EAMCET

ENGINEERING ENTRANCE EXAM

SOLVED PAPER–1999

PHYSICS

1. Two particles of mass 1 kg and 3 kg have position vectors $2\hat{i}+3\hat{j}+4\hat{k}$ and $-2\hat{i}+3\hat{j}-4\hat{k}$ respectively. The centre of mass, has a position vector :

   (a) $\hat{i}+3\hat{j}-2\hat{k}$ (b) $-\hat{i}-3\hat{j}-2\hat{k}$

   (c) $-\hat{i}+3\hat{j}+2\hat{k}$ (d) $-\hat{i}+3\hat{j}-2\hat{k}$

2. A stone is projected vertically up to reach maximum height h. The ratio of its kinetic energy to its potential energy, at a height $\frac{4}{5}h$, will be :

   (a) 5 : 4 (b) 4 : 5 (c) 1 : 4 (d) 4 : 1

3. An object initially at rest explodes into 3 fragments A, B and C. The momentum of A is $P\hat{i}$ and that of B is $\sqrt{3}P\hat{j}$ where P is a positive number. The momentum of C will be :

   (a) $(1+\sqrt{3})P$ in a direction of making 120° with that of A

   (b) $(1+\sqrt{3})P$ in a direction of making 150° with that of B

   (c) $2P$ in a direction making 150° with that of A

   (d) $2P$ in a direction making 150° with that of B

4. The mass of a balloon with its contents is 1.5 kg. It is descending with an acceleration equal to half that of acceleration due to gravity. If it is to go up with the same acceleration, keeping the volume same, its mass should be decreased by :

   (a) 1.2 kg (b) 1 kg (c) 0.75 kg (d) 0.5 kg

5. The speed of a projectile at its maximum height is $\frac{\sqrt{3}}{2}$ times its initial speed. If the range of the projectile is P times the maximum height attained by it, then P equals :

   (a) $\frac{4}{3}$ (b) $2\sqrt{3}$ (c) $4\sqrt{3}$ (d) $\frac{3}{4}$

6. Water drops fall from a tap on the floor 5 m below at regular intervals of time, the first drop striking the floor when the fifth drop begins to fall. The height at which the third drop will be, from ground, at that instant when first drop strikes the ground, will be, (taking $g = 10\ ms^{-2}$) :

   (a) 1.25 m (b) 2.15 m

   (c) 2.75 m (d) 3.75 m

7. A car starts from rest and travels with uniform acceleration α, for some time and then with uniform retardation β and comes to rest. If the total travel time of car is t, the maximum velocity attained by it is given by :

   (a) $\frac{\alpha\beta}{(\alpha+\beta)}t$ (b) $\frac{1}{2}\frac{\alpha\beta}{(\alpha+\beta)}t^2$

   (c) $\frac{\alpha\beta}{(\alpha-\beta)}t$ (d) $\frac{1}{2}\frac{\alpha\beta}{(\alpha-\beta)}t^2$

8. The angle between two vectors $6\hat{i}+6\hat{j}-3\hat{k}$ and $7\hat{i}+4\hat{j}+4\hat{k}$ is given by :

   (a) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (b) $\cos^{-1}\left(\frac{5}{\sqrt{3}}\right)$

   (c) $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$ (d) $\sin^{-1}\left(\frac{\sqrt{5}}{3}\right)$

9. The dimensional formula for latent heat is :

   (a) $[MLT^{-2}]$ (b) $[ML^2T^{-2}]$

   (c) $[M^0L^2T^{-2}]$ (d) $[MLT^{-1}]$

10. The S.I unit of moment of inertia is :

    (a) kg/m^2 (b) $kg\ m^2$

    (c) N/m^2 (d) Nm^2

11. A ball A moving with a speed of 99 ms^{-1} collides directly with another identical ball B moving with a speed v in the opposite direction, A comes to rest after the collision. If the coefficients of restitution is 0.8, the speed of B before collision, is :
(a) 10 ms^{-1} (b) 81 ms^{-2}
(c) 22.5 ms^{-1} (d) 90 ms^{-1}

12. Bullets of 0.03 kg mass each, hit a plate at the rate of 200 bullets per second, with a velocity of 50 ms^{-1} and reflect back with a velocity of 30 ms^{-1}. The average force acting on the plate, in newtons, is :
(a) 120 (b) 180
(c) 300 (d) 480

13. A body takes $1\frac{1}{3}$ times as much time to slide down a rough inclined plane as it takes to slide down an indentical but smooth inclined plane. If the angle of inclined plane is 45°, the coefficient of friction is :
(a) $\frac{7}{16}$ (b) $\frac{9}{16}$ (c) $\frac{7}{9}$ (d) $\frac{3}{4}$

14. The minimum speed for a particle at the lowest point of a vertical circle of radius R, to describe the circle is v. If the radius of circle is reduced to one - fourth its value, the corresponding minimum speed will be :
(a) $\frac{v}{4}$ (b) $\frac{v}{2}$ (c) $2v$ (d) $4v$

15. A car is moving on a circular level road of curvature 300 m. If the coefficient of friction is 0.3 and acceleration due to gravity 10m/s^2, the maximum speed that car can have is :
(a) 30 km/h (b) 81 km/h
(c) 108 km/h (d) 162 km/h

16. The moment of inertia of a thin uniform rod of mass M and length L about an axis perpendicular to the rod, through its center is I. The moment of inertia of the rod about axis perpendicular to the rod through its end point is :
(a) $\frac{I}{4}$ (b) $\frac{I}{2}$
(c) $2I$ (d) $4I$

17. Taking that earth revolves round the sun in a circular orbit of radius 15×10^{10} m, with a time period of 1 year the time taken by another planet, which is at a distance of 540×10^{10} m, to revolve round the sun in circular orbit once, will be :
(a) 216 years (b) 144 years
(c) 72 years (d) 36 years

18. If R is the radius of earth, the height, at which the weight of a body becomes $\frac{1}{4}$ of its weight on the surface of earth, is :
(a) $2R$ (b) R (c) $\frac{R}{2}$ (d) $\frac{R}{4}$

19. The maximum velocity of a particle executing SHM is v. If the amplitude is doubled and the time period of oscillation decreased to $\frac{1}{3}$ of its original value, the max. velocity becomes :
(a) 18 v (b) 12 v
(c) 6 v (d) 3 v

20. Two simple pendulums of lengths $16l$ and l are in phase at the mean position at a certain time. If T is the time period of shorter pendulum , the minimum time after which they will be again in phase :
(a) $\frac{1}{3}T$ (b) $\frac{2}{3}T$ (c) $\frac{3}{2}T$ (d) $\frac{4}{3}T$

