

AIEEE 2011 – Mathematics Solutions

1. Consider 5 independent Bernoulli's trials each with probability of success p . If the probability of at least one failure is greater than or equal to $\frac{31}{32}$, then p lies in the interval

- (1) $\left(\frac{11}{12}, 1\right]$ (2) $\left(\frac{1}{2}, \frac{3}{4}\right]$
 (3) $\left(\frac{3}{4}, \frac{11}{12}\right]$ (4) $\left(0, \frac{1}{2}\right]$

Ans: [4]

2. The coefficient of x^7 in the expansion of $(1 - x - x^2 + x^3)^6$ is
 (1) 132 (2) 144
 (3) -132 (4) -144

Ans: [4]

3. $\lim_{x \rightarrow 2} \left(\frac{\sqrt{1 - \cos\{2(x-2)\}}}{x-2} \right)$

- (1) equals $\frac{1}{\sqrt{2}}$ (2) does not exist
 (3) equals $\sqrt{2}$ (4) equals $-\sqrt{2}$

Ans: [2]

4. Let R be the set of real numbers
Statement -1

$A = \{(x, y) \in R \times R : y - x \text{ is an integer}\}$ is an equivalence relation on R .

Statement -2

$B = \{(x, y) \in R \times R : x - \alpha y \text{ for some rational number } \alpha\}$ is an equivalence relation on R .

- (1) Statement -1 is false, Statement -2 is true
 (2) Statement -1 is true, Statement -2 is true; Statement -2 is a correct explanation for statement-1
 (3) Statement-1 is true, Statement -2 is true, Statement-2 is not correct explanation for Statement-1
 (4) Statement -1 is true, Statement-2 is false

Ans: [4]

5. Let α, β be real and z be complex number. If $z^2 + \alpha z + \beta = 0$ has two distinct roots on the line $\text{Re } z = 1$, then it is necessary that

- (1) $\beta \in (1, \infty)$ (2) $\beta \in (0, 1)$
 (3) $\beta \in (-1, 0)$ (4) $|\beta| = 1$

Ans: [1]

6. $\frac{d^2x}{dy^2}$ equal

- (1) $-\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-3}$ (2) $\left(\frac{d^2y}{dx^2}\right)^{-1}$
 (3) $-\left(\frac{d^2y}{dx^2}\right)^{-1}\left(\frac{dy}{dx}\right)^{-3}$ (4) $\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-2}$

Ans: [1]

7. The number of values of k for which the linear equations

$$4x + ky + 2z = 0$$

$$kx + 4y + z = 0$$

$$2x + 2y + z = 0$$

possess a non-zero solution is

- (1) zero (2) 3
 (3) 2 (4) 1

Ans: [3]

8. **Statement -1**

The point $A(1, 0, 7)$ is the mirror image of the

point $B(1, 6, 3)$ in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$

Statement -2

The line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ bisects the line

segment joining $A(1, 0, 7)$ and $B(1, 6, 3)$

- (1) Statement -1 is false, Statement -2 is true
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 (4) Statement -1 is true, Statement-2 is false

Ans: [2]

AIEEE 2011 – Mathematics Solutions

9. Consider the following statements
 P : Suman is brilliant
 Q : Suman is rich
 R : Suman is honest
 The negation of the statement "Suman is brilliant and dishonest if and only if sumna is rich" can be expressed as
 (1) $\sim(P \wedge \sim R) \leftrightarrow Q$ (2) $\sim P \wedge (Q \leftrightarrow \sim R)$
 (3) $\sim(Q \leftrightarrow (P \wedge \sim R))$ (4) $\sim Q \leftrightarrow \sim P \wedge R$

Ans: [3]

10. The lines $L_1: y - x = 0$ and $L_2: 2x + y = 0$ intersect the line $L_3: y + 2 = 0$ at P and Q respectively. The bisector of the acute angle between L_1 and L_2 intersects L_3 at R.

Statement -1

The ratio PR : RQ equals $2\sqrt{2} : \sqrt{5}$.

Statement -2

In any triangle, bisector an angle divides the trianle into two similar triangles.

