INDRAPRASTHA CET
Engineering Entrance Exam
Solved Paper 2009

PHYSICS

1. The Galaxy, in which we live is
   (a) Milkyway (b) Radio Galaxy
   (c) Spiral Galaxy (d) None of these

2. The equation of state of the gas is expressed as $\left(p + \frac{a}{V^2}\right)(V - b) = nRT$,
   where p = pressure, V = volume, T = temperature and n, a, b, R are constants. The dimensions of a will be
   (a) $[ML^{-1}T^{-1}]$ (b) $[ML^5T^{-2}]$
   (c) $[L^{-3}]$ (d) $[L^6]$

3. The dimensional formula of modulus of rigidity is
   (a) $[ML^{-2}T^{-2}]$ (b) $[ML^{-3}T^{-2}]$
   (c) $[ML^2T^{-2}]$ (d) $[ML^{-1}T^{-2}]$

4. 1 ns is defined as
   (a) 10^{-9} s of Kr-clock of 1650763.73 oscillations
   (b) 10^{-9} s of Kr-clock of 652189.63 oscillations
   (c) 10^{-9} s of Cs-clock of 1650763.73 oscillations
   (d) 10^{-9} s of Cs-clock of 9192631770 oscillations

5. If the angle between two vectors $\vec{A}$ and $\vec{B}$ is 120°, its resultant C will be
   (a) $C = |A - B|$ (b) $C < |A - B|$
   (c) $C > |A - B|$ (d) $C = |A + B|$

6. The direction of $\vec{A}$ is vertically upward and direction of $\vec{B}$ is in north direction. The direction of $\vec{A} \times \vec{B}$ will be
   (a) western direction
   (b) eastern direction
   (c) at 45° upward in north
   (d) vertically downward

7. If $\vec{A} = \vec{B} + \vec{C}$ and the values of $\vec{A}$, $\vec{B}$ and $\vec{C}$ are 13, 12 and 5 respectively, then the angle between $\vec{A}$ and $\vec{C}$ will be
   (a) $\cos^{-1}(5/13)$ (b) $\cos^{-1}(13/12)$
   (c) $\pi/2$ (d) $\sin^{-1}(5/12)$

8. A car is circulating on the path of radius r and at any time its velocity is v and rate of increase of velocity is a. The resultant acceleration of the car will be
   (a) $\sqrt{\frac{v^2}{a^2} + r^2}$ (b) $\sqrt{\frac{v^2}{r} + a}$
   (c) $\sqrt{\frac{v^4}{r^2} + a}$ (d) $\left(\frac{v^2}{r} + a\right)$

9. A particle of mass m is being circulated on a vertical circle of radius r. If the speed of particle at the highest point be v, then
   (a) $mg = \frac{mv^2}{r}$ (b) $mg > \frac{mv^2}{r}$
   (c) $mg < \frac{mv^2}{r}$ (d) $mg \geq \frac{mv^2}{r}$

10. A particle of mass m is circulating on a circle of radius r having angular momentum L, then the centripetal force will be
    (a) L^2/mr (b) L^2m/r
    (c) L^2/mr^3 (d) L^2/mr^2

11. A uniform disc of mass 2 kg and radius 15 cm is revolving around the central axis by 4 rad-s^{-1}. The linear momentum of disc will be
    (a) 1.2 kg-ms^{-1} (b) 1.0 kg-ms^{-1}
    (c) 0.6 kg-ms^{-1} (d) None of these

12. If the torque of the rotational motion be zero, then the constant quantity will be
    (a) angular momentum
    (b) linear momentum
    (c) angular acceleration
    (d) centripetal acceleration

13. What will be the change in acceleration due to gravity when earth shrinks by 1% to its radius ?
    (a) Increase by 1% (b) Increase by 2%
    (c) Decrease by 1% (d) None of these

: the acceleration due to gravity at the
ce, then what will be the increase in
tial energy if object of mass m is raised by
dius R ?

mgR (b) $2mgR$

gR (d) $\frac{1}{4}mgR$

tellite is revolving around the planet. The
tational force between them varies with
^{2}, where R is the radius of the satellite. The
re of the time period T will be directly
ortional to

R^3 (b) $R^{7/2}$

$R^{3/2}$ (d) $R^{5/7}$

required kinetic energy of an object of mass
o that it may escape, will be

$\frac{1}{4}mgR$ (b) $\frac{1}{2}mgR$

mgR (d) $2mgR$

ar of mass m is driven with an acceleration a
ng a straight level road against a constant
rnal resistive force R. When the velocity of
car is v, the rate at which engine of the car is
ng work, will be

$R \cdot v$ (b) $ma \cdot v$

$(R + ma) \cdot v$ (d) $(ma - R) \cdot v$

a real gas (van der Waals' gas)

Boyle temperature is a / Rb

Critical temperature is a / Rb

Triple temperature is $2a / Rb$

Inversion temperature is $a / 2Rb$

the electric flux entering and leaving an
closed surface respectively is ϕ_1 and ϕ_2, the
ctric charge inside the surface will be

