PREVIOUS YEAR PAPER

UP PGT 2016 — Physics (Series A)

UP PGT · 1 or 2 February 2019

125 questions · +3.4 for a correct answer, −0 for a wrong one · 120 minutes

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Questions from the U.P. Secondary Education Services Selection Board's paper of 1 or 2 February 2019. Each question is followed by its answer, and the answer key is repeated on the last page.

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Physics

1. Kepler’s second law – areal velocity remains constant – is equivalent to which of the following conservation laws ?

(a) Energy

(b) Linear momentum

(c) Angular momentum

(d) None of the above

Answer: (c)

2. At what temperature will the Fahrenheit and Kelvin thermometer scales give the same numerical value ?

(a) – 40.75°

(b) 180.25°

(c) 435.50°

(d) 574.25°

Answer: (d)

3. In Joule-Thompson effect, which quantity remains constant ?

(a) Temperature

(b) Enthalpy

(c) Entropy

(d) Internal energy

Answer: (b)

4. The ratio of intensities of two light waves is 25 : 16. If they interfere, the ratio of intensities of maxima and minima of resultant pattern is

(a) 5 : 4

(b) 9 : 1

(c) 49 : 9

(d) 81 : 1

Answer: (d)

5. A ray of light is incident at polarising angle on a transparent plate of refractive index $\sqrt{3}$. What is the angle of refraction ?

(a) 30°

(b) 60°

(c) 90°

(d) 120°

Answer: (a)

6. Two lenses of focal lengths f1 and f2 are at a distance d from each other. When will the spherical aberration be minimum ?

(a) $d = \frac{1}{2}(f1 + f2)$

(b) $d = \frac{1}{2}(f1 - f2)$

(c) $d = f1 - f2$

(d) $d = f1 + f2$

Answer: (c)

7. An electric charge q is placed at the centre of a cube of side l. The electric flux passing through one of its faces is

(a) $q/(6\varepsilon 0)$

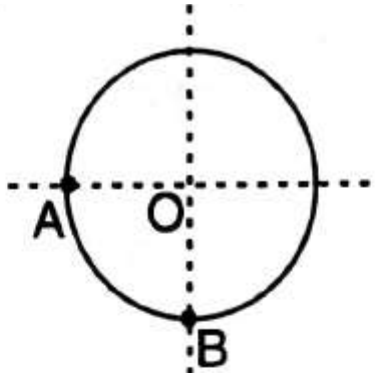
(b) $q/(l\varepsilon 0)$

(c) $q/(l^2\varepsilon 0)$

(d) $ql^2/(4\pi\varepsilon 0)$

Answer: (a)

8. A wire of 40 Ω resistance is bent to form a complete circle as in the figure. What is the effective resistance between points A and B ?



(a) 40.33 Ω

(b) 30.66 Ω

(c) 7.50 Ω

(d) 5.00 Ω

Answer: (c)

9. The shortest wavelength in the radiation obtained from an X-ray tube having accelerating voltage of 50,000 volts is about

(a) 0.0025 Å
(b) 0.025 Å
(c) 0.250 Å
(d) 2.5 Å

Answer: (c)

10. The function of a grid in the triode is to control the

(a) Cathode potential
(b) Filament current
(c) Cathode temperature
(d) Anode current

Answer: (d)

11. The source of solar energy is

(a) Chemical reactions
(b) Nuclear fusion
(c) Nuclear fission
(d) Gravitational interaction with other solar systems

Answer: (b)

12. The maximum efficiency of a half wave rectifier c be

(a) 25.3%
(b) 40.6%
(c) 50.5%
(d) 81.2%

Answer: (b)

13. The excess pressure inside a soap bubble of radius 3 mm will be (Surface tension is 0.03 N/m)

(a) 60 N/m²
(b) 120 N/m²
(c) 40 N/m²
(d) 80 N/m²

Answer: (c)

14. Three capillaries of equal lengths but internal radii r, 2r and 3r respectively are connected in series, a liquid flows in streamline motion through them. If the pressure difference across the entire system is 77 cm (of water), then the pressure difference across the first capillary is

(a) 71.64 cm
(b) 70.32 cm
(c) 76.00 cm
(d) 77.00 cm

Answer: (a)

15. The ratio of the gram molecular specific heats (γ) of a diatomic gas is

(a) 1.66

(b) 1.33

(c) 1.40

(d) 1.00

Answer: (c)

16. If the root mean square velocity of hydrogen molecules at NTP is 1.84 km/sec, what will it be for oxygen molecules at NTP ?