- (1) Statement -1 is false, Statement -2 is true
 (2) Statement -1 is true, Statement -2 is true; Statement -2 is a correct explanation for statement-1
 (3) Statement-1 is true, Statement -2 is true, Statement-2 is not correct explanation for Statement-1
 (4) Statement -1 is true, Statement-2 is false

Ans: [4]

11. A man saves Rs 200 in each of the first three months of his services. In each of the subsequent months his saving increases by Rs. 40 more than the saving of immediately previous month. His total saving from the start of service wil be Rs. 11040 after
 (1) 21 months (2) 18 months
 (3) 19 months (4) 20 months

Ans: [1]

12. Equations of the ellipse whose axes are the axes of coordinates and which passes through the point $(-3, 1)$ and has eccentricity $\sqrt{\frac{2}{5}}$ is
 (1) $5x^2 + 3y^2 - 32 = 0$ (2) $3x^2 + 5y^2 - 32 = 0$
 (3) $5x^2 + 3y^2 - 48 = 0$ (4) $3x^2 + 5y^2 - 15 = 0$

Ans: [2]

13. If $A = \sin^2 x + \cos^4 x$ then for all real x .
 (1) $\frac{3}{4} \leq A \leq \frac{13}{16}$ (2) $\frac{3}{4} \leq A \leq 1$
 (3) $\frac{13}{16} \leq A \leq 1$ (4) $1 \leq A \leq 2$

Ans: [2]

14. The value of $\int_0^1 \frac{8 \log(1+x)}{1+x^2} dx$ is

- (1) $\log 2$ (2) $\pi \log 2$
 (3) $\frac{\pi}{8} \log 2$ (4) $\frac{\pi}{2} \log 2$

Ans: [2]

15. If the angle between the line $x = \frac{y-1}{2} = \frac{z-3}{\lambda}$ and

the plane $x + 2y + 3z = 4$ is $\cos^{-1}\left(\sqrt{\frac{5}{14}}\right)$

- (1) $\frac{5}{3}$ (2) $\frac{2}{3}$
 (3) $\frac{3}{2}$ (4) $\frac{2}{5}$

Ans: [2]

16. For $x \in \left(0, \frac{5\pi}{2}\right)$, define

$$f(x) = \int_0^x \sqrt{t} \sin t \, dt$$

Then f has

- (1) local maximum at π and local minimum at 2π
 (2) lcoal maximum at π and 2π
 (3) lcoal minimum at π and 2π
 (4) local minimum at π and local maximum at 2π

Ans: [1]

AIEEE 2011 – Mathematics Solutions

17. The domain of the function

- (1) $f(x) = \frac{1}{\sqrt{|x|-x}}$ is (2) $(-\infty, \infty) - \{0\}$
 (3) $(0, \infty)$ (4) $(-\infty, 0)$

Ans: [4]

18. If the mean deviation about the median of the numbers $a, 2a, \dots, 50a$ is 50, then $|a|$ equals

- (1) 5 (2) 2
 (3) 3 (4) 4

Ans: [4]

19. If $\frac{r}{a} = \frac{1}{\sqrt{10}}(3\text{R} + \text{R})$ and $\frac{r}{b} = \frac{1}{7}(2\text{R} + 3\text{R} - 6\text{R})$, then

- the value of $(2\frac{r}{a} - \frac{r}{b}) \cdot \left[\left(\frac{r}{a} \times \frac{r}{b} \right) \left(\frac{r}{a} + 2\frac{r}{b} \right) \right]$ is
 (1) 3 (2) -5
 (3) -3 (4) 5

Ans: [2]

20. The value of p and q for which the function

$$f(x) = \begin{cases} \frac{\sin(p+1)x + \sin x}{x}, & x < 0 \\ q, & x = 0 \\ \frac{\sqrt{x+x^2} - \sqrt{x}}{x^{3/2}}, & x > 0 \end{cases}$$

is continuous for all x in \mathbb{R} , are,

- (1) $p = \frac{1}{2}, q = \frac{3}{2}$ (2) $p = \frac{1}{2}, q = -\frac{3}{2}$
 (3) $p = \frac{5}{2}, q = \frac{3}{2}$ (4) $p = -\frac{3}{2}, q = \frac{1}{2}$

Ans: [4]

21. The two circles $x^2 + y^2 = ax$ and $x^2 + y^2 = c^2$ ($c > 0$) touch each other if

- (1) $|a| = 2c$ (2) $2|a| = c$
 (3) $|a| = c$ (4) $a = 2c$

Ans: [3]