$(\phi_1 - \phi_2)\varepsilon_0$ (b) $(\phi_2 - \phi_1)\varepsilon_0$

$(\phi_1 + \phi_2)/\varepsilon_2$ (d) $(\phi_2 - \phi_1)/\varepsilon_0$

e Binary Coded Decimal (BCD) equivalent of
9 is

111001110 (b) 010000101001

110101101 (d) 0100101001

ne dispersive power of a plane transmission
ffraction

) increases with increase in order of diffraction

) decreases with increase in angle of diffraction

) decreases with increase in area of ruled surface

) depends upon the material

22. The proper life of pion (π^+) is 2.5×10^{-8} s. In a beam of pions travelling with a speed of $0.9\,c$, the pion, in the laboratory frame, can travel a maximum distance of

(a) 6.75 m (b) 15.49 m

(c) 7.50 m (d) 17.10 m

23. The satisfactory theory of Brownian motion was invented by

(a) Brown (b) Carnot

(c) Einstein (d) Maxwell

24. Which of the following is not the main characteristic of LASER beam ?

(a) High irradiance

(b) High divergence

(c) Highly monochromatic

(d) Highly coherent

25. The characteristic impedance (Z_0) of free space is

(a) 377 Ω (b) 357 Ω

(c) 100 Ω (d) 1000 Ω

26. The energy of a particle in a one-dimensional square potential well (n being the principal quantum number) is

(a) $E \propto n$ (b) $E \propto n^2$

(c) $E \propto \frac{1}{n}$ (d) $E \propto \frac{1}{n^2}$

27. The phase velocity (v_p) of travelling wave is

(a) $v_p = \omega / k$ (b) $v_p = d\omega / dk$

(c) $v_p = c$ (d) $v_p = c / v_g$

28. The values of L, C and R for a circuit are 1H, 9 F and 3Ω. What is the quality factor for the circuit at resonance ?

(a) 1 (b) 9 (c) $\frac{1}{9}$ (d) $\frac{1}{3}$

29. Curie law χT = constant, relating magnetic susceptibility (χ) and absolute temperature (T) of magnetic substances, is obeyed by

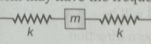
(a) all magnetic substances

(b) paramagnetic substances

(c) diamagnetic substances

(d) None of the above

30. The normal mode of vibration of the given spring mass system may have the frequency



(a) $\frac{1}{2\pi}\sqrt{\frac{k}{m}}$ (b) $\frac{1}{2\pi}\sqrt{\frac{2k}{m}}$

(c) $\frac{1}{2\pi}\sqrt{\frac{k}{2m}}$ (d) $2\pi\sqrt{\frac{k}{m}}$

ode rays enter a magnetic field making
ue angle with the lines of magnetic
ction. What will be the nature of the path
ved ?
Parabola (b) Helix
Circle (d) Straight line

spin-orbit interaction has no effect in the
of the hydrogen atom
-level (b) p-level
l-level (d) f-level

cubic crystal, the spacing of various crystal
es $d_{100} : d_{110} : d_{111}$ in simple cubic is
: 1 : 1 (b) $1 : \frac{1}{\sqrt{2}} : 1$
: 1 : $\frac{1}{\sqrt{2}}$ (d) $1 : \frac{1}{\sqrt{2}} : \frac{1}{\sqrt{3}}$

t is the angle between the bonds of different
on atoms of diamond lattice ?
50° (b) 90°
120° (d) None of these

average energy of classical oscillator is
kT (b) $\frac{1}{2}kT$
$\frac{3}{2}kT$ (d) $(kT)^2$

average energy of the Planck oscillator is
$h\nu$ (b) $\frac{h\nu}{(e^{h\nu/kT} - 1)}$
$\frac{h\nu}{(e^{h\nu/kT} + 1)}$ (d) kT

ne of a p-n junction, which can be used as the
lator, is
zener diode (b) tunnel diode
gunn diode (d) None of these

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ch, is
zener diode (b) tunnel diode
gunn diode (d) None of these

lse or a wave train travels along a stretched
g and reaches the fixed end of the string. It
be reflected back with
the same phase as the incident pulse but
with velocity reversed
a phase change of 180° with no reversal of
velocity
the same phase as the incident pulse with no
reversal of velocity
a phase change of 180° with velocity
reversed

40. The nucleus of an atom consists of
(a) electrons and protons
(b) electrons, protons and neutrons
(c) electrons and neutrons
(d) neutrons and protons

41. The hollow shaft is .....than a solid shaft of same mass, material and length.
(a) less stiff (b) more stiff
(c) equally stiff (d) None of these

42. A laser beam is used for carrying out surgery because it
(a) is highly monochromatic
(b) is highly coherent
(c) is highly directional
(d) can be sharply focused

43. The position vector of a point is $\vec{R} = x\,\hat{i} + y\,\hat{j} + z\,\hat{k}$ and another vector is $\vec{A} = 3\,\hat{i} + 2\,\hat{j} + 5\,\hat{k}$. Which of the mathematical relations is correct ?
(a) $\nabla(\vec{A}\,\vec{R}) = 0$ (b) $\nabla(\vec{A}\,\vec{R}) = \vec{A}$
(c) $\nabla(\vec{A}\,\vec{R}) = \vec{R}$ (d) None of these