21. The elongation of a steel wire stretched by a force is e. If a wire of the same material of double the length, and half the diameter is subjected to double the force, its elongation will be :
(a) 16 e (b) 4 e (c) $\frac{e}{4}$ (d) $\frac{e}{16}$

22. When a cylindrical tube is dipped vertically into a liquid then the angle of contact is 140°, if the tube is dipped, with an inclination of 40° then angle of contact is :
(a) 100° (b) 140°
(c) 180° (d) 60°

23. In a compensated pendulum two rods of different metals are used with their lengths in ratio of 2 : 3. The coefficients of linear expansions for metals in the ratio is :
(a) 1 : 1 (b) 2 : 3
(c) 3 : 2 (d) 9 : 4

24. If on heating liquid through 80°C, the mass expelled is $\left(\frac{1}{100}\right)^{th}$ of mass still remaining, the coefficient of apparent expansion of liquid is :
(a) 126.5×10^{-4}/°C (b) 0.8×10^{-4}/°C
(c) 1.25×10^{-6}/°C (d) 1.25×10^{-4}/°C

25. For a perfect gas, if α, β are the volume and pressure coefficients of expansions, then :
(a) $\alpha = \beta$ (b) $\alpha > \beta$
(c) $\alpha < \beta$ (d) $\alpha > \beta, \alpha < \beta$

26. When heat energy of 1500 J is supplied to a gas at constant pressure, 2.1×10^5 N/m^2, there was an increase in its volume equal to 2.5×10^{-3} m^3. The increase in its internal energy in joules is :
(a) 450 (b) 525 (c) 975 (d) 2025

27. A liquid of mass M and specific heat S is at temperature $2t$. If another liquid of thermal capacity 1.5 times at a temperature of $\frac{t}{3}$ is added to it, the resultant temperature will be :
(a) $\frac{4}{3}t$ (b) t (c) $\frac{t}{2}$ (d) $\frac{2t}{3}$

28. The relation between melting point of ice and pressure is shown by ice line, which will be :
(a) with a positive slope
(b) with a negative slope
(c) parallel to pressure axis
(d) parallel to temperature axis

29. In a medium, in which a transverse progressive wave is travelling to the phase difference between two points with a distance of separation is 1.25 cm is $\frac{\pi}{4}$. If the frequency of wave is 1000 Hz, its velocity will be :
(a) 10^4 m/s (b) 125 m/s
(c) 100 m/s (d) 10 m/s

30. A glass tube 1.5 m long and open at both ends is immersed vertically in a water tank completely. A tuning fork of 600 Hz is vibrated and kept at the upper end of tube and tube is gradually raised out of water. The total number of resonances heard before when the tube comes out of water, taking $v = 330$ m/s :
(a) 12 (b) 6 (c) 8 (d) 4

31. A car with a horn of frequency 620 Hz, travels towards a large wall with a speed 20 m/s. If velocity of sound is 330 m/s the frequecny of echo of sound of horn as heard by driver :
(a) 700 Hz (b) 660 Hz
(c) 620 Hz (d) 550 Hz

32. The final image in an astronomical telescope is :
(a) real, erect (b) virtual, inverted
(c) real, inverted (d) none of these

33. The least distance of distinct vision is 25 cm. If the focal length of convex lens is 10 cm, it acts as a simple microscope of maximum magnification :
(a) 2.5 (b) 3 (c) 3.5 (d) 5

34. In a Huygen's eye piece, with an eye piece of focal length F, the distance between the eye piece and field lens should be :
(a) $\frac{2}{3}F$ (b) F (c) $2F$ (d) $3F$

35. In a spectrometer experiment three prisms A, B and C with same angle of prism but of different materials of refractive indices $\mu_A = 1.33$, $\mu_B = 1.55$, $\mu_C = 1.44$ are used. The corresponding angles of minimum deviation D_A, D_B, D_C measured will be such that :
(a) $D_A > D_B > D_C$ (b) $D_A < D_B < D_C$
(c) $D_A < D_C < D_B$ (d) none of these

36. The temperature at which a ferromagnetic material becomes paramagnetic is called :
(a) neutral temprature
(b) curie temprature
(c) inversion temprature
(d) none of the above

37. The magnetic field strength at a point at a distance d from the centre, on the axial line of a very short bar magnet of magnetic moment M, is B. The magnetic induction at a distance $2d$ from centre, on equatorial line of magnet of magnetic moment $8M$, will be :
(a) $4B$ (b) $\frac{B}{2}$ (c) $2B$ (d) $\frac{B}{4}$

38. A magnetic needle is placed with its north pole facing north in north south direction. In its map of magnetic field the null point will be :
(a) on its equatorial line
(b) on its axial line
(c) on line making 45° with its axial line
(d) At a distance equal to twice the length of magnet on both line

39. Two charges 8C and $-6C$ are placed at a distance of separation d between them and exerts a force of magnitude F on each other. If a charge 8C is added to each of these and they are brought nearer to by a distance d/3, the magnitude of force between them will be :
(a) $\frac{F}{3}$ (b) $\frac{9F}{4}$
(c) $6F$ (d) $\frac{2F}{3}$

40. The electric field intensity in air at a point 20 cm from a point charge Q coulombs is 4.5×10^5 N/C. The magnitude of Q is :
(a) 0.1 μC (b) 0.2 μC
(c) 1 μC (d) 2 μC

41. A parallel plate capacitor filled with a dielectric of relative permitivity 5 between its plates is charged to acquire an energy E and isolated. If the dielectric is replaced by another of relative permitivity 2, its energy becomes :
(a) E (b) $0.4E$
(c) $2.5E$ (d) $6.25E$

42. In a meter bridge the gaps are closed by resistance 2 and 3 ohm. The value of shunt to be added to 3 ohm resistor to shift the balancing point by 22.5 cm is :
(a) 1 Ω (b) 2 Ω
(c) 2.5 Ω (d) 5 Ω

43. When two infinitely long parallel wires seperated by a distance of 1 m, each carry a current of 3 A, the force in N/m length experienced by each will be given $\mu_0 = 4\pi \times 10^{-7}$ SI units :
(a) 2×10^{-7} (b) 3×10^{-7}
(c) 6×10^{-7} (d) 18×10^{-7}

44. The neutral temperature of a thermocouple with cold junction at 20°C is 220°C. Its temperature of inversion is :
(a) 420°C (b) 120°C
(c) 110°C (d) 440°C

45. In a photoelectric experiment, the maximum velocity of photoelectrons emitted :
(a) depends on intensity of incident radiation
(b) does not depend on the cathode material
(c) depends on frequency of incident radiation
(d) does not depend on wave length of the incident radiation