22. Let V be the purchase value of an equipment and $V(t)$ be the value after it has been used for t years. The value $V(t)$ depreciates at a rate given by

differential equation $\frac{dV(t)}{dt} = -k(T-t)$, where $k > 0$ is a constant and T is the total life in years of the equipment. Then the scrap value $V(T)$ of the equipment is

- (1) e^{-kT} (2) $T^2 - \frac{1}{k}$
 (3) $I - \frac{kT^2}{2}$ (4) $I - \frac{k(T-t)^2}{2}$

Ans: [3]

23. If C and D are two events such that $C \subset D$ and $P(D) \neq 0$, then the correct statement among the following is

- (1) $P(C|D) = \frac{P(D)}{P(C)}$ (2) $P(C|D) = P(C)$
 (3) $P(C|D) \geq P(C)$ (4) $P(C|D) < P(C)$

Ans: [3]

24. Let A and B be two symmetric matrices of order 3

Statement -1

$A(BA)$ and $(AB)A$ are symmetric matrices

Statement -2

AB is symmetric matrix if matrix multiplication of A with B commutative.

- (1) Statement -1 is false, Statement -2 is true
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 (4) Statement -1 is true, Statement-2 is false

Ans: [3]

25. If $\omega (\neq 1)$ is a cube root of unity, and

$(1 + \omega)^7 = A + B\omega$. Then (A, B) equals

- (1) $P(C|D) = \frac{P(D)}{P(C)}$ (2) $P(C|D) = P(C)$
 (3) $P(C|D) \geq P(C)$ (4) $P(C|D) < P(C)$

Ans: [3]

AIEEE 2011 – Mathematics Solutions

26. **Statement -1**
The number of ways of distributing 10 identical balls in 4 distinct boxes such that no box is empty is 9C_3 .

Statement -2
The number of ways of choosing any 3 places from 9 different places is 9C_3
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(4) Statement -1 is true, Statement-2 is false

Ans: [3]

27. The shortest distance between line $y - x = 1$ and curve $x = y^2$ is

- (1) $\frac{4}{\sqrt{3}}$ (2) $\frac{\sqrt{3}}{4}$
(3) $\frac{3\sqrt{2}}{8}$ (4) $\frac{8}{3\sqrt{2}}$

Ans: [3]

28. The area of the region enclosed by the curves $y = x$, $x = e$, $y = (1/x)$ and the positive x-axis is

- (1) $5/2$ square units
(2) $1/2$ square units
(3) 1 square units
(4) $3/21$ square units

Ans: [4]