44. A body is at rest on the surface of the earth. Which of the following statements is correct ?
(a) No force is acting on the body
(b) Only weight of the body acts on it
(c) Net downward force is equal to the net upward force
(d) None of the above statement is correct

45. A solid sphere of mass M and radius R has a spherical cavity of radius $\frac{R}{2}$ such that the centre of cavity is at a distance $R/2$ from the centre of the sphere. A point mass m is placed inside the cavity at a distance $R/4$ from the centre of sphere. The gravitational pull between the sphere and the point mass m is
(a) $11GMm/R^2$ (b) $14GMm/R^2$
(c) $GMm/2R^2$ (d) GMm/R^2

46. Which of the following combinations of Lissajous' figure will be like eight (8) ?
(a) $x = a \sin 4\omega t$, $y = b \sin \omega t$
(b) $x = a \sin 2\omega t$, $y = b \sin \omega t$
(c) $x = a \sin 2\omega t$, $y = b \sin 2\omega t$
(d) $x = a \sin \omega t$, $y = b \sin 4\omega t$

47. The resultant of two rectangular single harmonic motions of the same frequency and unequal amplitudes but differing in phase by $\pi/2$ is
(a) simple harmonic (b) circular
(c) elliptical (d) parabolic

48. $dU + \delta W = 0$ is valid for
(a) adiabatic process
(b) isothermal process
(c) isobaric process
(d) isochoric process

49. The theory of refrigerator is based on
(a) Joule-Thomson effect
(b) Newton's particle theory
(c) Joule's effect
(d) None of the above

50. Under the influence of weak magnetic field, normal Zeeman effect might be exhibited by
(a) H (b) He
(c) Na (d) K

MATHEMATICS

51. If $A(z_1), B(z_2), C(z_3)$ and $P(z)$ represent complex numbers such that $|z_1 - z| = |z_2 - z| = |z_3 - z|$, then A, B, C lies on
(a) a straight line (b) a circle
(c) a parabola (d) an ellipse

52. If the complex numbers z_1, z_2 and origin form vertices of an equilateral triangle, then the value of $z_1^2 + z_2^2$ will be
(a) $z_1 z_2$ (b) $z_1 + z_2$
(c) $2z_1 z_2$ (d) $z_1 - z_2$

53. Three numbers form an increasing GP. If the middle term is doubled, then the new numbers are in AP. The common ratio of the GP will be
(a) $2 - \sqrt{3}$ (b) $2 \pm \sqrt{3}$
(c) $3\sqrt{2}$ (d) $3 + \sqrt{2}$

54. If the equations $ax^2 + 2cx + b = 0$ and $ax^2 + 2bx + c = 0, (b \neq c)$ have a common root, then the value of $a + 4b + 4c$ will be
(a) -2 (b) 1
(c) -1 (d) None of these

55. If one root of $ax^2 + bx + c = 0$ is twice the other root, then
(a) $b^2 = 9ac$ (b) $2b^2 = 9ac$
(c) $2b^2 = ac$ (d) $b^2 = ac$

56. The number of ways of distributing 8 distinct toys among 5 children will be
(a) 5^8 (b) 8^5
(c) ${}^8P_5$ (d) 40

57. The value of
$C_1 - 2 \cdot C_2 + 3 \cdot C_3 - 4 \cdot C_4 + \ldots$
where $C_r = {}^nC_r$ will be
(a) -1 (b) 1
(c) 0 (d) None of these

58. If the equations
$$2x - y + 2z = 2$$
$$x - 2y + z = -4$$
$$x + y + \lambda z = 4$$
have no solution, then the value of λ will be
(a) 1 (b) 2
(c) 3 (d) -4

59. If $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$, then the value of α, if $A^2 = B$, will be
(a) 4 (b) 3
(c) 5 (d) None of these

60. The probability that at least one of the events A and B occurs is 0.6. If A and B occur simultaneously with probability 0.2, then $P(\bar{A}) + P(\bar{B})$ will be
(a) 1.5 (b) 1.3 (c) 1.2 (d) 0.8

61. If $\sin\left(\sin^{-1}\frac{1}{5} + \cos^{-1} x\right) = 1$, then x is
(a) $\frac{1}{5}$ (b) $\frac{2}{5}$
(c) $\frac{3}{5}$ (d) $\frac{\pi}{2}$

62. The value of $\tan\left[\cos^{-1}\left(\frac{4}{5}\right) + \tan^{-1}\left(\frac{2}{3}\right)\right]$ will be
(a) $\frac{6}{11}$ (b) $\frac{6}{17}$
(c) $\frac{11}{6}$ (d) $\frac{17}{6}$

63. In a ΔABC, if $\tan\frac{A}{2} = \frac{5}{6}$ and $\tan\frac{C}{2} = \frac{2}{5}$, then the sides a, b, c are in
(a) AP (b) GP
(c) HP (d) None of these

64. The value of
$\cos\left(\frac{\pi}{5}\right)\cos\left(\frac{2\pi}{5}\right)\cos\left(\frac{4\pi}{5}\right)\cos\left(\frac{8\pi}{5}\right)$ will be
(a) $\frac{1}{16}$ (b) $-\frac{1}{16}$
(c) 0 (d) $\frac{1}{2}$