(a) 0.42 km/sec

(b) 0.40 km/sec

(c) 0.38 km/sec

(d) 0.46 km/sec

Answer: (d)

17. The potential difference of an electron microscope is increased from 20 kV to 80 kV. Its resolving power will become

(a) Two times

(b) Four times

(c) Half

(d) Quarter

Answer: (a)

18. Which of the following is incorrect ?

(a) Zone plate has many focii

(b) Zone plate is similar to convex lens

(c) Focal length of zone plate depends on wavelength of light used

(d) None of the above

Answer: (d)

19. A spring has length 10 cm and a force constant 10^3 N/m. Two masses of 10 gm and 90 gm are attached to its ends. The spring is placed on a horizontal table, stretched and released. What is the frequency of oscillation ?

(a) 50 Hz

(b) 45 Hz

(c) 53 Hz

(d) 60 Hz

Answer: (c)

20. What is the fundamental basis of a laser ?

(a) Absorption

(b) Spontaneous emission

(c) Stimulated emission

(d) Scattering

Answer: (c)

21. On moving from the surface towards the centre of a charged solid metal sphere, the electric field

(a) Increases

(b) Decreases

(c) Is same as on surface

(d) Is everywhere zero

Answer: (d)

22. The current flowing in a coil of self induction 0.4 mH is changed by 250 mA in 0.1 seconds. What is the induced emf in the coil ?

(a) – 1 mV

(b) – 2 mV

(c) – 3 mV

(d) – 5 mV

Answer: (a)

23. A 220 volt A.C. source is connected across an inductance of One Henry. If the frequency of the source is 50 Hz then what is the powerloss ?

(a) 220 W

(b) 110 W

(c) 440 W

(d) Zero

Answer: (d)

24. An X-ray tube operates at 20 kV. Which of the f wing is correct ?
1) 0.5 Å wavelength will be absent
2) 0.8 Å wavelength will be present
(h = 6.6 × 10−³4 Js, c = 3 × 108 m/s, 1 eV = 1.6 × 10−¹9 J)

(a) Only 1

(b) Only 2

(c) Both 1 and 2

(d) Neither 1 nor 2

Answer: (c)

25. The half life of radon is 3.8 days starting with 9.6 mg of radon, how much will be left after 19 days ?

(a) 0.5 mg

(b) 0.6 mg

(c) 0.3 mg

(d) 0.2 mg

Answer: (c)

26. Dimension of $1/(\mu_0\varepsilon_0)$ is

(a) $[LT^{-1}]$

(b) $[L^{-1}T]$

(c) $[L^{-2}T^{2}]$

(d) $[L^{2}T^{-2}]$

Answer: (d)

27. Two lenses of powers +4D and –2D are kept in contact. The combinations focal length will be

(a) 100 cm

(b) 75 cm

(c) 50 cm

(d) 25 cm

Answer: (c)

28. Law of Malus is

(a) $I = I0\ \mathrm{Sin}^2\ \theta$

(b) $I = I0\ \mathrm{Sin}\ \theta$

(c) $I = I0\ \mathrm{Cos}^2\ \theta$

(d) $I = I0\ \mathrm{Tan}^2\ \theta$

Answer: (c)

29. A transistor amplifier has $\beta = 30$, $R_{Load} = 4000\ \Omega$ and input resistance $R_{in} = 400\ \Omega$. Its voltage amplification is

(a) 100

(b) 200

(c) 300

(d) 400

Answer: (c)

30. Formula for variation of acceleration due to gravity while going above the surface of the earth is

(a) $g' = g/(1 - h/Re)^2$

(b) $g' = g/(1 - h/Re)$

(c) $g' = g/(1 + h/Re)$

(d) $g' = g/(1 + h/Re)^2$

Answer: (d)

31. For a perfectly rigid body, Young's modulus of elasticity will be

(a) ∞

(b) 100

(c) 1

(d) 0

Answer: (a)

32. What remains constant during simple harmonic motion ?
(a) Restoring force
(b) Kinetic energy
(c) Potential energy
(d) Time period
Answer: (d)

33. What is the relation between phase difference (Δϕ) and path difference (Δx) ?
(a) $\Delta\phi = (2\pi/\lambda)\Delta x$
(b) $\Delta\phi = (\lambda/2\pi)\Delta x$
(c) $\Delta\phi = \lambda/(2\pi\Delta x)$
(d) $\Delta\phi = (\pi/\lambda)\Delta x$
Answer: (a)