29. If $\frac{dy}{dx} = y + 3 > 0$ and $y(0) = 2$, the $y(\ln 2)$ is equal to:

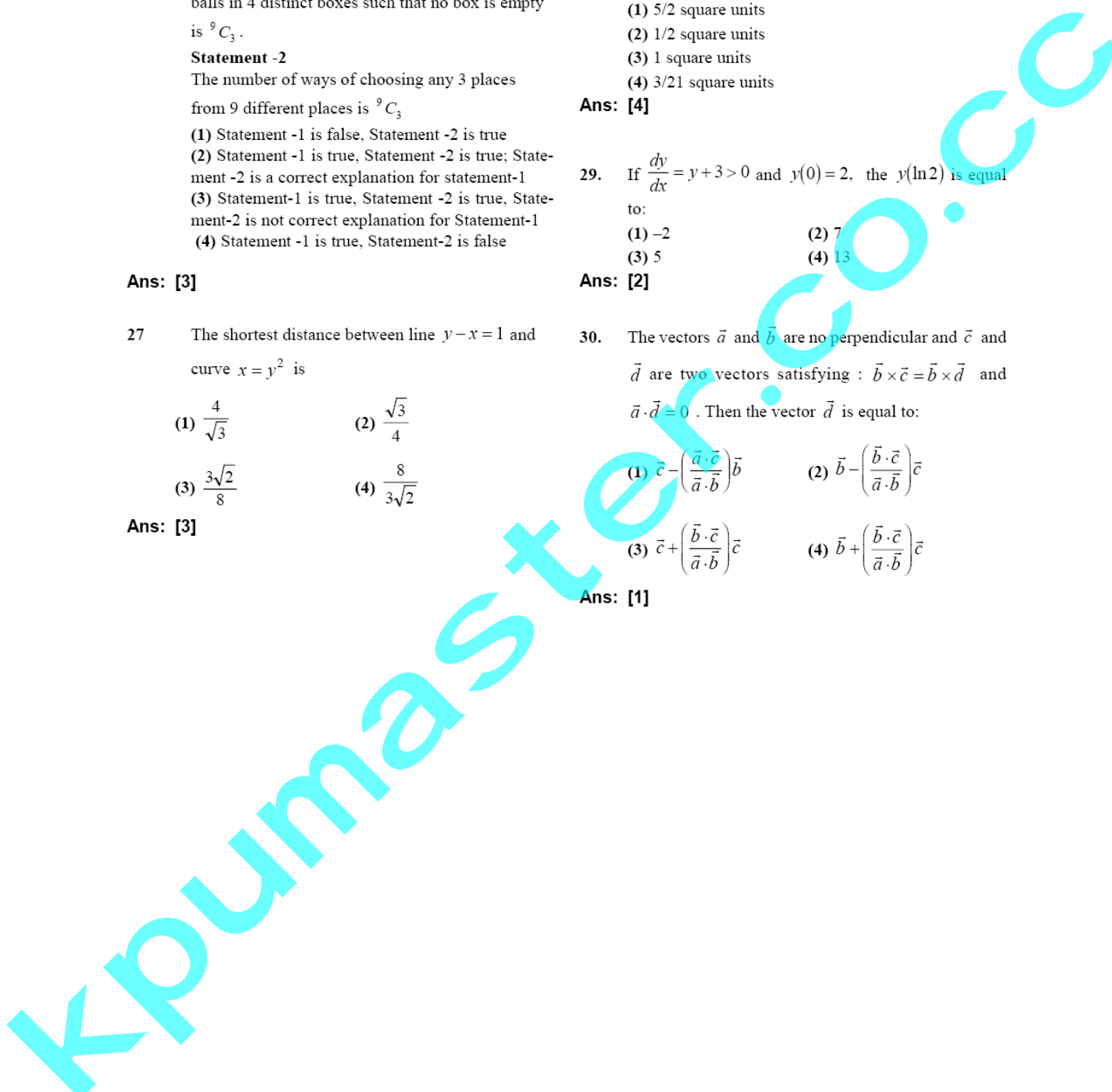
- (1) -2 (2) 7
(3) 5 (4) 13

Ans: [2]

30. The vectors \vec{a} and \vec{b} are not perpendicular and \vec{c} and \vec{d} are two vectors satisfying : $\vec{b} \times \vec{c} = \vec{b} \times \vec{d}$ and $\vec{a} \cdot \vec{d} = 0$. Then the vector \vec{d} is equal to:

- (1) $\vec{c} - \left(\frac{\vec{a} \cdot \vec{c}}{\vec{a} \cdot \vec{b}}\right) \vec{b}$ (2) $\vec{b} - \left(\frac{\vec{b} \cdot \vec{c}}{\vec{a} \cdot \vec{b}}\right) \vec{c}$
(3) $\vec{c} + \left(\frac{\vec{b} \cdot \vec{c}}{\vec{a} \cdot \vec{b}}\right) \vec{c}$ (4) $\vec{b} + \left(\frac{\vec{b} \cdot \vec{c}}{\vec{a} \cdot \vec{b}}\right) \vec{c}$

Ans: [1]



AIEEE 2011 – Chemistry Solutions

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Ans: [4]

2. The coefficient of x^7 in the expansion of $(1 - x - x^2 + x^3)^6$ is
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Ans: [1]

6. $\frac{d^2x}{dy^2}$ equal

- (1) $-\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-3}$ (2) $\left(\frac{d^2y}{dx^2}\right)^{-1}$
 (3) $-\left(\frac{d^2y}{dx^2}\right)^{-1}\left(\frac{dy}{dx}\right)^{-3}$ (4) $\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-2}$

Ans: [1]

7. The number of values of k for which the linear equations

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8. **Statement -1**

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point $B(1, 6, 3)$ in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$

Statement -2

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Ans: [2]