46. In hydrogen spectrum the shortest wavelength in Balmer series is λ. The shortest wave length in Bracket series will be :
(a) 2λ (b) 4λ
(c) 9λ (d) 16λ

47. In a nuclear reactor, material used for control rods is :
(a) uranium (b) graphite
(c) liquid sodium (d) cadmium

48. In intrisic semiconductors :
(a) the conduction band and valence band overlap
(b) the gap between conduction band and valence band is more than 16 eV
(c) the gap between conduction and valence band is near about 1 eV
(d) none of the above

49. The element that can be used as acceptor impurity to dope silicon is :
(a) antimony
(b) arsenic
(c) boron
(d) phosphorus

50. A varying current in a coil changes from 10 A to zero in 0.5 s. If the average emf induced in the coil is 2 volts, the self inductance of the coil is :
(a) 5.0 henry
(b) 0.1 henry
(c) 11.0 henry
(d) 12.0 henry

1. Which of the following is not true ?
   (a) Aluminium liberates hydrogen on treating with a base
   (b) Aluminium is used in the preparation of duralumin
   (c) Aluminium is extracted by the electrolysis of alumina in presence of cryolite
   (d) Aluminium is a strong oxidising agent

2. The industrial preparation of nitric acid by Ostwald's process involves :
   (a) reduction of NH_3
   (b) oxidation of NH_3
   (c) hydrogenation of NH_3
   (d) hydrolysis of NH_3

3. In which of the following reactions ozone acts as a reducing agent ?
   (a) $BaO_2 + O_3 \longrightarrow BaO + 2O_2$
   (b) $2HCl + O_3 \longrightarrow Cl_2 + H_2O + O_2$
   (c) $PbS + 4O_3 \longrightarrow PbSO_4 + 4O_2$
   (d) $2KI + O_3 + H_2O \longrightarrow 2KOH + I_2 + O_2$

4. Aqueous solution of carnallite gives positive test for :
   (a) chloride ions only
   (b) potassium ions only
   (c) potassium and chloride ions only
   (d) potassium, magnesium and chloride ions

5. Oxalic acid is heated with conc. H_2SO_4 when the resultant gases are passed over red hot carbon, X is obtained. X is :
   (a) CO (b) CH_4 (c) CO_2 (d) C_2H_4

6. Which of the following is the weakest acid in its aqueous solution ?
   (a) H_2Te (b) H_2Se (c) H_2S (d) H_2Po

7. What is the oxidation state of Fe in the product formed when acidified potassium ferrocyanide is treated with H_2O_2 ?
   (a) + 2 (b) + 3 (c) + 4 (d) + 6

8. A burning strip of Mg is introduced into a jar containing a gas. After sometime the walls of the container are coated with carbon. The gas in the container is :
   (a) O_2 (b) N_2
   (c) CO_2 (d) H_2O

9. Inorganic benzene contains :
   (a) C, H, Al (b) C, H, B
   (c) B, N, H (d) C, N, H

10. Which of the following is the anhydride of HNO_3 ?
    (a) NO (b) N_2O_3
    (c) N_2O_4 (d) N_2O_5

11. In Rutherford's α-ray scattering experiment, the alpha particles are detected using a screen coated with :
    (a) carbon black (b) platinum black
    (c) zinc sulphide
    (d) polytetrafluoro ethylene

12. The molecule having zero dipole moment is :
    (a) $CHCl_3$ (b) H_2O (c) CCl_4 (d) HCl

13. What is the numerical value of the gas constant R in J $mol^{-1}K^{-1}$?
    (a) 0.0821 (b) 8.314×10^7
    (c) 8.314 (d) 1.987

14. Which of the following is an oxide mineral ?
    (a) Zinc blende (b) Magnetite
    (c) Dolomite (d) Carnallite

15. The unit of electrochemical equivalent are :
    (a) g coulomb (b) g amp^{-1} sec^{-1}
    (c) g amp sec^{-1} (d) amp^{-1} sec

16. The number of acetylene molecules required to form one molecule of benzene is :
    (a) 1 (b) 2 (c) 3 (d) 4

17. At what temperature the density of heavy water will be maximum ?
    (a) 0°C (b) 11.6°C (c) 4°C (d) 27°C

18. Which of the following set of raw materials are used in the manufacture of Na_2CO_3 by Solvay process ?
    (a) $Ca(OH)_2$, NH_3, CO_2
    (b) $CaCl_2$, NH_3, CO_2
    (c) NaOH, NH_3, CO_2
    (d) NaCl, NH_3, CO_2

19. The half-life of a first order reaction is 10 sec. What is its rate constant (in sec^{-1}) ?
    (a) 0.0693 (b) 0.693
    (c) 6.93 (d) 69.3

20. Absolute alcohol is prepared by distillation of rectified spirit in the presence of :
(a) Na (b) $CaCO_3$
(c) $(C_2H_5O)_2Mg$ (d) $Ca(OH)_2$

21. Which of the following pairs of ions contain the same number of unpaired electrons ?
(a) Ni^{2+}; Co^{2+} (b) Mn^{2+}; Fe^{3+}
(c) Mn^{2+}; Ni^{2+} (d) Ti^{3+}; Co^{2+}

22. The number of C—C sigma bonds present in 1-butyne is :
(a) 2 (b) 3 (c) 4 (d) 5

23. The following reaction is known to occur in the body. If CO_2 escapes from the system :

$$CO_2 + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$$

(a) H^+ ion concentration increases
(b) H^+ ion concentration decreases
(c) H_2CO_3 concentration does not change
(d) the forward reaction will be promoted

24. Hydrolysis of chloroform with aqueous KOH gives finally :
(a) $COCl_2$ (b) CH_3NC
(c) HCOOK (d) $CH_2Cl(OH)$

25. Chlorine is passed into dilute cold KOH solution. What are the oxidation number of chlorine in the products formed ?
(a) –1; + 5 (b) –1; + 3
(c) + 1; + 7 (d) –1; + 1

26. Chloroethane is treated with alc. KOH. The product formed is :
(a) C_2H_6O (b) C_2H_6
(c) C_2H_4 (d) C_2H_4O

27. Δx = (Hydration energy) – (Lattice energy), for a salt Δx is found to be 500 kcal mol^{-1}. Then on increasing the temperature, its solubility in water :
(a) increases
(b) decreases
(c) remains same
(d) increases initially and decreases

28. Ethyne is treated with 30% H_2SO_4 in the presence of 1% mercuric sulphate at 70°C. What is the product formed ?
(a) Ethene (b) Ethanol
(c) Ethanal (d) Ethylene glycol