65. The distance between the lines $3x + 4y = 9$ and $6x + 8y = 15$ will be
(a) $\frac{3}{2}$ (b) $\frac{3}{8}$
(c) $\frac{3}{10}$ (d) 6

66. If the algebraic sum of the perpendicular distances from the points (2, 0), (0, 2) and (1, 1) on a variable line is zero, then the line will pass through the fixed point
(a) (1, 2) (b) (1, 1)
(c) (0, 0) (d) (2, 1)

67. The locus of the point of intersection of the lines $x\cos\alpha + y\sin\alpha = p$ and $x\sin\alpha - y\cos\alpha = q$ (α is a variable) will be
(a) a circle (b) a straight line
(c) a parabola (d) an ellipse

68. The locus of the mid points of the chords of a circle which subtend a right angle at its centre (equation of the circle is $x^2 + y^2 = a^2$) will be
(a) $x^2 + y^2 = 3a^2$ (b) $x^2 + y^2 = \frac{a^2}{3}$
(c) $2(x^2 + y^2) = a^2$ (d) $4(x^2 + y^2) = a^2$

69. If the line $3x - 2y + p = 0$ is normal to the circle $x^2 + y^2 = 2x - 4y - 1$, then p will be
(a) –5 (b) 7
(c) –7 (d) 5

70. If the two circles $x^2 + y^2 = r^2$ and $x^2 + y^2 - 10x + 16 = 0$ intersect at two real points, then
(a) $1 < r < 7$ (b) $3 < r < 10$
(c) $2 < r < 9$ (d) $2 < r < 8$

71. The equation of the common tangent to the parabolas $y^2 = 2x$ and $x^2 = 16y$ will be
(a) $x + y + 2 = 0$ (b) $x - 3y + 1 = 0$
(c) $x + 2y - 2 = 0$ (d) $x + 2y + 2 = 0$

72. The equation of the tangent to the parabola $y^2 = 8x$, which is parallel to the line $2x - y + 7 = 0$, will be
(a) $y = x + 1$ (b) $y = 2x + 1$
(c) $y = 3x + 1$ (d) $y = 4x + 1$

73. The distance of a point on ellipse $\frac{x^2}{6} + \frac{y^2}{2}$ = from its centre is 2. The eccentric angle of t point will be
(a) $\frac{\pi}{4}$ or $\frac{\pi}{3}$ (b) $\frac{\pi}{3}$ or $\frac{3\pi}{5}$
(c) $\frac{\pi}{4}$ or $\frac{3\pi}{4}$ (d) None of these

74. The distance between the foci of a hyperbola 16 and its eccentricity is $\sqrt{2}$. Its equation will b
(a) $x^2 - y^2 = 1$ (b) $x^2 - y^2 = 20$
(c) $x^2 - y^2 = 4$ (d) $x^2 - y^2 = 32$

75. The vector of magnitude 9 unit perpendicular the vectors $4\hat{i} - \hat{j} + 3\hat{k}$ and $-2\hat{i} + \hat{j} - 2\hat{k}$ will b
(a) $3\hat{i} + 6\hat{j} - 6\hat{k}$ (b) $-3\hat{i} + 6\hat{j} + 6\hat{k}$
(c) $3\hat{i} - 6\hat{j} + 6\hat{k}$ (d) $3\hat{i} + 6\hat{j} + 6\hat{k}$

76. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{b} \neq \vec{0}$, then $\vec{a} - \vec{c}$ will be equal to
(a) $k\vec{b}$ (b) $k\vec{a}$
(c) $k\vec{c}$ (d) $k(\vec{a} + \vec{b})$

77. The value of 'λ', so that the vecto $\hat{i} - 3\hat{j} + \hat{k}$, $2\hat{i} + \lambda\hat{j} + \hat{k}$ and $3\hat{i} + \hat{j} - 2\hat{k}$ a coplanar, will be
(a) 0 (b) 2
(c) $-\frac{1}{2}$ (d) –4

78. The line passing through the point (–1, 2, 3) an perpendicular to the plane $x - 2y + 3z + 5 =$ will be
(a) $\frac{x+1}{1} = \frac{y-2}{3} = \frac{z-3}{5}$
(b) $\frac{x+1}{1} = \frac{y-2}{3} = \frac{z+3}{3}$
(c) $\frac{x+1}{1} = \frac{y-2}{3} = \frac{z-3}{2}$
(d) $\frac{x+1}{1} = \frac{y-2}{-2} = \frac{z-3}{3}$

79. The value of k, if the line
$\frac{x-4}{1} = \frac{y-2}{1} = \frac{z-k}{1}$
lies on the plane $2x - 4y + z = 7$, will be
(a) 5 (b) 7
(c) 9 (d) 11

0. If the line of intersection of the planes $2x + 3y + z = 1$ and $x + 3y + 2z = 2$ makes angle α with positive direction of x-axis, then $\cos\alpha$ will be equal to