AIEEE 2011 – Chemistry Solutions

11. Ozonolysis of an organic compound gives formaldehyde as one of the products. This confirms the presence of:
 (1) an acetylenic triple bond
 (2) two ethylenic double bonds
 (3) a vinyl group
 (4) an isopropyl group
Ans: [3]
12. The degree of dissociation (α) of a weak electrolyte, A_xB_y is related to van't Hoff factor (i) by the expression:
 (1) $\alpha = \frac{x+y+1}{i-1}$ (2) $\alpha = \frac{i-1}{(x+y-1)}$
 (3) $\alpha = \frac{i-1}{x+y-1}$ (4) $\alpha = \frac{x+y-1}{i-1}$
Ans: [2]
13. A gas absorbs a photon of 355 nm and emits at two wavelengths. If one of the emissions is at 680 nm, the other is at:
 (1) 518 nm (2) 1035 nm
 (3) 325 nm (4) 743 nm
Ans: [4]
14. Identify the compound that exhibits tautomerism.
 (1) Phenol (2) 2-Butene
 (3) Lactic acid (4) 2-Pentanone
Ans: [4]
15. The entropy change involved in the isothermal reversible expansion of 2 moles of an ideal gas from a volume of 10 dm³ to a volume of 100 dm³ at 27°C is
 (1) 42.3 J mol⁻¹ K⁻¹ (2) 38.3 J mol⁻¹ K⁻¹
 (3) 35.8 J mol⁻¹ K⁻¹ (4) 32.3 J mol⁻¹ K⁻¹
Ans: [2]
16. Silver Mirror test is given by which one of the following compounds?
 (1) Benzophenone (2) Acetaldehyde
 (3) Acetone (4) Formaldehyde
Ans: [2, 4]
17. Trichloroacetaldehyde was subjected to Cannizzaro's reaction by using NaOH. The mixture of the products contains sodium trichloroacetate and another compound. The other compound is:
 (1) Chloroform (2) 2, 2, 2-Trichloroethanol
 (3) Trichloromethanol (4) 2, 2, 2-Trichloropropanol
Ans: [2]
18. The reduction potential of hydrogen half cell will be negative if:
 (1) $p(H_2) = 2$ atm and $[H^+] = 2.0$ M
 (2) $p(H_2) = 1$ atm and $[H^+] = 2.0$ M
 (3) $p(H_2) = 1$ atm and $[H^+] = 1.0$ M
 (4) $p(H_2) = 2$ atm and $[H^+] = 1.0$ M
Ans: [4]
19. Phenol is heated with a solution of mixture of KBr and $KBrO_3$. The major product obtained in the above reaction is:
 (1) 2, 4, 6-Tribromophenol
 (2) 2-Bromophenol
 (3) 3-Bromophenol
 (4) 4-Bromophenol
Ans: [1]
20. Among the following the maximum covalent character is shown by the compound:
 (1) $MgCl_2$ (2) $FeCl_2$
 (3) $SnCl_2$ (4) $AlCl_3$
Ans: [4]
21. Boron cannot form which one of the following anions?
 (1) BO_2^- (2) BF_6^{3-}
 (3) BH_4^- (4) $B(OH)_4^-$
Ans: [2]