29. Which of the following is used as a rocket fuel ?
(a) H_2 (b) N_2 (c) C_2H_2 (d) CH_4

30. Which of the following alkane cannot be prepared by Wurtz reaction ?
(a) C_2H_6 (b) C_3H_6 (c) CH_4 (d) C_4H_{10}

31. The oxidation number of nitrogen in HN_3 is :
(a) $+\frac{1}{3}$ (b) 0 (c) $-\frac{1}{3}$ (d) 1

32. *n*-octane and *n*-nonane have :
(a) same molecular formula
(b) same molecular weight
(c) similar chemical properties
(d) same boiling point

33. The activity of a radioactive element is 2×10^{10} disintegration per second. After ten minutes the activity is reduced to 2×10^9 distintegrations per second. The disintegration constant of the radioactive element is :
(a) 2 (b) 2.303
(c) 10 (d) none of these

34. The pH of a 1 litre solution is 2. It is diluted with water till its pH becomes 4. How many litres of water are added ?
(a) 99 (b) 9 (c) 999 (d) 9.9

35. The unit of radio-activity is :
(a) Fermi (b) Farad
(c) Curie (d) Hertz

36. At 90°C the concentration of H_3O^+ in pure water is 10^{-6} mol L^{-1}. What is the value of K_w at this temperature ?
(a) 10^{-6} (b) 10^{-8} (c) 10^{-14} (d) 10^{-12}

37. Among the first lines of Lyman, Balmer, Paschen and Brackett series in hydrogen atomic spectra, which has the highest energy ?
(a) Lyman (b) Balmer
(c) Paschen (d) Brackett

38. Which of the following covalent molecules is an exception to octet rule ?
(a) $BeCl_2$ (b) CO_2 (c) H_2O (d) CH_4

39. A mixture contains 16 g of oxygen, 28 g of nitrogen and 8 g of CH_4. Total pressure of mixture is 740 mm. What is the partial pressure of nitrogen in mm ?
(a) 185 (b) 370 (c) 555 (d) 740

40. A solid organic compound X on heating is directly converted into the vapour phase which on cooling solidifies. The best method for purifying X is :
(a) distillation
(b) distillation at reduced pressure
(c) sublimation
(d) steam distillation

41. How many moles of potassium chlorate should be decomposed completely to obtain 67.2 L of oxygen at NTP ?
(a) 3 (b) 4 (c) 1 (d) 2

42. Tinstone is contaminated with Wolframite. Which one of the following methods can be employed to dress the tinstone ore ?
(a) Levigation
(b) Electromagnetic separation
(c) Floatation process
(d) Roasting

43. In which of the following reactions heat liberated is known as standard heat of formation of CO_2 ?
(a) $2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)} + 135.5$ kcal
(b) $C_{(diamond)} + O_{2(g)} \rightarrow 2CO_{2(g)} + 94.5$ kcal
(c) $C_{(graphite)} + O_{2(g)} \rightarrow CO_{2(g)} + 94.05$ kcal
(d) $CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)} + 212.8$ kcal

44. The solvent used in the preparation of Grignard reagent is :
(a) dry ether (b) dry acetone
(c) dry alcohol (d) none of these

45. O^{2-} and Si^{4+} are isoelectronic ions. If the ionic radius of O^{2-} is 1.4 Å, the ionic radius of Si^{4+} will be :
(a) 1.4 Å (b) 0.41 Å
(c) 2.8 Å (d) 1.5 Å

46. Which of the following compounds undergo aldol condensation ?
(a) CH_3CHO (b) $(CH_3)_3CHO$
(c) CCl_3CHO (d) HCHO

47. Acetic acid gives acetic anhydride when treated with :
(a) PCl_5 (b) P_2O_5
(c) Zn/NH_4Cl (d) $LiAlH_4$

48. Which of the following reagents converts nitrobenzene into N-phenyl hydroxylamine ?
(a) Sn/HCl (b) Zn/NaOH
(c) Zn/NH_4Cl (d) $LiAlH_4$

49. The electronic configuration of sodium is :
(a) $[Ne]\,3s^2$ (b) $[Ne]\,3s^1$
(c) $[Ar]\,4s^1$ (d) $[Ar]\,4s^2$

50. The oxidation number of Mn in potassium permanganate is :
(a) +6 (b) +7
(c) +5 (d) 8

MATHEMATICS

1. $\dfrac{\sin\theta + \sin 2\theta}{1 + \cos\theta + \cos 2\theta}$ is equal to :
(a) $\sin\theta$ (b) $\cos\theta$
(c) $\tan\theta$ (d) $\cot\theta$

2. $\tan^{-1}\left(\dfrac{1}{2}\right) + \tan^{-1}\left(\dfrac{1}{3}\right)$ is equal to :
(a) $\dfrac{\pi}{2}$ (b) $\dfrac{\pi}{4}$ (c) $\dfrac{\pi}{3}$ (d) $\dfrac{\pi}{6}$

3. The maximum value of $1 + 8\sin^2 x^2 \cos^2 x^2$ is :
(a) -8 (b) -1
(c) 3 (d) 9

4. The period of $\sin^3 x + \cos^3 x$ is :
(a) $\dfrac{\pi}{3}$ (b) π (c) 2π (d) $\dfrac{2\pi}{3}$

5. If $|x| = x$, then $\dfrac{1}{2}\log\left(\dfrac{1+x}{1-x}\right)$ is equal to :
(a) $\tan^{-1} x$ (b) $\sin^{-1} x$
(c) $\cos^{-1} x$ (d) $\tanh^{-1} x$

6. From the top of a building of height h metres the angle of depression of an object on the ground is α. The distance of the object from foot of the building, is :
(a) $h\cot\alpha$ (b) $h\tan\alpha$
(c) $h\cos\alpha$ (d) $h\sin\alpha$

7. The general solution of $\tan^2\theta = 3$ is :
(a) $n\pi + (-1)^n\dfrac{\pi}{3}$ (b) $2n\pi \pm \dfrac{\pi}{3}$
(c) $n\pi \pm \dfrac{\pi}{3}$ (d) $2n\pi + (-1)^n\dfrac{\pi}{3}$

8. In a ΔABC, $r\left[\cot\frac{B}{2}+\cot\frac{C}{2}\right]$ is equal to :
(a) r (b) b
(c) c (d) a

9. In a triangle ABC,
$r_1\cot\frac{A}{2}+r_2\cot\frac{B}{2}+r_3\cot\frac{C}{2}$ is equal to :
(a) $2r$ (b) $3R$ (c) $4s$ (d) $3s$