(a) $\frac{1}{\sqrt{2}}$ (b) $\frac{1}{\sqrt{5}}$

(c) $\frac{1}{\sqrt{7}}$ (d) $\frac{1}{\sqrt{3}}$

1. If $y = \tan^{-1}\sqrt{\frac{1-\cos x}{1+\cos x}}$, then $\frac{dy}{dx}$ will be

(a) $\sin x \cos x$ (b) $\frac{\pi}{2}$

(c) $\frac{1}{2}$ (d) $\frac{1}{1+\cos^2 x}$

2. The value of $\lim_{x\to 1}(1-x)\cdot\tan\left(\frac{\pi x}{2}\right)$ will be

(a) $\frac{\pi}{2}$ (b) $\frac{2}{\pi}$

(c) 2π (d) π

3. Let $f(x) = \begin{cases} \frac{x^2-4x+3}{x^2+2x-3}, & x \neq 1 \\ k, & x = 1 \end{cases}$

If $f(x)$ is continuous at $x = 1$, then the value of k will be

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

4. The point on the curve $y = 2x^2 - 4x + 5$, at which the tangent is parallel to x-axis, will be

(a) (1, 3) (b) (−1, 3)

(c) (1, −3) (d) (−1, −3)

5. The point on $x^2 = 2y$, which is closest to the point (0, 5), will be

(a) $(2\sqrt{2}, 0)$ (b) (0, 0)

(c) (2, 2) (d) None of these

6. The interval, in which the function $f(x) = x^2e^{-x}$ is an increasing function, will be

(a) $(-\infty, \infty)$ (b) (−2, 0)

(c) $(2, \infty)$ (d) (0, 2)

7. Let $f(x) = \begin{cases} x^n \cdot \sin\left(\frac{1}{x}\right), & x \neq 0 \\ 0, & x = 0 \end{cases}$

Then, $f(x)$ is differentiable at $x = 0$, if

(a) $n \in (0, 1)$ (b) $n \in (1, 2)$

(c) $n \in (1, \infty)$ (d) $n \in (-\infty, \infty)$

88. In which interval the function

$f(x) = \sqrt{\log_{10}\left(\frac{5x-x^2}{4}\right)}$ is defined ?

(a) [1, 4] (b) [0, 5)

(c) (0, 1) (d) $(-1, \infty)$

89. The function $f(x) = \sin x + \cos x$ will be

(a) an even function (b) an odd function

(c) a constant function (d) None of these

90. The value of $\int \frac{\cos\sqrt{x}}{\sqrt{x}}dx$ will be

(a) $2\sin\sqrt{x} + c$ (b) $2\cos\sqrt{x} + c$

(c) $2\sin x + c$ (d) $\sqrt{2}\sin x + c$

91. The value of $\int_2^3 \frac{\sqrt{x}}{\sqrt{5-x}+\sqrt{x}}dx$ will be

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

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

92. The area common to the curves $y^2 = x$ and $x^2 = y$ will be

(a) 1 sq unit (b) $\frac{2}{3}$ sq unit

(c) $\frac{1}{4}$ sq unit (d) $\frac{1}{3}$ sq unit

93. If $x + y \leq 2$; $x \geq 0$, $y \geq 0$, then the point, at which the maximum value of $3x + 2y$ is attained, will be

(a) (0, 0) (b) $\left(\frac{1}{2}, \frac{1}{2}\right)$

(c) (2, 0) (d) (0, 2)

94. The maximum value of $P = 6x + 8y$, if $2x + y \leq 30$, $x + 2y \leq 24$; $x \geq 0$, $y \geq 0$, will be

(a) 90 (b) 120

(c) 96 (d) 240

95. Regression of saving (s) of a family on income y may be expressed as $s = a + \frac{y}{m}$, where a and m are constants. In a random sample of 100 families the variance of savings is one quarter of the variance of incomes and the correlation coefficient is found to be 0.8, the value of m is

(a) 0.8 (b) 1.25

(c) 0.25 (d) None of these

96. The integral $\int_1^{10} x^3dx$ is approximately evaluated by Trapezoidal rule $\int_1^{10} x^3dx$

$= 3\left[\frac{1+10^3}{2} + \alpha + 7^3\right]$ for $n = 3$, then the value of α is

(a) 4^3 (b) 4^2

(c) 5^3 (d) None of these

97. The solution of the equation $\log_7 \log_5(\sqrt{x^2+5+x}) = 0$ is

(a) $x = -2$ (b) $x = 2$

(c) $x = 4$ (d) $x = 5$

98. A balloon is coming down at the rate of 4 m/min and its angle of elevation is 45° from a point on the ground which has been reduced to 30°, after 10 min. Balloon will be on the ground at a distance of how many metres from the observer ?

(a) $20\sqrt{3}$ m (b) $20(3+\sqrt{3})$ m

(c) $10(3+\sqrt{3})$ m (d) None of these

99. A fair coin is tossed n times. If the probability of getting 7 heads is equal to the probability of getting 9 heads, then the value of n will be

(a) 8 (b) 13

(c) 15 (d) None of these

100. The probabilities of solving a question by three students are $\frac{1}{2}, \frac{1}{4}, \frac{1}{6}$ respectively. What is the probability that the question is solved ?