34. When the net external torque acting on a rigid body is zero, then what becomes constant ?
(a) Linear momentum
(b) Energy
(c) Angular momentum
(d) None of the above
Answer: (c)

35. Two capillaries of diameter 5 mm and 4 mm respe vely are standing in water. The water rises 5.7 mm in the first one (diameter 5 mm). How much it rise in the other capillary ?
(a) 5.7 mm
(b) 7.1 mm
(c) 6.6 mm
(d) 9.9 mm
Answer: (b)

36. What does diffraction indicate ?
(a) Particle nature
(b) Wave nature
(c) Both particle and wave nature
(d) None of the above
Answer: (b)

37. The graph between square of time period and length of a simple pendulum is
(a) Straight line
(b) Circle
(c) Parabola
(d) Hyperbola
Answer: (a)

38. Sound waves in hydrogen gas are of which type ?

(a) Transverse

(b) Longitudinal

(c) Stationary

(d) Electromagnetic

Answer: (b)

39. In an AC circuit resonance condition is

(a) $L > 1/(\omega^2 C)$

(b) $L < 1/(\omega^2 C)$

(c) $L = 1/(\omega^2 C)$

(d) $L = C$

Answer: (c)

40. The internal resistance of an ideal voltmeter should be

(a) Zero

(b) Infinite

(c) Equal to internal resistance of source

(d) Negative

Answer: (b)

41. A lens of refractive index μ2 is immersed in a med[illegible] of refractive index μ1. The radii of curvature of the surfaces of the lense are R1 and R2 [illegible]e focal length (f) will be

(a) $1/f = (\mu 2 - 1)(1/R1 - 1/R2)$

(b) $1/f = (\mu 2/\mu 1 - 1)(1/R1 - 1/R2)$

(c) $1/f = (\mu 2/\mu 1 - 1)(1/R1 + 1/R2)$

(d) $1/f = (\mu 1/\mu 2 - 1)(1/R1 + 1/R2)$

Answer: (b)

42. If the phase difference between an alternating current and voltage is π/2, which of the following can not be part of the circuit ?

(a) R, L both present

(b) C alone present

(c) L alone present

(d) L and C both present

Answer: (a)

43. In photoelectric effect, the most energetic electrons are emitted from

(a) Inner shells

(b) Surface of metal

(c) Nucleus

(d) Deep inside the metal

Answer: (b)

44. Which of the following is the unit of strain ?
    (a) Joule
    (b) Newton
    (c) No unit
    (d) Watt
    Answer: (c)

45. Formula Volt × Charge/Time (V × Q/T) can be equivalent to
    (a) Acceleration
    (b) Work done
    (c) Power
    (d) Velocity
    Answer: (c)

46. Material having low retentivity is suitable for making
    (a) Weak magnets
    (b) Temporary magnets
    (c) Permanent magnets
    (d) Electro magnets
    Answer: —

47. Which expression is incorrect ? (symbols have the sual meaning)
    (a)
    $$\vec{\nabla}.\vec{E} = \frac{\rho}{\epsilon_0}$$
    (b)
    $$\oiint \vec{E}.\vec{ds} = \frac{q}{\epsilon_0}$$
    (c)
    $$\vec{E} = \vec{\nabla} V$$
    (d)
    $$\nabla^2 V = \frac{-\rho}{\epsilon_0}$$
    Answer: (c)

48. If a point charge 1.5 × 10−6 C is placed at the origin, then the 30 V equipotential surface will have radius

(a) 135 m

(b) 450 m

(c) 270 m

(d) 900 m

Answer: (b)

49. Attraction between nucleons is due to exchange of

(a) Photons

(b) Mesons

(c) Hadrons

(d) Neutrinos

Answer: (b)

50. A body of mass 2 gm and charge + 5 μC is suspended from the ceiling at the end of a string. If a horizontal electric field of 10 KV/m is applied, what is the angle between the string and vertical direction ?

