle strain. Correct stability order is IV > III > II > I

JEE Main Mathematics Questions

Ques 1. If a, b, c are in A. P. and a + 1, b, c + 3 are in G. P., arithmetic mean of a, b, c is 8, then the value of cube of geometric mean of a, b, c is:

A. 312
B. 314
C. 318
D. 128

Ans. A
Solu. a, b, c, → A.P.
a + 1, b, c + 3 → G.P.
(a+b+c)/3 =8 ⇒ a + c = 16
2b = a + c c = 16 – a ⇒ b = 8 …(1)

64 = (a + 1) (c + 3)
64 = ac + 3a + c + 3
64 = a(16 − a) + 3a + 16 − a + 3
64 = 16a − a² + 2a + 19
a2 − 18a + 45 = 0
(a − 15)(a − 3) = 0 ⇒ a = 15 or a = 3 ⇒ c = 1 or c = 13
((abc)⅓) = 1 × 15 × 8 or 13 × 3 × 8 = 120 or 312

Ques 2. If $\int_{-1}^{1} \frac{\cos \alpha x}{1+3^x} dx = \frac{2}{\pi}$ then α is

    A. π/6
    B. π/2
    C. π/3
    D. Π

Ans. B

$$I = \int_{-1}^{1} \frac{\cos \alpha x}{1+3^x}$$

$$\Rightarrow \quad I = \int_{0}^{1} \frac{\cos \alpha x}{1+3^x} + \frac{\cos \alpha x}{1+3^{-x}} dx$$

$$= \int_{0}^{1} \cos \alpha x \, dx$$

$$= \frac{\sin \alpha x}{\alpha} \Big]_{0}^{1} = \frac{\sin \alpha}{\alpha} = \frac{2}{\pi}$$

Solu.

    α=π/2

Ques 3. If coefficient of x⁴, x⁵, x⁶ of (1 + x)ⁿ are in A.P., then maximum value of n is equal to

A. 28
B. 21
C. 14
D. 7

Ans. C

Ques 4. Let relation defined as (x1, y1) R (x2, y2) x1 ≤ x2, y1 ≤ y2 and given that
(a) R is reflexive but not symmetric.
(b) R is transitive.
then

    A. (a) is true, (b) is false
    B. (a) is false, (b) is true
    C. Both are true
    D. Both are false

Ans. C
Solu. (x1, y1) R (x2, y2)
When x1 ≤ x2, y1 ≤ y2
For reflexive (x1, y1) R (x1, y1)
⇒ x1 ≤ x1 & y1 ≤ y1 so, R is reflexive
For symmetric, When (x1, y1) R (x2, y2)
⇒ x1 ≤ x2 & y1 ≤ y2
for (x2, y2) R (x1, y1)
x2 ≤ x1 & y2 ≤ y1
That is not necessarily true so R is not symmetric
For transitive, If (x1, y1) R (x2, y2)
⇒ x1 ≤ x2 & y1 ≤ y2 & (x2, y2) R (x3, y3)
⇒ x2 ≤ x3 & y2 ≤ y3 For (x1, y1) R (x3, y3)
⇒ x1 ≤ x3 & y1 ≤ y3
So, R is transitive Both (a) & (b) are true.

Ques 5. The value of

$$\frac{1 \times 2^2 + 2 \times 3^2 + \ldots + 100 \times (101)^2}{1^2 \times 2 + 2^2 \times 3 + \ldots + 100^2 \times 101}$$

A. 305/301
B. 301/305
C. 350/310
D. 310/350

Ans. A

Solu. The given problem can be written as

$$\frac{\displaystyle\sum_{n=1}^{100} n(n+1)^2}{\displaystyle\sum_{n=1}^{100} n^2(n+1)}$$

$$\Rightarrow \frac{\displaystyle\sum_{n=1}^{100} n^3 + 2n^2 + n}{\displaystyle\sum_{n=1}^{100} n^3 + n^2}$$

$$= \frac{\left(\dfrac{100(101)}{2}\right)^2 + \dfrac{2.100(101)(201)}{6} + \dfrac{100(101)}{2}}{\left(\dfrac{100(101)}{2}\right)^2 + \dfrac{100(101)(201)}{6}}$$

$$= \frac{\dfrac{(100)(101)}{4} + \dfrac{2(201)}{6} + \dfrac{1}{2}}{\dfrac{100(101)}{2} + \dfrac{201}{6}}$$

$$= \frac{300(101) + 4(201) + 6}{300(101) + 2(201)} = \frac{15555}{15351} = \frac{5185}{5117} = \frac{305}{301}$$

Ques 6. A parabola $y^2 = 12x$ has a chord PQ with mid-point (4, 1) then equation of PQ passes through

A. (½, -20)
B. (½, -10)
C. (10, -½)
D. (-10, -½)

Ans. A
Solu. Chord with the given middle point is given by $\Rightarrow$ T = S1
$\Rightarrow yy_1 - 6(x + x_1) = y_1^2 - 12x_1$
$y - 6 (x + 4) = 1 - 48$
$\Rightarrow y - 6x + 23 = 0$
(1/2, −20) is correct answer.