10. In a triangle $A=\sqrt{15}-\sqrt{11}$, $B=\sqrt{17}-\sqrt{13}$, then :
(a) $A<B$ (b) $A>B$ (c) $B=2A$ (d) $A=2B$

11. If α,β are the cube roots of unity, then $\alpha^5+\beta^5+\alpha\beta$ is equal to :
(a) 0 (b) α (c) β (d) 1

12. P represents $z=x+iy$ in argand plane and $|3z-1|=3\,|z-2|$; then locus of P is :
(a) $x=0$ (b) $x^2+y^2=8$
(c) $y=x$ (d) $6x=7$

13. The least positive integer n such that $\left(\frac{1-i}{1+i}\right)^{2n}=1$, is :
(a) 2 (b) 4 (c) 6 (d) 14

14. If $\frac{3+2i\sin\theta}{1-2i\sin\theta}$ is real, then θ is equal to :
(a) 0 (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$

15. The locus of the point whose distance from x axis is twice its distance from y axis, is :
(a) $y^2=4x^2$ (b) $4y^2=x^2$
(c) $y=3x$ (d) $4x+y=0$

16. If the axes are rotated through an angle 30° about the origin, then the transformed equation of $x^2+2\sqrt{3}xy-y^2=2a^2$, is :
(a) $x^2+y^2=a^2$ (b) $x^2-y^2=a^2$
(c) $x^2+y^2=2a^2$ (d) $x^2-y^2=2a^2$

17. The ratio in which the line $y=x$ divides the segment joining (2, 3) and (8, 6) is :
(a) 1 : 2 (b) 1 : − 2 (c) 1 : − 3 (d) 1 : 3

18. Equation of a straight line making an intercept of 3 units on the y-axis and inclined at 45° to the x-axis, is :
(a) $y=x-1$ (b) $y=x+3$
(c) $y=45\,x+3$ (d) $y=x+45$

19. If the straight line $y=4-3x$, $ay=x+10$ and $2y+bx+9=0$ represents the three consecutive sides of rectangle, then ab is equal to :
(a) 18 (b) − 2 (c) $\frac{1}{2}$ (d) $-\frac{1}{3}$

20. The equation of lines passing through the intersection of lines $x-2y+5=0$ and $3x+2y+7=0$ and perpendicular to $x-y=0$ is :
(a) $x+y=0$ (b) $x+y=2$
(c) $x+y+2=0$ (d) $x+y+1=0$

21. The reflection of a point (6, 8) about the line $x=y$, is :
(a) (4, 2) (b) (− 6, − 8)
(c) (− 8, − 10) (d) (8, 6)

22. The product of length of perpendiculars from (− 1, 2) to the pair of lines $2x^2-5xy+2y^2=0$, is :
(a) $\frac{1}{2}$ (b) 3 (c) 4 (d) 8

23. If $\lambda x^2+6xy+9y^2+4x+12y+3=0$ represents a pair of straight lines, then λ is equal to :
(a) 1 (b) − 3 (c) − 4 (d) 5

24. The angle between the pair of straight lines $y^2\cos^2\theta-xy\cos^2\theta+x^2(\sin^2\theta-1)=0$, is :
(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{3}$ (c) $\frac{2\pi}{3}$ (d) $\frac{\pi}{2}$

25. If the equation
$ax^2+5xy-6y^2-10x+11y+c=0$ represents two perpendicular lines, then c is equal to :
(a) − 4 (b) − 6 (c) 4 (d) 6

26. The parametric equations
$x=\frac{2a(1-t^2)}{1+t^2}$, and $y=\frac{4at}{1+t^2}$ represents a circle of radius is equal to :
(a) $\frac{9}{2}$ (b) a (c) $2a$ (d) $4a$

27. The inverse point of (1, − 1) with respect to the circle $x^2+y^2=4$ is equal to :
(a) (− 1, 1) (b) (− 2, 2)
(c) (1, − 1) (d) (2, − 2)

28. The equation of polar of (− 2, 3) w.r.to $x^2+y^2-4x-6y+5=0$, is :
(a) $x=y$ (b) $x+y=0$
(c) $y=0$ (d) $x=0$

29. If the circle $x^2 + y^2 + 2x - 2y + 4 = 0$ cuts the circle $x^2 + y^2 + 4x + 2fy + 2 = 0$ orthogonally, then f is equal to :
(a) 1 (b) -1 (c) 2 (d) -2

30. The slope of radical axis of the circles $x^2 + y^2 + 3x + 4y - 5 = 0$ and $x^2 + y^2 - 5x + 5y + 6 = 0$, is :
(a) 1 (b) 3 (c) 5 (d) 8

31. The vertex of the parabola $x^2 + 12x - 9y = 0$ is :
(a) $(6, -4)$ (b) $(-6, 4)$
(c) $(6, 4)$ (d) $(-6, -4)$

32. If $2y = 5x + k$ is tangent to parabola $y^2 = 6x$, then k is equal to :
(a) $\frac{2}{5}$ (b) $\frac{3}{5}$ (c) $\frac{4}{5}$ (d) $\frac{6}{5}$

33. The focus of parabola $y^2 - 4y - 8x - 4 = 0$ is :
(a) (1, 1) (b) (1, 2) (c) (2, 0) (d) (2, 2)

34. The pole of line $x = \frac{a}{e}$ w.r. to ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is equal to :
(a) $\left(\frac{a}{e}, 0\right)$ (b) $\left(-\frac{a}{e}, 0\right)$
(c) $(ae, 0)$ (d) $(-ae, 0)$

35. The eccentricity of hyperbola $4x^2 - 9y^2 = 2ax + b^2$ is :
(a) $\frac{a}{b}$ (b) $\frac{\sqrt{b}}{a}$ (c) $\frac{\sqrt{13}}{2}$ (d) $\frac{\sqrt{13}}{3}$

36. The equation $\frac{1}{r} = \frac{1}{8} + \frac{3}{8}\cos\theta$ represents a/an :
(a) circle (b) ellipse
(c) parabola (d) hyperbola

37. If $\vec{a}$ and $\vec{b}$ are unit vectors such that $|\vec{a} \times \vec{b}| = \vec{a} \cdot \vec{b}$, then $|\vec{a} + \vec{b}|^2$ is equal to :
(a) 2 (b) $2 + \sqrt{2}$ (c) $2 - \sqrt{2}$ (d) $\sqrt{2}$

38. $(\hat{i} - \hat{j}) \times (\hat{j} - \hat{k}) \cdot (\hat{k} - \hat{i})$ is equal to :
(a) 0 (b) 1 (c) 2 (d) 3