(a) $\tan^{-1}(2.55)$

(b) $\tan^{-1}(3.00)$

(c) $\tan^{-1}(3.55)$

(d) $\tan^{-1}(4.00)$

Answer: (a)

51. If unpolarized light of intensity I0 falls on polarizer and the angle between polarizer and analyzer is 60°, then the intensity of the emergent is

(a) I0/8

(b) I0/4

(c) I0/2

(d) I0

Answer: (a)

52. The average energy of the Planck oscillator is

(a) kT

(b)

$$h\nu/[e^{(h\nu/kT)} - 1]$$

(c)

$$h\nu/[e^{(h\nu/kT)} + 1]$$

(d)

$$h\nu/[e^{-(h\nu/kT)} - 1]$$

Answer: (b)

53. When tension in a wire is T1 its length is L1 and when tension is T2, its length is L2. What is the length when there is no tension ?

(a) (T2L1 – T1L2)/(T2 – T1)

(b) (T2 – T1)/(T2L1 – T1L2)

(c) Zero

(d) (T2L1 – T1L2)/($T2^2$ – $T1^2$)

Answer: (a)

54. The gravitational field due to a mass distribution is kx^(−3/2) in X-direction at distance x (constant k > 0). If potential at infinity is zero, the potential at distance x will be

(a) $2k\sqrt{x}$

(b) $2k/\sqrt{x}$

(c) $2kx^3$

(d) $2k/x^3$

Answer: (b)

55. A 1m long resonance tube (internal radius 1 cm) gives first resonance at length 4.6 cm and second resonance at 14.0 cm. When a tuning fork of frequency 2000 Hz is used. What is the speed of sound ?

(a) 332 m/s

(b) 336 m/s

(c) 340 m/s

(d) 376 m/s

Answer: (d)

56. The distance x travelled by an object in ti… …given by $x = a + bt^2/a$. The dimensions of a and b are

(a) L, L^2T^{-2}

(b) LT^{-1}, LT^{-2}

(c) L, LT^{-2}

(d) L^2, L^2T^{-2}

Answer: (a)

57. If the position of a particle y is given by $y = 3t^3 + t^2 + 5$, then what is the acceleration at t = 2 ?

(a) 5.39

(b) 5.38

(c) 37

(d) 38

Answer: (d)

58. If potential is given by $V = 5(x^2 + xy)$, what will be the electric field at point (1, –2, 0) ?

(a) $\vec{E} = -5\hat{j}$

(b) $\vec{E} = -5\hat{i}$

(c) $\vec{E} = -5\hat{i} + 5\hat{j}$

(d) $\vec{E} = -3\hat{i} - 3\hat{j}$

Answer: (a)

59. If e_λ and a_λ are the emissive and absorptive powers of a body and E_λ the emissive power of an ideal black body, then according to Kirchhoff's law which relation is correct ?

(a) $e_\lambda = a_\lambda = E_\lambda$

(b) $e_\lambda E_\lambda = a_\lambda$

(c) $e_\lambda = a_\lambda E_\lambda$

(d) $e_\lambda a_\lambda E_\lambda$ = constant

Answer: (c)

60. A force $\vec{F} = 4\hat{i} + 5\hat{j} + 6\hat{k}$ is applied on a body and it is displaced by $\vec{x} = 3\hat{i} + 7\hat{j} + 8\hat{k}$. How much work is done ?

(a) 48

(b) 60

(c) 95

(d) 120

Answer: (c)

61. A ring, a circular plate, a spherical shell and a solid sphere have same mass and radius. Which will have least moment of inertia about its geometrical axis ?

(a) Ring

(b) Circular plate

(c) Spherical shell

(d) Solid sphere

Answer: (d)

62. Which one of the following represents the correct relation between various elastic constants of a material ?

(a) $3/Y = 9/\eta + 1/K$

(b) $3/Y = 1/\eta + 9/K$

(c) $9/Y = 3/\eta + 1/K$

(d) $9/Y = 1/\eta + 3/K$

Answer: (c)

63. A particle moves in a circular path with uniform speed. The direction of acceleration of the particle will be

(a) Along the radius

(b) Along the tangent to the path

(c) Normal to the plane of the path

(d) Acceleration is zero

Answer: (a)

64. Normal atmospheric pressure is 105 Pascal. What force does the atmosphere exert on an area of 3 sq. cm. of your head ?

(a) 10 N

(b) 15 N

(c) 20 N

(d) 30 N

Answer: (d)

65. The first law of thermodynamics is equivalent to the conservation law of

(a) Temperature

(b) Energy

(c) Heat

(d) Momentum

Answer: (b)

66. If Cp and C_v are the molar heat capacities of an ideal gas at constant pressure and constant volume respectively, then which of the following quantities will be a universal constant ?