AIEEE 2011 – Chemistry Solutions

22. Sodium ethoxide has reacted with ethanoyl chloride. The compound that is produced in the above reaction is
(1) Ethyl ethanoate (2) Diethyl ether
(3) 2-Butanone (4) Ethyl chloride
Ans: [1]
23. Which of the following reagents may be used to distinguish between phenol and benzoic acid
(1) Neutral FeCl_3 (2) Aqueous NaOH
(3) Tollen's reagent (4) Molisch reagent
Ans: [1]
24. A vessel at 1000 K contains CO_2 with a pressure of 0.5 atm. Some of the CO_2 is converted into CO on the addition of graphite. If the total pressure at equilibrium is 0.8 atm the value of K is
(1) 0.18 atm (2) 1.8 atm
(3) 3 atm (4) 0.3 atm
Ans: [2]
25. The strongest acid amongst the following compounds is
(1) $\text{ClCH}_2\text{CH}_2\text{CH}_2\text{COOH}$
(2) CH_3COOH
(3) HCOOH
(4) $\text{CH}_3\text{CH}_2\text{CH}(\text{Cl})\text{CO}_2\text{H}$
Ans: [4]
26. Which one of the following orders presents the correct sequence of the increasing basic nature of the given oxides?
(1) $\text{K}_2\text{O} < \text{Na}_2\text{O} < \text{Al}_2\text{O}_3 < \text{MgO}$
(2) $\text{Al}_2\text{O}_3 < \text{MgO} < \text{Na}_2\text{O} < \text{K}_2\text{O}$
(3) $\text{MgO} < \text{K}_2\text{O} < \text{Al}_2\text{O}_3 < \text{Na}_2\text{O}$
(4) $\text{MgO} < \text{K}_2\text{O} < \text{MgO} < \text{Al}_2\text{O}_3$
Ans: [2]
27. A 5.2 molal aqueous solution of methyl alcohol, CH_3OH is supplied. What is the mole fraction of methyl alcohol in the solution?
(1) 0.050 (2) 1.100
(3) 0.190 (4) 0.086
Ans: [4]
28. The presence or absence of hydroxy group on which carbon atom of sugar differentiates RNA and DNA?
(1) 4th (2) 1st
(3) 2nd (4) 3rd
Ans: [3]
29. Which of the following statement is wrong?
(1) N_2O_4 has two resonance structures.
(2) The stability of hydrides increases from NH_3 to BiH_3 in group 15 of the periodic table.
(3) Nitrogen cannot form $d\pi - p\pi$ bond.
(4) Single $\text{N}-\text{N}$ bond is weaker than the single $\text{P}-\text{P}$ bond.
Ans: [2]
30. Which of the following statements regarding sulphur is incorrect?
(1) The oxidation state of sulphur is never less than +4 in its compounds.
(2) S_2 molecular is paramagnetic
(3) The vapour at 200°C consists mostly of S_8 rings.
(4) At 600°C the gas mainly consists of S_2
Ans: [1]

AIEEE 2011 – Physics Solutions

69. Energy required for the electron excitation in Li^{++} from the first to the third Bohr orbit is:

- (1) 122.4 eV (2) 12.1 eV
(3) 36.3 eV (4) 108.8 eV

Ans: (4)

70. The electrostatic potential inside a charged spherical ball is given by $\phi = ar^2 + b$ where r is the distance from the centre; a, b , are constants. Then the charge density inside the ball is

- (1) $-6a\epsilon_0$ (2) $-24\pi a\epsilon_0 r$
(3) $-6a\epsilon_0 r$ (4) $-24\pi a\epsilon_0$

Ans: (1)

71. Work done in increasing the size of a soap bubble from a radius of 3 cm to 5 cm is nearly (Surface tension of soap solution = 0.03 Nm^{-1}):

- (1) $0.4\pi \text{ mJ}$ (2) $4\pi \text{ mJ}$
(3) $0.2\pi \text{ mJ}$ (4) $2\pi \text{ mJ}$

Ans: (1)

72. A resistor R and $2 \mu\text{F}$ capacitor in series is connected through a switch to 200 V direct supply. Across the capacitor is a neon bulb that lights up at 120 V. Calculate the value of R to make the bulb light up 5 s after the switch has been closed. ($\log_{10} 2.5 = 0.4$)

- (1) $3.3 \times 10^7 \Omega$ (2) $1.3 \times 10^4 \Omega$
(3) $1.7 \times 10^5 \Omega$ (4) $2.7 \times 10^6 \Omega$

Ans: (4)

73. A current I flows in an infinitely long wire with cross section in the form of a semicircular ring of radius R . The magnitude of the magnetic induction along its axis is:

- (1) $\frac{\mu_0 I}{4\pi R}$ (2) $\frac{\mu_0 I}{\pi^2 R}$
(3) $\frac{\mu_0 I}{2\pi^2 R}$ (4) $\frac{\mu_0 I}{2\pi R}$

Ans: (2)

74. An object, moving with a speed of 6.25 m / s, is decelerated at a rate given by

$$\frac{dv}{dt} = -2.5\sqrt{v}$$

where v is the instantaneous speed. The time taken by the object, to come to rest, would be:

- (1) 8 s (2) 1 s
(3) 2 s (4) 4 s

Ans: (3)

75. **Direction:**

The question has paragraph followed by two statements, **Statement-1** and **Statement-2**. Of the given four alternatives after the statements, choose the one that describes the statements.

A thin air film is formed by putting the convex surface of a plano-convex lens over a plane glass plate. With monochromatic light, this film gives an interference pattern due to light reflected from the top (convex) surface and the bottom (glass plate) surface of the film.