39. If the position vectors of $\vec{A}$ and $\vec{B}$ are $3\hat{i} - 2\hat{j} + \hat{k}$ and $2\hat{i} + 4\hat{j} - 3\hat{k}$, then $|\vec{AB}|$ is equal to :
(a) $\sqrt{14}$ (b) $\sqrt{29}$ (c) $\sqrt{43}$ (d) $\sqrt{53}$

40. If $|\vec{a}| = 3$, $|\vec{b}| = 4$ and $|\vec{a} + \vec{b}| = 1$, then $|\vec{a} - \vec{b}|$ is equal to :
(a) 5 (b) 6 (c) 7 (d) 8

41. If $\vec{a}$ and $\vec{b}$ are unit vectors and $|\vec{a} \times \vec{b}| = 1$, then the angle between $\vec{a}$ and $\vec{b}$ is :
(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{3}$ (d) π

42. If $\vec{a} = 3\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} + 5\hat{k}$, then the unit vectors along $\vec{a} - \vec{b}$ is :
(a) $\sqrt{\frac{2\hat{i} + 4\hat{j} + 4\hat{k}}{\sqrt{34}}}$
(b) $\frac{\hat{i} - 2\hat{j} - 2\hat{k}}{3}$
(c) $\frac{-2\hat{i} + 4\hat{j} + 4\hat{k}}{6}$
(d) none of these

43. If $\vec{a} = -\hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = \hat{i} - 2\hat{j} + \hat{k}$, $\vec{c} = 4\hat{i} - 3\hat{j} - 2\hat{k}$ and $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$, then λ is equal to :
(a) 1 (b) 2 (c) 3 (d) 4

44. $(\vec{a} \times \vec{b}) \times (\vec{b} \times \vec{c})$ is equal to :
(a) $[\vec{a}\ \vec{b}\ \vec{c}]\vec{a}$ (b) $[\vec{a}\ \vec{b}\ \vec{c}]\vec{b}$
(c) $[\vec{a}\ \vec{b}\ \vec{c}]\vec{c}$ (d) $[\vec{a}\ \vec{b}\ \vec{c}]$

45. If the area of parallelogram, whose adjacent sides are $3\hat{i} + 4\hat{j} - \lambda\hat{k}$ and $2\hat{j} - 4\hat{k}$ is $\sqrt{436}$ sq unit and $\lambda = 0$, then λ is equal to :
(a) 0 (b) 4
(c) 1 (d) 3

46. The probability of getting a total score of 7 when two unbiased dice are thrown simultaneously, is :
(a) $\frac{7}{36}$ (b) $\frac{29}{36}$ (c) $\frac{1}{6}$ (d) $\frac{5}{6}$

47. One of the two events A and B must occur. If $P(A) = \frac{2}{3}P(B)$, odds in favour of B are :
(a) 1 : 2 (b) 2 : 1
(c) 2 : 3 (d) 3 : 2

48. A single letter is selected at random from the word "PROBABILITY". The probability that it is a vowel, is :
(a) $\frac{3}{11}$ (b) $\frac{4}{11}$ (c) $\frac{2}{11}$ (d) $\frac{1}{11}$

49. A random variable X has following distribution

X	1	2	3	4
$P(X)$	c	$2c$	$3c$	$4c$

the value of c is :
(a) 0.1 (b) 0.2 (c) 10 (d) 20

50. In a poisson distribution, if $P(X=0) = P(X=1) = k$, then the value of k is :
(a) 1 (b) $\frac{1}{e}$ (c) e (d) $\sqrt{e}$

51. If the mean of 9 binomial distribution is 6, then its variance is :
(a) 2 (b) 3 (c) 4 (d) $\sqrt{2}$

52. If $f : R \to R$ is defined by $f(x) = 3x - 2$, then $fof(x) + 2$ is equal to :
(a) $f(x)$ (b) $2f(x)$ (c) $3f(x)$ (d) $-f(x)$

53. If ${}^{n}P_7 = 42\,{}^{n}P_5$, then n is equal to :
(a) -1 (b) 5 (c) 7 (d) 12

54. The least value of n that satisfies ${}^{n-1}C_3 + {}^{n-1}C_4 > {}^{n}C_3$ is :
(a) 6 (b) 7 (c) 8 (d) 9

55. If $x = 7 + 4\sqrt{3}$ and $xy = 1$, then $\frac{1}{x^2} + \frac{1}{y^2}$ is equal to :
(a) 64 (b) 134 (c) 194 (d) $\frac{1}{49}$

56. If $x = 27$ and $y = \log_3 4$, then x^y is equal to :
(a) 1 (b) 4 (c) 16 (d) 64

57. $\log_8 128$ is equal to :
(a) $\frac{7}{3}$ (b) $\frac{3}{7}$ (c) $\frac{1}{16}$ (d) 16

58. $f : R \to R$, defined by $f(x) = \sin x$ and $g : R \to R$, defined by $g(x) = x^2$, $(fog)(x)$ is equal to :
(a) $x^2 + \sin x$ (b) $x^2 \sin x$
(c) $\sin^2 x$ (d) $\sin x^2$

59. If $\frac{1}{(1-2x)(1+3x)} = \frac{A}{1-2x} + \frac{B}{1+3x}$, then $2B$ is equal to :
(a) A (b) $2A$ (c) $3A$ (d) $-3A$

60. The term independent of x in expansion of $\left(x^2 - \frac{1}{x}\right)^6$ is equal to :
(a) -12 (b) 15
(c) 24 (d) -15

61. The coefficient of the 8th term in expansion of $(1+x)^{10}$ is equal to :
(a) 7 (b) ${}^{10}C_3$
(c) 120 (d) 210

62. The coefficient of the middle term in the expansion of $(1+x)^{40}$ is equal to :
(a) $\frac{1 \cdot 3 \cdot 4 \ldots 39}{20!} \cdot 2^{20}$
(b) $\frac{1 \cdot 3 \cdot 5 \ldots 39}{20!}$
(c) $\frac{40!}{(20!)^2}$
(d) $4!\,2^{20}$

63. If $2x - 7 - 5x^2$ has maximum value at $x = a$, then a is equal to :
(a) $-\frac{1}{5}$ (b) $\frac{1}{5}$ (c) $\frac{34}{5}$ (d) $-\frac{34}{5}$

64. The maximum value of $c + 2bx - x^2$ is equal to :
(a) b^2c (b) $b^2 - c$ (c) $c - b^2$ (d) $b^2 + c$

65. If $A(\alpha) = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, then $A(\alpha), A(\beta)$ is equal to :
(a) $A(\alpha) - A(\beta)$ (b) $A(\alpha) + A(\beta)$
(c) $A(\alpha + \beta)$ (d) $A(\alpha - \beta)$