(a) $Cp - C_v$

(b) $Cp + C_v$

(c) Cp/C_v

(d) $Cp.C_v$

Answer: (a)

67. Using light of wavelength 6000 Å in Young's experiment, 64 fringes were observed in the field of view. How many fringes will be observed if light of wavelength 4800 Å is used ?

(a) 50

(b) 64

(c) 80

(d) 120

Answer: (c)

68. If in one complete rotation of the Nicol Prism, no variation in intensity is observed for the transmitted light, then the incident light must be which one of the following ?

(a) Plane polarized

(b) Circularly polarized

(c) Elliptically polarized

(d) Mixture of plane polarized and unpolarized

Answer: (b)

69. The equation of a damped harmonic oscillator is

$$\frac{d^2x}{dt^2} + 2k\frac{dx}{dt} + \omega_0^2 x = 0$$

When will there be overdamping ?

(a) $k < \omega 0$

(b) $k = \omega 0$

(c) $k > \omega 0$

(d) $k = \omega 0^2$

Answer: (c)

70. An air core solenoid has 2000 turns in a length of cm. Its diameter is 2 cm. If a current of 5 amps flows through the coil, what will be the flux de y within it ?

(a) 0.042 T

(b) 0.035 T

(c) 0.030 T

(d) 0.021 T

Answer: (d)

71. If the electron in the hydrogen atom jumps from the third to the second orbit, what is the wavelength of the emitted radiation ?
(R ≡ Rydberg Constant)

(a) 36/(5R)

(b) 5R/36

(c) 5/R

(d) R/6

Answer: (a)

72. The equation $\vec{\nabla} \times \vec{E} = -\partial \vec{B}/\partial t$ is the differential form of which law ?

(a) Ampere's law

(b) Faraday law

(c) Coulomb law

(d) Gauss law

Answer: (b)

73. What potential must be applied to stop the fastest photoelectrons emitted when ultraviolet light of 2000 Å wavelength falls on a nickel surface ?
(Work function of nickel = 5.01 eV)

(a) 5.01 V
(b) 3.02 V
(c) 2.10 V
(d) 1.20 V

Answer: (d)

74. Nuclear forces are

(a) Always repulsive
(b) Always attractive
(c) Attractive at large distances and repulsive at short distances
(d) Repulsive at large distances and attractive at short distances

Answer: (c)

75. What is the dimension of the coefficient of viscosity 'η' ?

(a) $ML^{-1}T^{-1}$
(b) $ML^{-1}T^{-2}$
(c) $ML^{-2}T^{-2}$
(d) $ML^{-2}T^{-1}$

Answer: (a)

76. If the work done by a force in moving a particle from point A to point B does not depend on the path, then the force is of which type ?

(a) Central
(b) Non-conservative
(c) Conservative
(d) Inverse square law force

Answer: (c)

77. The first law of thermodynamics for an adiabatic process is

(a) $dU = \delta W$
(b) $dU = 0$
(c) $dU = -\delta W$
(d) $dU = -\delta Q + 2\delta W$

Answer: (c)

78. A Carnot engine has the same efficiency when it works between a source at 1000° K and a sink at 500° K, as it has when the source is at T°K and sink is at 1000° K. What is the value of T ?

(a) 1500° K
(b) 2000° K
(c) 3000° K
(d) 500° K

Answer: (b)

79. A man can not see objects more distant than 40 cm. What is the power of the lens needed to allow him to see very distant objects ?

(a) – 3.5 D

(b) + 3.5 D

(c) – 2.5 D

(d) + 2.5 D

Answer: (c)

80. A sound source of frequency 440 Hz is tied to the end of a 1.5 m long string and rotated in a horizontal plane at an angular velocity of 20 radians/sec. What is the frequency range of the sound heard by a listener standing for away ? (Velocity of sound in air = 330 m/s)

(a) 440 – 480 Hz

(b) 403 – 484 Hz

(c) 400 – 500 Hz

(d) 408 – 490 Hz

Answer: (b)

81. If the polarizing angle for a medium is 60°, what will the critical angle be ?

(a) 60°

(b) $\cos^{-1}(1/\sqrt{3})$

(c) $\sin^{-1}(1/\sqrt{3})$

(d) $\tan^{-1}(1/\sqrt{3})$

Answer: (c)

82. An organ pipe of length 0.5 m is open at both ends. What is the frequency of its fundamental note ? (Velocity of sound in air = 350 m/s)

(a) 350 Hz

(b) 175 Hz

(c) 700 Hz

(d) 450 Hz

Answer: (a)

83. 27 identical mercury drops are each charged to 10 V potential. Then they are merged to form one large drop. What will be the potential of the large drop ?

