

VITEEE 2021 Memory Based Question Paper PDF

PART - I (PHYSICS)

1. The distance of the centres of moon and earth is D . The mass of earth is 81 times the mass of the moon. At what distance from the centre of the earth, the gravitational force will be zero?

(a) $\frac{D}{2}$ (b) $\frac{2D}{3}$
 (c) $\frac{4D}{3}$ (d) $\frac{9D}{10}$

2. Two wires A and B are of the same material. Their lengths are in the ratio of 1 : 2 and the diameter are in the ratio 2 : 1. If they are pulled by the same force, then increase in length will be in the ratio of

(a) 2 : 1 (b) 1 : 4
 (c) 1 : 8 (d) 8 : 1

3. If $x = at + bt^2$, where x is the distance travelled by the body in kilometers while t is the time in seconds, then the unit of b is

(a) km/s (b) kms
 (c) km/s² (d) kms²

4. A soap bubble of radius r_1 is placed on another soap bubble of radius r_2 ($r_1 < r_2$). The radius R of the soapy film separating the two bubbles is

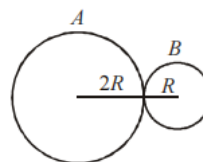
(a) $r_2 + r_1$ (b) $\frac{r_2 - r_1}{r_1 r_2}$

(c) $\frac{r_1 r_2}{r_2 - r_1}$ (d) $\sqrt{r_1^2 + r_2^2}$

5. A charge q is moving with a velocity v parallel to a magnetic field B . Force on the charge due to magnetic field is

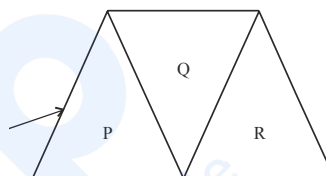
(a) $q v B$ (b) $q B/v$
 (c) zero (d) $B v/q$

6. Two spheres A and B of masses m and $2m$ and radii $2R$ and R respectively are placed in contact as shown. The COM of the system lies



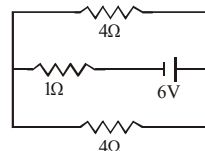
- (a) inside A
 (b) inside B
 (c) at the point of contact
 (d) None of these

7. Identify the correct statement.
- Static friction depends on the area of contact
 - Kinetic friction depends on the area of contact
 - Coefficient of kinetic friction is more than the coefficient of static friction
 - Coefficient of kinetic friction is less than the coefficient of static friction
8. The distance travelled by a particle starting from rest and moving with an acceleration $\frac{4}{3}\text{ms}^{-2}$, in the third second is:
- 6m
 - 4m
 - $\frac{10}{3}\text{m}$
 - $\frac{19}{3}\text{m}$
9. Photoelectric work function of a metal is 1eV. Light of wavelength $\lambda = 3000 \text{ \AA}$ falls on it. The photo electrons come out with a maximum velocity of:
- 10 metres/sec
 - 10^2 metres/sec
 - 10^4 metres/sec
 - 10^6 metres/sec
10. The coefficient of apparent expansion of mercury in a glass vessel is $153 \times 10^{-6}/^\circ\text{C}$ and in a steel vessel is $144 \times 10^{-6}/^\circ\text{C}$. If α for steel is $12 \times 10^{-6}/^\circ\text{C}$, then that of glass is
- $9 \times 10^{-6}/^\circ\text{C}$
 - $6 \times 10^{-6}/^\circ\text{C}$
 - $36 \times 10^{-6}/^\circ\text{C}$
 - $27 \times 10^{-6}/^\circ\text{C}$
11. A step-up transformer operates on a 230 V line and supplies a load of 2 ampere. The ratio of the primary and secondary windings is 1 : 25. The current in the primary is
- 15 A
 - 50 A
 - 25 A
 - 12.5 A
12. Two bodies of same mass are projected with the same velocity at an angle 30° and 60° respectively. The ratio of their horizontal ranges will be
- 1 : 1
 - 1 : 2
 - 1 : 3
 - $2 : \sqrt{2}$
13. Two point charges $+3\mu\text{C}$ and $+8\mu\text{C}$ repel each other with a force of 40N. If a charge of $-5\mu\text{C}$ is added to each of them, then the force between them will become
- 10N
 - +10N
 - +20N
 - 20N
14. A sphere rolls down on an inclined plane of inclination θ . What is the acceleration as the sphere reaches the bottom?
- $\frac{5}{7}g \sin \theta$
 - $\frac{3}{5}g \sin \theta$
 - $\frac{2}{7}g \sin \theta$
 - $\frac{2}{5}g \sin \theta$
15. A given ray of light suffers minimum deviation in an equilateral prism P. Additional prisms Q and R of identical shape and of same material as that of P are now combined as shown in figure. The ray will now suffer