(a) $\frac{35}{48}$ (b) $\frac{1}{48}$

(c) $\frac{11}{16}$ (d) $\frac{2}{11}$

CHEMISTRY

101. Increasing order (lowest first) for the values of e/m for electron (e), proton (p), neutron (n) and α-particles is

(a) e, p, n, α (b) n, α, p, e

(c) n, p, e, α (d) n, p, α, e

102. A particle moving with a velocity 10^6 m/s will have de-Broglie wavelength nearly

[Given, $m = 6.62 \times 10^{-27}$ kg,

$h = 6.62 \times 10^{-34}$ J-s]

(a) 10^{-9} m (b) 10^{-13} m

(c) 10^{-19} m (d) 1 Å

103. Bohr's radius of 2nd orbit of Be^{3+} is equal to that of

(a) 4th orbit of hydrogen

(b) 2nd orbit of He^+

(c) 3rd orbit of Li^{2+}

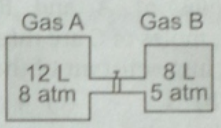
(d) first orbit of hydrogen

104. Half-life period of a radioactive element is 100 yr. How long will it take for its 93.75% decay?

(a) 400 yr (b) 300 yr

(c) 200 yr (d) 193 yr

105. Two vessels containing gases A and B are interconnected as shown in the figure. The stopper is opened, the gases are allowed to mix homogeneously. The partial pressures of A and B in the mixture will be, respectively



(a) 8 and 5 atm (b) 9.6 and 4 atm

(c) 4.8 and 2 atm (d) 6.4 and 4 atm

106. The temperature, at which a gas shows maximum ideal behaviour, is known as

(a) Boyle's temperature

(b) inversion temperature

(c) critical temperature

(d) absolute temperature

107. The unit of rate constant of a second order reaction is

(a) mol/L-s

(b) L/mol-s

(c) L^2/mol^2-s

(d) per second

108. $2N_2O_5 \rightleftharpoons 4NO_2 + O_2$

For the above reaction which of the following is not correct about rates of reaction?

(a) $\frac{-d[N_2O_5]}{dt} = 2\frac{d[O_2]}{dt}$

(b) $\frac{-2d[N_2O_5]}{dt} = \frac{d[NO_2]}{dt}$

(c) $\frac{d[NO_2]}{dt} = 4\frac{d[O_2]}{dt}$

(d) $\frac{-2d[N_2O_5]}{dt} = 4\frac{d[NO_2]}{dt} = \frac{d[O_2]}{dt}$

109. $A + B \rightarrow$ Product

If concentration of A is doubled, rate increases 4 times. If concentrations of A and B both are doubled, rate increases 8 times. The differential rate equation of the reaction will be

(a) $\frac{dC}{dt} = kC_A \times C_B$ (b) $\frac{dC}{dt} = kC_A^2 \times C_B^3$

(c) $\frac{dC}{dt} = kC_A^2 \times C_B$ (d) $\frac{dC}{dt} = kC_A^2 \times C_B^2$

110. Which of the following is a wrong statement about equilibrium state?

(a) Rate of forward reaction = Rate of backward reaction

(b) Equilibrium is dynamic

(c) Catalysts increase value of equilibrium constant

(d) Free energy change is zero

111. $A + B \rightleftharpoons C + D$

Initially moles of A and B are equal. At equilibrium, moles of C are three times that of A. The equilibrium constant of the reaction will be

(a) 1 (b) 3 (c) 4 (d) 9

112. If for $N_2 + 3H_2 \rightleftharpoons 2NH_3$, $K_{eq} = 1.6 \times 10^{-5}$, then the value of K_{eq} for the reaction $NH_3 \rightleftharpoons \frac{1}{2}N_2 + \frac{3}{2}H_2$ will be