Ques 7. Team A plays 10 matches, probability of winning is 1/3 and losing is ⅔. They win x matches and lose y matches. Probability such that |x − y| ≤ 2 is P then find 3^9P.
A. 8288
B. 8381
C. 8461
D. 8911

Ans. A
Solu. Probability of winning matches = 1/3 and
losing matches = ⅔
We need to find |x – y| ≤ 2
x = Number of winning matches
Y = Number of losing matches.
As we know x + y = 10 |x – y| ≤ 2
So,
Case I, x = 4, y = 6

$$^{10}C_4 \left(\frac{1}{3}\right)^4 \left(\frac{2}{3}\right)^6 = \frac{210.2^6}{3^{10}}$$

Case II, x = 5, y = 5

$$^{10}C_5\left(\frac{1}{3}\right)^5\left(\frac{2}{3}\right)^5 = \frac{252.2^5}{3^{10}}$$

Case III, x = 6, y = 4

$$^{10}C_6\left(\frac{1}{3}\right)^6\left(\frac{2}{3}\right)^4 = \frac{210.2^4}{3^{10}}$$

So required probability $2^4/3^{10}[2^2 .210\ 2.252 + 210]$,
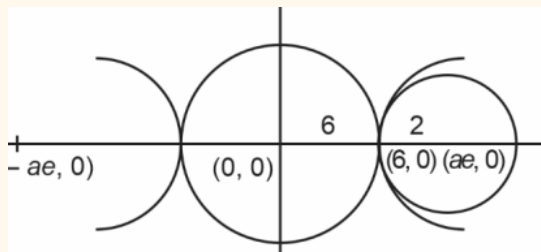$1554.2^4/3^{10} = 518.2^4/3^9$
Now, $3^9P = 8288$

Ques 8. For a hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ **, C1 is a circle touching hyperbola having centre at origin and C2 is circle centred at four and touching hyperbola at vertices, if area of C1 = 36π and area of C2 = 4π. Find a2 + b2 = ?**

    A. 40
    B. 43
    C. 64
    D. 56

Ans. C
Solu.

Radius of C_1 = 6
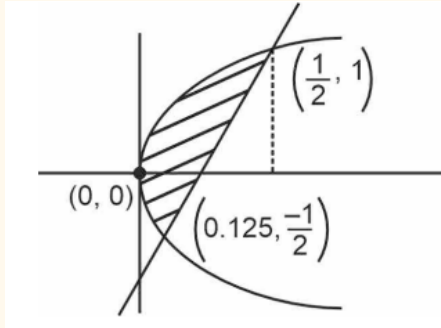Radius of C_2 = 2
2ae = 16 ae = 8
$b^2 = a^2e^2 - a^2$
$\Rightarrow b^2 + a^2 = 64$

Ques 9. Find area bounded by y2 ≤ 2x and y ≥ 4x − 1

A. 9/ 32

B. 11/ 32

C. 11/ 8

D. 11/ 3

Ans. A

Solu. Given region is

$$\text{Area} = \int_{-\frac{1}{2}}^{1}\left(\frac{y+1}{4}-\frac{y^2}{2}\right)dy$$

$$=\left[\frac{y^2}{8}+\frac{y}{4}-\frac{y^3}{6}\right]_{-\frac{1}{2}}^{1}$$

$$=\left(\frac{1}{8}+\frac{1}{4}-\frac{1}{6}\right)-\left(\frac{1}{32}-\frac{1}{8}+\frac{1}{48}\right)$$

$$=\frac{5}{24}-\left(\frac{3-12+2}{96}\right)$$

$$=\frac{5}{24}+\frac{7}{96}$$

$$=\frac{27}{96}=\frac{9}{32}$$

Ques 10. $(x^2 + 1)^2 dy + (y(2x^3 + x) - 2)dx = 0$, $y(0) = 0$, then $y(2)$ is equal to

A. $2/5 \tan^{-1}2$

B. $\frac{3}{5} \tan^{-1}2$

C. $2/5 \tan^{-1}3$

D. $3/5 \tan^{-1}3$

Ans. A

$$\frac{dy}{dx} = \frac{2 - y\left(2x^3 + x\right)}{\left(x^2 + 1\right)^2}$$

$$\frac{dy}{dx} + \frac{2x^3 + x}{\left(x^2 + 1\right)^2} y = \frac{2}{\left(x^2 + 1\right)^2}$$

Solu.

$$\text{I.F.} = e^{\int \frac{2x^3 + x}{\left(x^2 + 1\right)^2} dx}$$

$$= x^2 + 1$$

$$y \cdot \left(x^2 + 1\right) = \int \frac{2}{\left(x^2 + 1\right)} dx + c$$

$$y(x^2 + 1) = 2\tan^{-1}x + c$$

$$y(0) = 0 \qquad \Rightarrow c = 0$$

$$\Rightarrow \quad y = \frac{2\tan^{-1}x}{x^2 + 1}$$

$$y(2) = \frac{2\tan^{-1}2}{5}$$

Ques 11. If a, b, c are in increasing A.P. and a + 1, b, c + 3 are in G.P. If A.M. of a, b, c is 8. Find cube of G.M. of a, b, c.