- greater deviation
- no deviation
- same deviation as before
- total internal reflection

16. The current in the 1Ω resistor shown in the circuit is



- $\frac{2}{3} \text{ A}$
- 3 A
- 6 A
- 2 A

17. The root mean square velocity of hydrogen molecules at 300 K is 1930 metre/sec. Then the r.m.s velocity of oxygen molecules at 1200 K will be

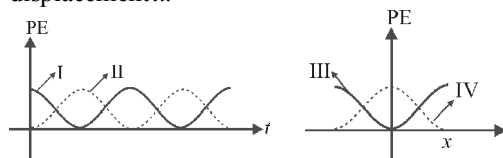
- 482.5 metre/sec
- 965 metre/sec
- 1930 metre/sec
- 3860 metre/sec

18. Lenz's law gives

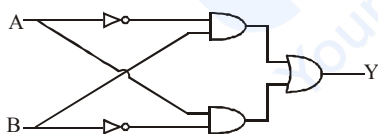
- the magnitude of the induced e.m.f.
- the direction of the induced current
- both the magnitude and direction of the induced current
- the magnitude of the induced current

19. A parallel plate capacitor with air between the plates has a capacitance of 8 pF. Calculate the capacitance if the distance between the plates is reduced by half and the space between them is filled with a substance of dielectric constant. ($k = 6$)
- (a) 72 pF (b) 81 pF
(c) 84 pF (d) 96 pF

20. For a particle executing S.H.M. the displacement x is given by $x = A \cos \omega t$. Identify the graph which represents the variation of potential energy (P.E.) as a function of time t and displacement x .



- (a) I, III (b) II, IV
(c) II, III (d) I, IV
21. A radioactive sample contains 10^{-3} kg each of two nuclear species A and B with half-life 4 days and 8 days respectively. The ratio of the amounts of A and B after a period of 16 days is
- (a) 1 : 2 (b) 4 : 1
(c) 1 : 4 (d) 2 : 1
22. A string of 7 m length has a mass of 0.035 kg. If tension in the string is 60.5 N, then speed of a wave on the string is
- (a) 77 m/s (b) 102 m/s
(c) 110 m/s (d) 165 m/s
23. The following circuit represents



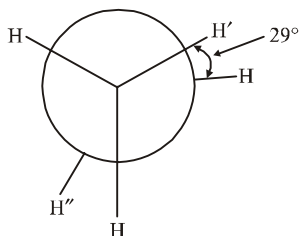
- (a) OR gate (b) AND gate
(c) NAND gate (d) None of these
24. A straight section PQ of a circuit lies along the X -axis from $x = -\frac{a}{2}$ to $x = \frac{a}{2}$ and carries a steady current i . The magnetic field due to the section PQ at a point $X = +a$ will be
- (a) proportional to a
(b) proportional to a^2
(c) proportional to $1/a$
(d) zero

25. A source producing sound of frequency 170 Hz is approaching a stationary observer with a velocity 17 ms^{-1} . The apparent change in the wavelength of sound heard by the observer is (speed of sound in air = 340 ms^{-1})
- (a) 0.1 m (b) 0.2 m
(c) 0.4 m (d) 0.5 m