66. The real part of $\begin{vmatrix} \cos\alpha + i\sin\alpha & \cos\beta + i\sin\beta \\ \sin\beta + i\cos\beta & \sin\alpha + i\cos\alpha \end{vmatrix}$ is equal to :
(a) 0 (b) 1
(c) $2\cos\alpha$ (d) $2\sin\beta$

67. If the matrix $\begin{bmatrix} \cos\theta & \sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is singular, then θ is equal to :
(a) π (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{4}$

68. If $x \neq 0$ and $\begin{vmatrix} 1 & x & 2x \\ 1 & 3x & 5x \\ 1 & 3 & 4 \end{vmatrix} = 0$, then x is equal to :
(a) -1 (b) -2
(c) 1 (d) 2

69. If $\begin{bmatrix} x & y^3 \\ 2 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 8 \\ 2 & 0 \end{bmatrix}$, then $\begin{bmatrix} x & y \\ 2 & 0 \end{bmatrix}^{-1}$ is equal to :

(a) $\begin{bmatrix} 0 & -2 \\ -2 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} 0 & -8 \\ -2 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & \frac{1}{2} \\ \frac{1}{2} & -\frac{1}{4} \end{bmatrix}$

70. If a, b are elements of group, then $(aob)^{-1}$ is equal to :

(a) aob^{-1} (b) $a^{-1}ob^{-1}$

(c) $b^{-1}oa^{-1}$ (d) $b^{-1}oa$

71. For the set $G = \{-1, 1\}$ be a group the binary operation is equal to :

(a) addition (b) subtraction

(c) multiplication (d) addition modulo 2

72. In a group (G, o) the elements a and b are such that $a^3 = e = b^3$ when e is the identity element, then a^7ob^{-4} is equal to :

(a) aob^{-1} (b) aob

(c) $a^{-1}ob$ (d) a^2ob

73. $\lim\limits_{x \to \infty} \dfrac{2x + 7 \sin x}{4x + 3 \cos x}$ is equal to :

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

74. If $y = f(x) = \dfrac{2x - 1}{x - 2}$, then $f(y)$ is equal to :

(a) x (b) y

(c) $2y - 1$ (d) $y - 2$

75. $\dfrac{d}{dx}\{\cos^{-1} x + \sin^{-1}\sqrt{1 - x^2}\}$ is equal to :

(a) 0 (b) 1

(c) $\dfrac{2}{\sqrt{1 - x^2}}$ (d) $-\dfrac{2}{\sqrt{1 - x^2}}$

76. The derivative of $\sin^{-1} x$ w.r. to $\cos^{-1}\sqrt{1 - x^2}$ is :

(a) 0 (b) 1

(c) $\cos^{-1} x$ (d) $\sin^{-1} x$

77. If $x = \theta - \dfrac{1}{\theta}$ and $y = \theta + \dfrac{1}{\theta}$, then $\dfrac{dy}{dx}$ is equal to :

(a) $\frac{x}{y}$ (b) $\frac{y}{x}$ (c) $-\frac{x}{y}$ (d) $-\frac{y}{x}$

78. If $y = x^x$, then $\dfrac{dy}{dx}$ is equal to :

(a) x^x (b) $x^x \log x$

(c) $x^x (1 + \log x)$ (d) $\dfrac{x^x}{\log x}$

79. If $y = \cot^{-1}\left[\tan\left(\dfrac{\pi}{2} - x\right)\right]$, then $\dfrac{dy}{dx}$ is equal to :

(a) 2 (b) 1

(c) $\dfrac{1}{1 + x^2}$ (d) $-\dfrac{1}{1 + x^2}$

80. In a cube the percentage increase in side is 1. The percentage increase in the volume of the cube is :

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

81. A cylindrical vessel of radius 0.5 m is filled with oil at the rate of 0.25 π m^3/min. The rate, at which the level of oil is increasing, is :

(a) 1 m/min (b) 2 m/min

(c) 5 m/min (d) 1.25 m/min

82. The equation of the tangent to the curve $y = x^3 - 2x + 7$ at the point (1, 6), is :

(a) $y = x + 5$ (b) $x + y = 7$

(c) $2x + y = 8$ (d) $x + 2y = 13$

83. If the acute angle between the curves $xy = 2$ and $y^2 = 4x$ is θ, then $\tan\theta$ is equal to :

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

84. If $x + y = 12$, then the minimum value of $x^2 + y^2$ is :

(a) 72 (b) 144

(c) 48 (d) 36

85. If $y = \sin(7 \sin^{-1} x)$, then $(1 - x^2) y_2 - xy_1$ is equal to :

(a) $-49y$ (b) $-7y$

(c) $49y$ (d) $7y$

86. If $z^2 = \dfrac{x^{1/2} + y^{1/2}}{x^{1/3} + y^{1/3}}$, then $x\dfrac{\partial z}{\partial x} + y\dfrac{\partial z}{\partial y}$ is :

(a) $\frac{2}{6}$ (b) $\frac{2}{3}z$

(c) $\frac{2}{5}z$ (d) $\frac{1}{12}z$

87. If $u = x + y$ and $v = x^2 - y^2$, then $\begin{vmatrix} \frac{\partial u}{\partial x} & \frac{\partial u}{\partial y} \\ \frac{\partial v}{\partial x} & \frac{\partial v}{\partial y} \end{vmatrix}$ is equal to :

(a) u (b) v
(c) $-2u$ (d) $u + v$

88. $\lim_{n \to \infty} \left[\frac{1}{n+1} + \frac{1}{n+2} + \ldots + \frac{1}{2n} \right]$ is equal to :

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

89. The minimum distance from the point (4, 2) to the parabola $y^2 = 8x$ is :

(a) $\sqrt{2}$ (b) $2\sqrt{2}$
(c) $3\sqrt{2}$ (d) $4\sqrt{2}$

90. $\int \frac{dx}{x(1+\log x)^3}$ is equal to :

(a) $-\frac{1}{2(1+\log x)^2} + c$

(b) $\frac{1}{2(1+\log x)^2} + c$

(c) $\frac{1}{(1+\log x)} + c$

(d) $-\frac{1}{3(1+\log x)^3} + c$

91. $\int \frac{1}{x} \sqrt{\frac{x-1}{x+1}}\, dx$ is equal to :

(a) $\cosh^{-1} x - \sec^{-1} x + c$
(b) $\cosh^{-1} x + \sec^{-1} x + c$
(c) $\sinh^{-1} x - \sec^{-1} x + c$
(d) $\sinh^{-1} x - \cos^{-1} x + c$

92. $\int \frac{3\,dx}{2x^2 - x - 1}$ is equal to :