    A. 123

B. 312

C. 415

D. 213

Ans. B

Solu. a, b, c, → A.P.

a + 1, b, c + 3 → G.P.

(a+b+c)/3 =8 ⇒ a + c = 16

2b = a + c c = 16 – a ⇒ b = 8 …(1)

64 = (a + 1) (c + 3)

64 = ac + 3a + c + 3

64 = a(16 – a) + 3a + 16 – a + 3

64 = 16a – a² + 2a + 19

a2 – 18a + 45 = 0

(a – 15)(a – 3) = 0 ⇒ a = 15 or a = 3 ⇒ c = 1 or c = 13

((abc)⅓) = 1 × 15 × 8 or 13 × 3 × 8 = 120 or 312

Ques 12. The radius of a circle is √10 . x + y = 4 is the line intersecting the circle at P & Q. A chord MN is of length 2 m having slope −1. Find perpendicular distance between the two chords PQ and MN.

A. 2

B. 3

C. 4

D. 5

Ans. B

Solu. Radius of circle = 10

In ΔMPO, √1² + d² = d

1² + d² = 10 [r= √10]

d² = 9

d = ±3

Since, distance is positive, distance between chord is 3.

Ques 13. In group A there are 4 men and 5 women and in group B there are 5 men and 4 women, if 4 people are selected from each group. Find a number of ways to select 4 men and 4 women.

Ans. 5626

Total	4M 5W	5 M 4 W
	A	B
	0M, 4W	4M, 0W → $^5C_4 \times {}^5C_4$
	1M, 3W	3M, 1W → $^4C_1 \times {}^5C_3 \times {}^5C_3 \times {}^4C_1$
	2M, 2W	2M, 2 W → $({}^4C_2)^2 \times ({}^5C_2)^2$
	3M, 1W	1M, 3W → $^4C_3 \times {}^5C_1 \times {}^5C_1 \times {}^4C_3$
	4M, 0W	0M, 4W → $^4C_4 \times {}^4C_4$

Solu.
$({}^4C_0)^2 ({}^5C_4)^2 + ({}^4C1)^2 \times ({}^5C_3)^2 + ({}^4C_2)^2 \times ({}^5C_2)^2 + ({}^4C_3)2 \times ({}^5C_1)^2 + ({}^4C_4)^2 \times ({}^5C_0)^2 = 5626$

Ques 14. If f(x)= 3√(x-2)+√4-x If minimum value = α Maximum value = β find α2 + β2

Ans. 22
Solu. $3\sqrt{(x - 2)} + \sqrt{(4 - x)}$
Let $x = 2\sin^2 \Theta + 4\cos^2 \Theta$
$= 3\sqrt{(2\sin^2 \Theta + 4\cos^2 \Theta - 2)} + \sqrt{(4 - 2\sin^2 \Theta - 4\cos^2 \Theta)}$
$= 3\sqrt{(2\cos^2 \Theta)} + \sqrt{(2\sin^2 \Theta)}$
$= 3\sqrt{2}|\cos \Theta| + \sqrt{2}|\sin\Theta|$
$= 3\sqrt{2}|\cos\Theta| + \sqrt{2}|\sin\Theta|$
$= 3\sqrt{2} \cos\Theta + \sqrt{2}\sin\Theta \le \sqrt{(18 + 2)}$
$3\sqrt{2}\cos \Theta + \sqrt{2} \sin \Theta \le \sqrt{20}$
Minimum value exist when $\Theta = \pi/2$
So minimum value = $\sqrt{2}$
$\Rightarrow \alpha^2 + \beta^2 = 20 + 2 = 22$

Ques 15. If f(x) =

$$f(x) = \begin{cases} \dfrac{(72)^x - 9^x - 8^x + 1}{\sqrt{2} - \sqrt{1 + \cos x}} & ; x \neq 0 \\ a \log 2 \log 3 & ; x = 0 \end{cases}$$

is continuous at x = 0. Then a2 equals to

    A. 1152

    B. 572

    C. 1225

    D. 1005

Ans. A

$$\lim_{x \to 0} \frac{(9^x - 1)(8^x - 1)}{(1 - \cos x)} \left(\sqrt{2} + \sqrt{1 + \cos x} \right)$$

$$\lim_{x \to 0} \frac{\left(\dfrac{9^x - 1}{x} \right)\left(\dfrac{8^x - 1}{x} \right)}{\left(\dfrac{1 - \cos x}{x^2} \right)} \times 2\sqrt{2}$$

Solu.

4√(2) * ln(9) * ln(8) = 24√(2) * log(2) * log(2)

=> a = 24√(2) a ^ 2 = 1152

Option (a) is correct