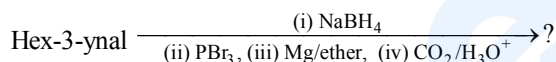
PART - II (CHEMISTRY)

26. Consider the following reactions:
- $$\text{NaCl} + \text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4 (\text{Conc.}) \rightarrow (\text{A}) + \text{Side products}$$
- $$(\text{A}) + \text{NaOH} \rightarrow (\text{B}) + \text{Side products}$$
- $$(\text{B}) + \text{H}_2\text{SO}_4 (\text{dilute}) + \text{H}_2\text{O}_2 \rightarrow (\text{C}) + \text{Side products}$$
- The sum of the total number of atoms in one molecule each of (A), (B) and (C) is _____.
- (a) 18 (b) 15
(c) 21 (d) 20
27. Xenon hexafluoride on partial hydrolysis produces compounds 'X' and 'Y'. Compounds 'X', 'Y' and the oxidation state of Xe are respectively :
- (a) $\text{XeOF}_4(+6)$ and $\text{XeO}_3(+6)$
(b) $\text{XeO}_2(+4)$ and $\text{XeO}_3(+6)$
(c) $\text{XeOF}_4(+6)$ and $\text{XeO}_2\text{F}_2(+6)$
(d) $\text{XeO}_2\text{F}_2(+6)$ and $\text{XeO}_2(+4)$
28. The edge length of unit cell of a metal having molecular weight 75 g/mol is $5 \text{ \AA}$ which crystallizes in cubic lattice. If the density is 2 g/cc then find the radius of metal atom. ($N_A = 6 \times 10^{23}$). Give the answer in pm.
- (a) 217 pm (b) 210 pm
(c) 220 pm (d) 205 pm
29. Consider the following statements:
- Increase in concentration of reactant increases the rate of a zero order reaction.
 - Rate constant k is equal to collision frequency A if $E_a = 0$.
 - Rate constant k is equal to collision frequency A if $E_a = \infty$.
 - In k vs T is a straight line.
 - In k vs $1/T$ is a straight line.
- Correct statements are
- (a) I and IV (b) II and V
(c) III and IV (d) II and III

30. To deposit 0.634 g of copper by electrolysis of aqueous cupric sulphate solution, the amount of electricity required (in coulombs) is
- (a) 1930 (b) 3960
(c) 4825 (d) 9650
31. In the following skew conformation of ethane, $H' - C - C - H''$ dihedral angle is :



- (a) 58° (b) 149°
(c) 151° (d) 120°
32. What is the product of following reaction?



- (a)
(b)
(c)
(d)
33. In the following sequence of reactions,
- $$CH_3CH_2OH \xrightarrow{P+I_2} A \xrightarrow[\text{ether}]{Mg} B \xrightarrow{HCHO} C \xrightarrow{H_2O} D$$
- the compound D is
- (a) propanal (b) butanal
(c) *n*-butyl alcohol (d) *n*-propyl alcohol.
34. Which of the following reactions can produce aniline as main product?

- (a) $C_6H_5NO_2 + Zn/KOH$
(b) $C_6H_5NO_2 + Zn/NH_4Cl$
(c) $C_6H_5NO_2 + LiAlH_4$
(d) $C_6H_5NO_2 + Zn/HCl$

35. Secondary structure of protein refers to
- (a) mainly denatured proteins and structure of prosthetic groups
(b) three-dimensional structure, especially the bond between amino acid residues that are distinct from each other in the polypeptide chain
(c) linear sequence of amino acid residues in the polypeptide chain
(d) regular folding patterns of continuous portions of the polypeptide chain

36. The increasing order for the values of e/m (charge/mass) is

- (a) e, p, n, α (b) n, p, e, α
(c) n, p, α, e (d) n, α, p, e

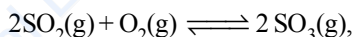
37. In which of the following pairs both the ions are coloured in aqueous solutions ?