(a) 6.25 (b) 25 (c) 250 (d) 500

113. A weak acid HX has dissociation constant 10^{-5}. The pH of 0.1 M solution of this acid will be

(a) 2 (b) 3

(c) 4 (d) 5

114. Which of the following is not a buffer solution?

(a) 100 mL 0.1 M CH_3COOH + 50 mL 0.1 M CH_3COONa

(b) 100 mL 0.1 M CH_3COOH + 50 mL 0.1 M NaOH

(c) 50 mL 0.1 M CH_3COOH + 100 mL 0.1 M NaOH

(d) 100 mL 0.1 M NH_4OH + 50 mL 0.1 M HCl

115. If K_{sp} of Ag_2S is 10^{-17}, the solubility of Ag_2S in 0.1 M solution of Na_2S will be

(a) 10^{-8} (b) 5×10^{-9}

(c) 10^{-15} (d) 10^{-16}

116. Which of the following has the highest value of solubility product?

(a) CuS (b) Bi_2S_3

(c) CdS (d) ZnS

117. The pH values of 0.1 M solution of HCl, CH_3COOH, NH_4Cl and CH_3COONa will have the order

(a) $HCl < CH_3COOH < NH_4Cl < CH_3COONa$

(b) $CH_3COONa < NH_4Cl < CH_3COOH < HCl$

(c) $NH_4Cl < CH_3COONa < CH_3COOH < HCl$

(d) All will have same pH value

118. For the titration of solution of oxalic acid and sodium hydroxide, the suitable indicator is

(a) phenolphthalein

(b) methyl orange

(c) any of these

(d) None of these

119. If 'F' is Faraday and 'N' is Avogadro number, then charge of electron can be expressed as

(a) $F \times N$ (b) $\frac{F}{N}$

(c) $\frac{N}{F}$ (d) F^2N

120. By passing 9.65 A current for 16 min 40 s, the volume of O_2 liberated at STP will be

(a) 280 mL (b) 560 mL

(c) 1120 mL (d) 2240 mL

121. By diluting a weak electrolyte, specific conductivity (K_c) and equivalent conductivity (λ_c) change as

(a) both increase

(b) K_c increases, λ_c decreases

(c) K_c decreases, λ_c increases

(d) both decrease

122. In Daniel cell, anode and cathode are respectively

(a) $Zn|Zn^{2+}$ and $Cu^{2+}|Cu$

(b) $Cu|Cu^{2+}$ and $Zn^{2+}|Zn$

(c) $Fe|Fe^{2+}$ and $Cu^{2+}|Cu$

(d) $Cu|Cu^{2+}$ and $Fe^{2+}|Fe$

123. $C_2H_2 + \frac{5}{2}O_2 \longrightarrow 2CO_2 + H_2O$; $\Delta H = -310$ kcal

$C + O_2 \longrightarrow CO_2$; $\Delta H = -94$ kcal

$H_2 + \frac{1}{2}O_2 \longrightarrow H_2O$; $\Delta H = -68$ kcal

On the basis of the above equations, ΔH_f (enthalpy of formation) of C_2H_2 will be

(a) −148 kcal (b) + 54 kcal

(c) −54 kcal (d) + 80 kcal

124. $I_2(s) \rightleftharpoons I_2(g)$; $\Delta H = +40$ kcal, $\Delta S = 80$ cal. The sublimation point of $I_2(s)$ will be
(a) 100°C (b) 127°C
(c) 227°C (d) 500°C

125. If 0.1 M solutions of each electrolyte are taken and if all electrolytes are completely dissociated, then whose boiling point will be highest?
(a) Glucose (b) KCl
(c) $BaCl_2$ (d) $K_4[Fe(CN)_6]$

126. A solid metal has ccp or fcc structure. The relation of side of cube (a) and radius of atom (r) will be
(a) $a = 2r$ (b) $a = 2\sqrt{2}\, r$
(c) $a = \frac{4}{\sqrt{3}} r$ (d) $a = \sqrt{\frac{3}{2}}\, r$

127. Hydrogen is prepared on large scale for industrial use
(a) by $Zn + H_2SO_4$ (b) by $Al + NaOH$
(c) by $Na + C_2H_5OH$ (d) from water gas

128. Which of the following properties of lithium does not show diagonal relationship with magnesium?
(a) Formation of Li^+ ion
(b) Formation of Li_3N
(c) Solubility of $LiHCO_3$
(d) Thermal decomposition of Li_2CO_3

129. Which of the following carbonates decomposes at lowest temperature?
(a) $MgCO_3$ (b) $CaCO_3$
(c) $SrCO_3$ (d) $BaCO_3$

130. In which of the following pairs both molecules do not possess same type of hybridisation?
(a) CH_4 and H_2O (b) PCl_5 and SF_4
(c) SF_6 and XeF_4 (d) BCl_3 and NCl_3

131. If H—X bond length is 2.00 Å and H—X bond has dipole moment 5.12×10^{-30} C-m, the percentage of ionic character in the molecule will be
(a) 10% (b) 16% (c) 18% (d) 20%

132. (i) H—C—H angle in CH_4
(ii) Cl—B—Cl angle in BCl_3
(iii) F—I—F angle in IF_7 in a plane
(iv) I—I—I angle in I_3^-
Increasing order of above bond angles is
(a) (i) < (ii) < (iii) < (iv)
(b) (ii) < (i) < (iii) < (iv)
(c) (iii) < (i) < (ii) < (iv)
(d) (iv) < (ii) < (i) < (iii)

133. According to molecular orbital theory, bond order in increasing order will be
(a) $O_2^{2+} < O_2 < O_2^- < O_2^{2-}$
(b) $O_2^{2-} < O_2^- < O_2 < O_2^{2+}$
(c) $O_2 < O_2^{2-} < O_2^- < O_2^{2+}$
(d) $O_2 < O_2^{2+} < O_2^- < O_2^{2-}$

134. Correct order of electron affinities of halogens is
(a) F > Cl > Br > I (b) I > Br > Cl > F
(c) Cl > F > I > Br (d) Cl > F > Br > I

135. Atomic radii of Ti, Zr and Hf vary
(a) Ti > Zr > Hf (b) Ti < Zr < Hf
(c) Ti < Hf < Zr (d) Ti < Zr = HF

136. If $NO_2(N_2O_4)$ is dissolved in NaOH, we get solution of
(a) $NaNO_2$
(b) $NaNO_3$
(c) mixture of $NaNO_2$ and $NaNO_3$
(d) $NaNO_4$

137. A gas, that relights glowing splinter, is
(a) H_2 (b) O_2
(c) N_2 (d) NO_2

138. A white-coloured inorganic compound, on heating, gives a gas which turns lime water milky and residue is left which is yellow when hot and turns white on cooling. The compound is
(a) $Pb(NO_3)_2$ (b) $PbCO_3$
(c) $BaCO_3$ (d) $ZnCO_3$