Statement - 1:

When light reflects from the air-glass plate interface, the reflected wave suffers a phase change of π .

Statement - 2:

The centre of the interference pattern is dark.

- (1) Statement - 1 is false, Statement - 2 is true.
(2) Statement - 1 is true, Statement - 2 is false.
(3) Statement - 1 is true, Statement - 2 is true and Statement - 2 is the correct explanation of Statement - 1
(4) Statement - 1 is true, Statement - 2 is true and Statement - 2 is **not** the correct explanation of Statement - 1.

Ans: (3)

76. Two bodies of masses m and $4m$ are placed at a distance r . The gravitational potential at a point on the line joining them where the gravitational field is zero is:

- (1) $-\frac{9Gm}{r}$ (2) zero
(3) $-\frac{4Gm}{r}$ (4) $-\frac{6Gm}{r}$

Ans: (1)

AIEEE 2011 – Physics Solutions

83. If a wire is stretched to make it 0.1% longer, its resistance will
 (1) decrease by 0.05% (2) increase by 0.05%
 (3) increase by 0.2% (4) decrease by 0.2%

Ans: (3)

84. A water fountain on the ground sprinkles water all around it. If the speed of water coming out of the fountain is v , the total area around the fountain that gets wet is:

- (1) $\pi \frac{v^2}{g^2}$ (2) $\pi \frac{v^2}{g}$
 (3) $\pi \frac{v^4}{g^2}$ (4) $\frac{\pi v^4}{2g^2}$

Ans: (3)

85. A thermally insulated vessel contains an ideal gas of molecular mass M and ratio of specific heats γ . It is moving with speed v and is suddenly brought to rest. Assuming no heat is lost to the surroundings, its temperature increases by:

- (1) $\frac{(\gamma-1)}{2R} Mv^2 K$ (2) $\frac{(\gamma-1)}{2(\gamma+1)R} Mv^2 K$
 (3) $\frac{(\gamma-1)}{2\gamma R} Mv^2 K$ (4) $\frac{\gamma Mv^2}{2R} K$

Ans: (1)

86. A screw gauge gives the following reading when used to measure the diameter of a wire
 Main scale reading: 0 mm.
 Circular scale reading: 52 divisions
 Given that 1 mm on main scale corresponds to 100 divisions of the circular scale.
 The diameter of wire from the above data is

- (1) 0.005 cm (2) 0.52 cm
 (3) 0.052 cm (4) 0.026 cm

Ans: (3)

87. A mass m hangs with the help of a string wrapped around a pulley on a frictionless bearing. The pulley has mass m and radius R . Assuming pulley to be a perfect uniform circular disc, the acceleration of the mass m , if the string does not slip on the pulley, is

- (1) $\frac{g}{3}$ (2) $\frac{3}{2}g$
 (3) g (4) $\frac{2}{3}g$

Ans: (4)

88. The transverse displacement $y(x, t)$ of a wave on a string is given by

$$y(x, t) = e^{-(ax^2 + bt^2 + 2\sqrt{ab}xt)}$$

This represents a:

- (1) standing wave of frequency $\frac{1}{\sqrt{b}}$
 (2) wave moving in $+x$ direction with speed $\sqrt{\frac{a}{b}}$
 (3) wave moving in $-x$ direction with speed $\sqrt{\frac{b}{a}}$
 (4) standing wave of frequency \sqrt{b}

Ans: (3)

89. A car is fitted with a convex side-view mirror of focal length 20 cm. A second car 2.8 m behind the first car is overtaking the first car at a relative speed of 15 m/s. The speed of the image of the second car as seen in the mirror of the first one is:

- (1) 15 m/s (2) $\frac{1}{10}$ m/s
 (3) $\frac{1}{15}$ m/s (4) 10 m/s

Ans: (3)

90. Let the $x - z$ plane be the boundary between two transparent media. Medium 1 in $z \geq 0$ has a refractive index of $\sqrt{2}$ and medium 2 with $z < 0$ has a refractive index of $\sqrt{3}$. A ray of light in medium 1 given by the vector $\vec{A} = 6\sqrt{3}\hat{i} + 8\sqrt{3}\hat{j} - 10\hat{k}$ is incident on the plane of separation. The angle of refraction in medium 2 is:

- (1) 75° (2) 30°
 (3) 45° (4) 60°

Ans: (3)