- (a) Sc^{3+}, Ti^{3+} (b) Sc^{3+}, Co^{2+}
(c) Ni^{2+}, Cu^{+} (d) Ni^{2+}, Ti^{3+}

38. The total number of possible isomers for square-planar $[Pt(Cl)(NO_2)(NO_3)(SCN)]^{2-}$ is:

- (a) 16 (b) 12
(c) 8 (d) 24

39. For the reaction,



$$\Delta H = -57.2 \text{ kJ mol}^{-1} \text{ and } K_c = 1.7 \times 10^{16}$$

Which of the following statement is INCORRECT?

- (a) The equilibrium constant is large suggestive of reaction going to completion and so no catalyst is required.
(b) The equilibrium will shift in forward direction as the pressure increases.
(c) The equilibrium constant decreases as the temperature increases.
(d) The addition of inert gas at constant volume will not affect the equilibrium constant.
40. The half-life of a reaction is inversely proportional to the square of the initial concentration of the reactant. Then the order of the reaction is

- (a) 0 (b) 1
(c) 2 (d) 3

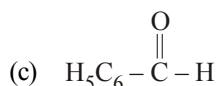
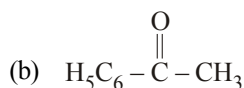
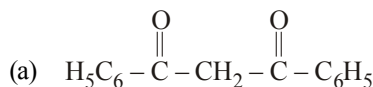
41. A galvanic cell is set up from electrodes *A* and *B*

Electrode *A*: $\text{Cr}_2\text{O}_7^{2-} / \text{Cr}^{3+}$, $E_{\text{red}}^\circ = +1.33 \text{ V}$

Electrode *B*: $\text{Fe}^{3+} / \text{Fe}^{2+}$, $E_{\text{red}}^\circ = 0.77 \text{ V}$

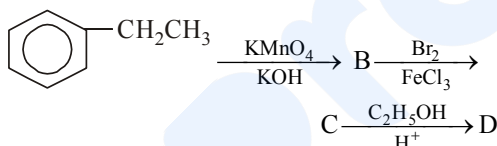
Which of the following statements is false ?

- (a) Standard e.m.f of the cell is 0.56 V
 (b) Current will flow from electrode *A* to *B* in the external circuit
 (c) *A* will act as cathode and have positive polarity
 (d) None of these
42. Keto-enol tautomerism is observed in :

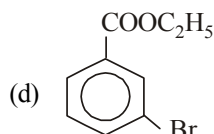
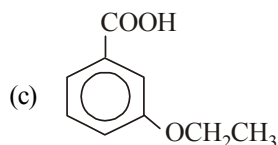
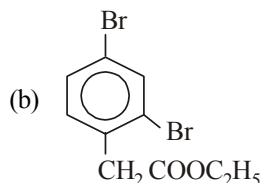
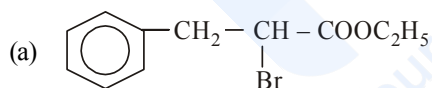


(d) Both (a) and (b)

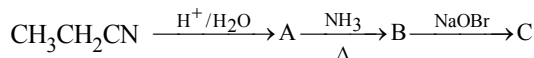
43. In a set of reactions, ethylbenzene yield a product D.



Identify D :

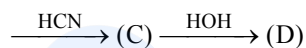
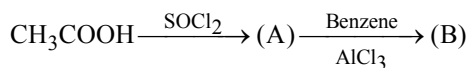


44. What will be the final product in the following reaction sequence –

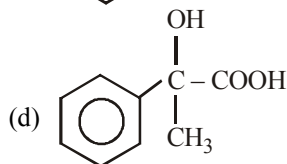
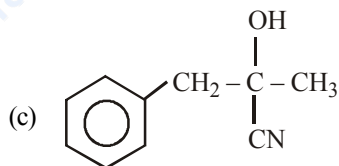
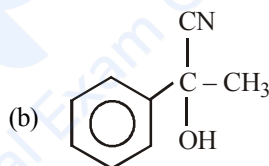
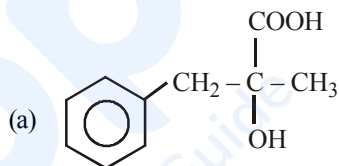