139. Buckminster-fullerene is a variety of
(a) boron (b) carbon
(c) ammonia (d) fluorine

140. What will be the compound if two valencies of carbonyl group are satisfied by two alkyl groups?
(a) Aldehyde (b) Ketone
(c) Acid (d) Acidic anhydride

141. 2-chloro-3-methylbutane is treated with sodium in etherial solution, then it will give
(a) 2,4-dimethylhexane
(b) 3,5-dimethylhexane
(c) 2,3,4,5-tetramethylhexane
(d) 2,6-dimethyloctane

142. $C_2H_5Cl + aq\ NaOH \rightarrow C_2H_5OH + NaCl$; this reaction is
(a) electrophilic substitution of I order
(b) electrophilic substitution of II order
(c) nucleophilic substitution of I order
(d) nucleophilic substitution of II order

143. Which of the following does not contain chiral carbon atom?
(a) Lactic acid
(b) 2-chlorobutanoic acid
(c) Tartaric acid
(d) Succinic acid

144. An organic alkadiene on reductive ozonolysis produces
(i) acetaldehyde
(ii) acetone
(iii) 2-methylpropane-1,3-dial
The formula of alkadiene will be

(a) $CH_3\underset{\underset{CH_3}{|}}{C}=CH\underset{\underset{CH_3}{|}}{C}HCH=CHCH_3$

(b) $CH_3\underset{\underset{CH_3}{|}}{C}HCH=\underset{\underset{CH_3}{|}}{C}CH=CHCH_3$

(c) $CH_3\underset{\underset{CH_3}{|}}{C}=CHCHC\underset{\underset{CH_3}{|}}{=}CHCH_3$

(d) $CH_3CH_2\underset{\underset{CH_3}{|}}{C}HCH=CHC\underset{\underset{CH_3}{|}}{=}CH_2$

145. Which of the following acids will have lowest value of pK_a?
(a) CH_3CH_2COOH (b) $CH_3\underset{\underset{Br}{|}}{C}HCOOH$
(c) $CH_3\underset{\underset{F}{|}}{C}HCOOH$ (d) FCH_2CH_2COOH

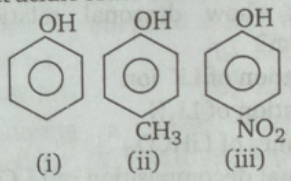
146. Which of the following will not respond to iodoform test?
(a) Ethyl alcohol (b) Propanol-2
(c) Propanol-1 (d) Ethanal

147. The strongest *ortho/para* directing group is
(a) $-NH_2$ (b) $-CH_3$
(c) $-Cl$ (d) $-C_2H_5$

148. Which of the following reactions can be used to change benzaldehyde to cinnamic acid?
(a) Perkin's reaction
(b) Knoevenagel reaction
(c) Reformatsky reaction
(d) Benzoin condensation

149. Which of the following is strongest base?
(a) $C_6H_5NH_2$ (b) $p\text{-}NO_2—C_6H_4NH_2$
(c) $m\text{-}NO_2—C_6H_4NH_2$ (d) $C_6H_5CH_2NH_2$

150. Correct acidic order of the following compounds is



(i) (ii) (iii)

(a) i > ii > iii (b) iii > i > ii
(c) ii > iii > i (d) i > iii > ii

Answers

PHYSICS

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

MATHEMATICS

51.	(b)	52.	(a)	53.	(*)	54.	(d)	55.	(b)	56.	(b)	57.	(c)	58.	(a)	59.	(d)	60.	(c)
61.	(a)	62.	(d)	63.	(a)	64.	(b)	65.	(c)	66.	(b)	67.	(a)	68.	(c)	69.	(c)	70.	(d)
71.	(d)	72.	(b)	73.	(c)	74.	(d)	75.	(b)	76.	(a)	77.	(d)	78.	(d)	79.	(b)	80.	(a)
81.	(c)	82.	(b)	83.	(d)	84.	(a)	85.	(c)	86.	(d)	87.	(c)	88.	(a)	89.	(d)	90.	(a)
91.	(c)	92.	(d)	93.	(c)	94.	(b)	95.	(d)	96.	(a)	97.	(c)	98.	(b)	99.	(d)	100.	(c)

CHEMISTRY

101.	(b)	102.	(b)	103.	(d)	104.	(a)	105.	(c)	106.	(a)	107.	(b)	108.	(d)	109.	(c)	110.	(c)
111.	(d)	112.	(c)	113.	(b)	114.	(c)	115.	(b)	116.	(d)	117.	(a)	118.	(a)	119.	(b)	120.	(c)
121.	(c)	122.	(a)	123.	(b)	124.	(c)	125.	(d)	126.	(b)	127.	(d)	128.	(a)	129.	(a)	130.	(d)
131.	(b)	132.	(c)	133.	(b)	134.	(d)	135.	(d)	136.	(c)	137.	(b)	138.	(d)	139.	(b)	140.	(b)
141.	(c)	142.	(d)	143.	(d)	144.	(a)	145.	(a)	146.	(c)	147.	(a)	148.	(a)	149.	(a)	150.	(b)

Note : * None of the given options is correct.