(a) $\log \left| \frac{x-1}{x+1} \right| + c$

(b) $\log \left| \frac{x-1}{2x+1} \right| + c$

(c) $\log \left| \frac{2(x-1)}{2x+1} \right| + c$

(d) $\log \left| \frac{x-1}{2x+1} \right| + c$

93. $\int \frac{\sin^3 x + \cos^3 x}{\sin^2 x \cos^2 x}\, dx$ is equal to :

(a) $\sin x + \cos x + c$
(b) $\tan x + \cot x + c$
(c) $\sec x - \operatorname{cosec} x + c$
(d) $\sin x - \cos x + c$

94. $\int_0^{\pi/4} (\tan^4 x + \tan^2 x)\, dx$ is equal to :

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

95. $\int_0^{\pi} \cos^3 x\, dx$ is equal to :

(a) 0 (b) -1
(c) 1 (d) $\frac{1}{2\sqrt{2}}$

96. The area bounded by the parabola $x = 4 - y^2$ and the y-axis (in sq unit) is :

(a) $\frac{3}{32}$ (b) $\frac{32}{3}$
(c) $\frac{32}{2}$ (d) $\frac{16}{3}$

97. The approximate value of $\int_{-3}^{3} x^4\, dx$, using trapezoidal rule and taking six equal intervals, is :

(a) 11.5 (b) 198
(c) 115 (d) 120

98. $\lim_{n \to \infty} \sum_{r=1}^{n} \left(\frac{1}{n} \right) \sqrt{\frac{n+r}{n-r}}$ is equal to :

(a) $\frac{\pi + 2}{2}$ (b) $\frac{\pi + 2}{4}$
(c) $\frac{\pi + 1}{2}$ (d) $\frac{\pi + 2}{3}$

99. The order of the differential equation $\left(\frac{dy}{dx} \right)^3 + \left(\frac{dy}{dx} \right)^2 + y^4 = 0$ is :

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

100. The solution of $2xy \frac{dy}{dx} = 1 + y^2$, is :

(a) $1 - y^2 = cx$ (b) $1 + y^2 = cx$
(c) $1 - x^2 = cy$ (d) $1 + x^2 = cy$

Answers

Physics

1.	(d)	2.	(c)	3.	(d)	4.	(b)	5.	(c)	6.	(d)	7.	(a)	8.	(d)	9.	(c)	10.	(b)
11.	(a)	12.	(d)	13.	(a)	14.	(b)	15.	(c)	16.	(d)	17	(a)	18.	(b)	19.	(c)	20.	(d)
21.	(a)	22.	(b)	23.	(c)	24.	(d)	25.	(a)	26.	(c)	27.	(b)	28.	(b)	29.	(c)	30.	(b)
31.	(a)	32.	(b)	33.	(c)	34.	(c)	35.	(c)	36.	(b)	37.	(b)	38.	(a)	39.	(c)	40.	(d)
41.	(c)	42.	(b)	43.	(d)	44.	(a)	45.	(c)	46.	(b)	47.	(d)	48.	(c)	49.	(c)	50.	(b)

Chemistry

1.	(d)	2.	(b)	3.	(a)	4.	(d)	5.	(a)	6.	(c)	7.	(b)	8.	(c)	9.	(c)	10.	(d)
11.	(c)	12.	(c)	13.	(c)	14.	(b)	15.	(b)	16.	(c)	17	(b)	18.	(d)	19.	(a)	20.	(c)
21.	(b)	22.	(b)	23.	(b)	24.	(c)	25.	(d)	26.	(c)	27.	(b)	28.	(c)	29.	(a)	30.	(c)
31.	(c)	32.	(c)	33.	(d)	34.	(a)	35.	(c)	36.	(d)	37.	(a)	38.	(a)	39.	(b)	40.	(c)
41.	(d)	42.	(b)	43.	(c)	44.	(a)	45.	(b)	46.	(a)	47.	(b)	48.	(c)	49.	(b)	50.	(b)

Mathematics

1.	(c)	2.	(b)	3.	(c)	4.	(c)	5.	(d)	6.	(a)	7.	(c)	8.	(d)	9.	(d)	10.	(b)
11.	(a)	12.	(d)	13.	(a)	14.	(a)	15.	(a)	16.	(b)	17	(a)	18.	(b)	19.	(a)	20.	(c)
21.	(d)	22.	(c)	23.	(a)	24.	(d)	25.	(a)	26.	(c)	27.	(d)	28.	(d)	29.	(b)	30.	(d)
31.	(d)	32.	(d)	33.	(b)	34.	(c)	35.	(d)	36.	(d)	37.	(b)	38.	(a)	39.	(d)	40.	(c)
41.	(b)	42.	(c)	43.	(b)	44.	(b)	45.	(a)	46.	(c)	47.	(d)	48.	(b)	49.	(a)	50.	(b)
51.	(a)	52.	(c)	53.	(d)	54.	(c)	55.	(c)	56.	(d)	57.	(a)	58.	(d)	59.	(c)	60.	(b)
61.	(b)	62.	(c)	63.	(b)	64.	(d)	65.	(c)	66.	(a)	67.	(d)	68.	(a)	69.	(d)	70.	(c)
71.	(c)	72.	(a)	73.	(d)	74.	(a)	75.	(d)	76.	(b)	77.	(a)	78.	(c)	79.	(b)	80.	(d)
81.	(a)	82.	(a)	83.	(b)	84.	(a)	85.	(a)	86.	(d)	87.	(c)	88.	(a)	89.	(b)	90.	(a)
91.	(a)	92.	(c)	93.	(c)	94.	(d)	95.	(a)	96.	(b)	97.	(c)	98.	(a)	99.	(a)	100.	(b)

Hints & Solutions

PHYSICS

1. $m_1 = 1$ kg, $m_2 = 3$ kg

$\vec{r_1} = 2\hat{i} + 3\hat{j} + 4\hat{k}$,

$\vec{r_2} = -2\hat{i} + 3\hat{j} - 4\hat{k}$

Position vector of centre of mass

$$\vec{r}_{cm} = \frac{m_1\vec{r_1} + m_2\vec{r_2}}{m_1 + m_2}$$

$$= \frac{1(2\hat{i} + 3\hat{j} + 4\hat{k}) + 3(-2\hat{i} + 3\hat{j} - 4\hat{k})}{1 + 3}$$

$$= \frac{-4\hat{i} + 12\hat{j} - 8\hat{k}}{4}$$

$$= -\hat{i} + 3\hat{j} - 2\hat{k}$$

2. Total energy of the stone $= mgh$

$\therefore$ PE at $\frac{4h}{5}$,

$$PE = mg\left(\frac{4}{5}h\right)$$

$$= \frac{4}{5}mgh$$