- (a) $\text{CH}_3\text{CH}_2\text{CONH}_2$
 (b) $\text{CH}_3\text{CH}_2\text{COBr}$
 (c) $\text{CH}_3\text{CH}_2\text{NH}_2$
 (d) $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$

45. In a set of reactions acetic acid yielded a product D.



The structure of (D) would be –



46. In fructose, the possible optical isomers are

- (a) 12 (b) 8
 (c) 16 (d) 4

47. The position of both, an electron and a helium atom is known within 1.0 nm . Further the momentum of the electron is known within $5.0 \times 10^{-26} \text{ kg ms}^{-1}$. The minimum uncertainty in the measurement of the momentum of the helium atom is

- (a) 50 kg ms^{-1} (b) 80 kg ms^{-1}
 (c) $8.0 \times 10^{-26} \text{ kg ms}^{-1}$ (d) $5.0 \times 10^{-26} \text{ kg ms}^{-1}$

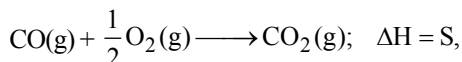
48. The value of $\log_{10} K$ for a reaction $A \rightleftharpoons B$ is

(Given : $\Delta_r H_{298K}^\circ = -54.07 \text{ kJ mol}^{-1}$,

$\Delta_r S_{298K}^\circ = 10 \text{ JK}^{-1} \text{ mol}^{-1}$ and $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$;

$$2.303 \times 8.314 \times 298 = 5705)$$

- (a) 5 (b) 10
(c) 95 (d) 100
49. If $C(s) + O_2(g) \longrightarrow CO_2(g)$; $\Delta H = R$ and



then heat of formation of CO is:

- (a) $R + S$ (b) $R - S$
(c) $R \times S$ (d) $S - R$
50. Which of the following compounds does not follow Markownikoff's law?
- (a) $CH_3CH=CH_2$ (b) CH_2CHCl
(c) $CH_3CH=CHCH_3$ (d) None

PART - III (MATHEMATICS)

51. The value of c in Rolle's Theorem for the function $f(x) = e^x \sin x$, $x \in [0, \pi]$ is

- (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$
(c) $\frac{\pi}{2}$ (d) $\frac{3\pi}{4}$

52. The equations $2x + 3y + 4 = 0$; $3x + 4y + 6 = 0$ and $4x + 5y + 8 = 0$ are

- (a) consistent with unique solution
(b) inconsistent
(c) consistent with infinitely many solutions
(d) None of the above

53. The shortest distance between the lines $x = y + 2 = 6z - 6$ and $x + 1 = 2y = -12z$ is

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

54. If the tangent at $P(1, 1)$ on $y^2 = x(2 - x)^2$ meets the curve again at Q , then Q is

- (a) (2, 2) (b) (-1, -2)
(c) $\left(\frac{9}{4}, \frac{3}{8}\right)$ (d) None of these

55. If $f(x) = x + \frac{x}{1+x} + \frac{x}{(1+x)^2} + \dots$ to ∞ , then at

$x=0$, $f(x)$

- (a) has no limit
(b) is discontinuous
(c) is continuous but not differentiable
(d) is differentiable

56. Radius of the circle $(x+5)^2 + (y-3)^2 = 36$ is

- (a) 2 (b) 3
(c) 6 (d) 5

57. If $\vec{a} = 2\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{c} = -\hat{i} + 2\hat{k}$ then $|\vec{c}|$.

$\vec{a}$ is equal to:

- (a) $2\sqrt{5}\hat{i} + 2\sqrt{5}\hat{j} + \sqrt{5}\hat{k}$
(b) $2\sqrt{5}\hat{i} - 2\sqrt{5}\hat{j} + \sqrt{5}\hat{k}$
(c) $\sqrt{5}\hat{i} + \sqrt{5}\hat{j} + \sqrt{5}\hat{k}$
(d) $\sqrt{5}\hat{i} + 2\sqrt{5}\hat{j} + \sqrt{5}\hat{k}$

58. If $(-4, 5)$ is one vertex and $7x - y + 8 = 0$ is one diagonal of a square, then the equation of second diagonal is

- (a) $x + 3y = 21$ (b) $2x - 3y = 7$
(c) $x + 7y = 31$ (d) $2x + 3y = 21$

59. $p \Rightarrow q$ can also be written as

- (a) $p \Rightarrow \sim q$ (b) $\sim p \vee q$
(c) $\sim q \Rightarrow \sim p$ (d) None of these

60. Let $\int \frac{x^{1/2}}{\sqrt{1-x^3}} dx = \frac{2}{3} \text{gof}(x) + C$, then

- (a) $f(x) = \sqrt{x}$
(b) $f(x) = x^{3/2}$ and $g(x) = \sin^{-1}x$
(c) $f(x) = x^{2/3}$
(d) None of these

61. Which one of the following is an infinite set?

- (a) The set of human beings on the earth
(b) The set of water drops in a glass of water
(c) The set of trees in a forest
(d) The set of all primes

62. The domain of the function

$$\sqrt{x^2 - 5x + 6} + \sqrt{2x + 8 - x^2} \text{ is}$$

- (a) $[2, 3]$ (b) $[-2, 4]$
(c) $[-2, 2] \cup [3, 4]$ (d) $[-2, 1] \cup [2, 4]$

63. Area bounded by the curve $y = \log x$ and the coordinate axes is
 (a) 2 (b) 1
 (c) 5 (d) $2\sqrt{2}$
64. The angle of intersection to the curve $y = x^2$, $6y = 7 - x^3$ at $(1, 1)$ is :
 (a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$
 (c) $\frac{\pi}{3}$ (d) π
65. Angle formed by the positive Y-axis and the tangent to $y = x^2 + 4x - 17$ at $\left(\frac{5}{2}, \frac{-3}{4}\right)$ is
 (a) $\tan^{-1} 9$ (b) $\frac{\pi}{2} - \tan^{-1} 9$
 (c) $\frac{\pi}{2} + \tan^{-1} 9$ (d) $\frac{\pi}{2}$
66. The value of $(1 + i)^4 \left(1 + \frac{1}{i}\right)^4$ is
 (a) 12 (b) 2
 (c) 8 (d) 16
67. The relation R defined on the set $A = \{1, 2, 3, 4, 5\}$ by $R = \{(x, y) : |x^2 - y^2| < 16\}$ is given by
 (a) $\{(1, 1), (2, 1), (3, 1), (4, 1), (2, 3)\}$
 (b) $\{(2, 2), (3, 2), (4, 2), (2, 4)\}$
 (c) $\{(3, 3), (4, 3), (5, 4), (3, 4)\}$
 (d) None of these
68. $\int \frac{2dx}{(e^x + e^{-x})^2} =$
 (a) $\frac{-e^{-x}}{(e^x + e^{-x})} + C$ (b) $\frac{-1}{(e^x + e^{-x})} + C$
 (c) $\frac{1}{(e^x + 1)^2} + C$ (d) $\frac{1}{(e^x + e^{-x})} + C$
69. The value of $\tan^{-1}(1) + \tan^{-1}(0) + \tan^{-1}(2) + \tan^{-1}(3)$ is equal to
 (a) π (b) $\frac{5\pi}{4}$
 (c) $\frac{\pi}{2}$ (d) None of these
70. In a culture the bacteria count is 1,00,000. The number is increased by 10% in 2 hours. In how many hours will the count reach 2,00,000 if the rate of growth of bacteria is proportional to the number present.
 (a) $\frac{2}{\log \frac{11}{10}}$ (b) $\frac{2 \log 2}{\log \left(\frac{11}{10}\right)}$
 (c) $\frac{\log 2}{\log 11}$ (d) $\frac{\log 2}{\log \left(\frac{11}{10}\right)}$
71. What is the angle between the two straight lines $y = (2 - \sqrt{3})x + 5$ and $y = (2 + \sqrt{3})x - 7$?
 (a) 60° (b) 45°
 (c) 30° (d) 15°
72. If the angle θ between the line $\frac{x+1}{1} = \frac{y-1}{2} = \frac{z-2}{2}$ and the plane $2x - y + \sqrt{\lambda}z + 4 = 0$ is such that $\sin \theta = \frac{1}{3}$ then the value of λ is
 (a) $\frac{5}{3}$ (b) $\frac{-3}{5}$
 (c) $\frac{3}{4}$ (d) $\frac{-4}{3}$
73. The distance of the point $(-5, -5, -10)$ from the point of intersection of the line $r = 2\hat{i} - \hat{j} + 2\hat{k} + \lambda(3\hat{i} + 4\hat{j} + 2\hat{k})$ and the plane $r \cdot (\hat{i} - \hat{j} + \hat{k}) = 5$ is
 (a) 13 (b) 12
 (c) $4\sqrt{15}$ (d) $10\sqrt{2}$
74. $\int_{\log \sqrt{\pi/2}}^{\log \sqrt{\pi}} e^{2x} \sec^2 \left(\frac{1}{3} e^{2x} \right) dx$ is equal to :
 (a) $\sqrt{3}$ (b) $\frac{1}{\sqrt{3}}$
 (c) $\frac{3\sqrt{3}}{2}$ (d) $\frac{1}{2\sqrt{3}}$
75. If $\frac{|x+3|+x}{x+2} > 1$, then $x \in$
 (a) $(-5, -2)$ (b) $(-1, \infty)$
 (c) $(-5, -2) \cup (-1, \infty)$ (d) None of these

PART - IV (ENGLISH & LOGICAL REASONING)

Directions (76-78): Study the paragraph and answer the questions that follow.

A training calendar and schedule for Fire Agency Specialties Team (F.A.S.T.) membership is available in this office to all applicants for F.A.S.T. membership. Training will take place the third week of each month. Classes will be taught on Monday afternoons, Wednesday evenings, and Saturday afternoons. So that the F.A.S.T. can maintain a high level of efficiency and preparedness for emergency response situations, its members must meet certain requirements.

First, in order for you to be considered for membership on F.A.S.T., your department must be a member of the F.A.S.T. organization, and you must have written permission from your fire chief or your department's highest ranking administrator.

Once active, you must meet further requirements to maintain active status. These include completion of technician-level training and certification in hazardous material (hazmat) operations. In addition, after becoming a member, you must also attend a minimum of 50% of all drills conducted by F.A.S.T. and go to at least one F.A.S.T. conference. You may qualify for alternative credit for drills by proving previous experience in actual hazmat emergency response.

If you fail to meet minimum requirements, you will be considered inactive, and the director of your team will be notified. You will be placed back on active status only after you complete the training necessary to meet the minimum requirements.

- 76.** Potential F.A.S.T. members can attend less than half of F.A.S.T. drills if they
- complete technician-level training requirements.
 - indicate prior real emergency experience.
 - receive permission from their fire chief.
 - enroll in three weekly training sessions.
- 77.** Which of the following is the main subject of the passage?
- preparing for hazmat certification
 - the main goal of F.A.S.T.
 - completing F.A.S.T. membership requirements
 - learning about your department's F.A.S.T. membership
- 78.** Applicants must be available for training
- three days each month.
 - three days each week.
 - every third month.
 - for 50% of classes.
- 79.** Jatin starting from a fixed point, goes 15 m towards North and then after turning to his right, he goes 15 m. Then, he goes 10 m, 15 m and 15 m after turning to his left each time. How far is he from his starting point ?
- 15 m
 - 5m
 - 10 m
 - 20 m
- 80.** Examine the following statements:
- All members of Mohan's family are honest.
 - Some members of Mohan's family are not employed.
 - Some employed persons are not honest.
 - Some honest persons are not employed.
- Which one of the following inferences can be drawn from the above statements?
- All members of Mohan's family are employed
 - The employed members of Mohan's family are honest
 - The honest members of Mohan's family are not employed
 - The employed member of Mohan's family are not honest