(a) 270 V

(b) 30 V

(c) 60 V

(d) 90 V

Answer: (d)

84. Three equal resistances R are connected in the form of a triangle. The equivalent resistance between any two corners is

(a) 3R

(b) (3/2)R

(c) (1/3)R

(d) (2/3)R

Answer: (d)

85. Two long parallel wires are at a distance 2R from each other. If currents i and 2i flow through them in opposite directions, what is the magnetic field B at the midpoint between them ?

(a) $\mu_0 i/(2\pi R)$

(b) $3\mu_0 i/(2\pi R)$

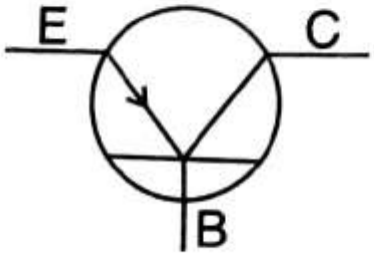
(c) $2\mu_0 i/(2\pi R)$

(d) $3\mu_0 i/(\pi R)$

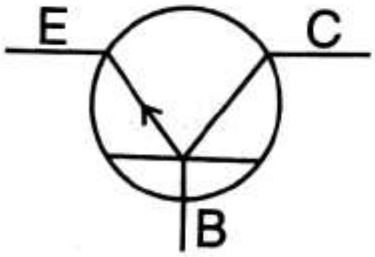
Answer: (b)

86. Which is a symbol of the n-p-n transistor ?

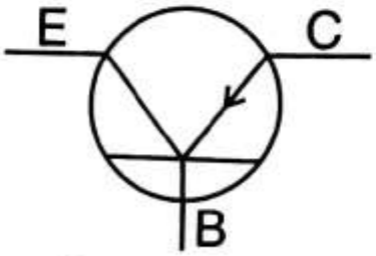
(a)



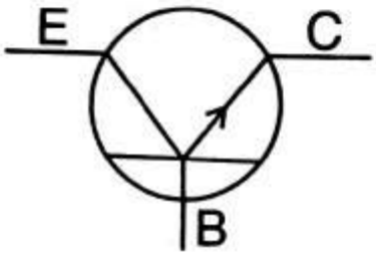
(b)



(c)



(d)



Answer: (b)

87. An element $_{84}X^{202}$ emits an α – particle and then a β– particle. If the final product is $_{a}Y^{b}$, then a and b are

(a) 82, 198

(b) 83, 198

(c) 82, 199

(d) 83, 199

Answer: (b)

88. Which of the following is incorrect ?

(a) Neutral pi-meson disintegrates into two photons

(b) Average life of +ve and –ve pi-mesons is about 10−8 secs.

(c) Mass of neutral pi-meson is about 264 times that of electron

(d) +ve pi-meson is a stable particle

Answer: (d)

89. Newton's formula for the focal length of a thin lens is

(a) $xx' = -ff'$

(b) $xx' = ff'$

(c) $xx' = -f^2f'$

(d) $xx' = f/f'$

Answer: (b)

90. A prism of angle 60° has minimum deviation angle of 30°. What is the refractive index of the material of the prism ?

(a) 2

(b) $\sqrt{2}$

(c) $\sqrt{(3/2)}$

(d) $\sqrt{3}$

Answer: (b)

91. If $|\vec{A} \times \vec{B}| = AB$, then angle between $\vec{A}$ and $\vec{B}$ is

(a) 0

(b) π/4

(c) π/2

(d) π

Answer: (c)

92. Boolean expression for AND gate is

(a) Y = A + B

(b) Y = A . B

(c)

$$Y = \overline{A.B}$$

(d)

$$Y = \overline{A+B}$$

Answer: (b)

93. What is the relation between orbital and escape velocities (v0 and ve) ? (orbit is close to earth's surface)

(a) ve = $\sqrt{2}$ v0

(b) ve = $\sqrt{3}$ v0

(c) ve = $\sqrt{5}$ v0

(d) ve = $\sqrt{7}$ v0

Answer: (a)

94. Equation for Bernoullis Theorem is

(a) $P + \rho v^2 + \rho gh$ = constant

(b) $P + mv^2 + mgh$ = constant

(c) $P + \frac{1}{2}\rho v^2 + \rho gh$ = constant

(d) $P + \frac{1}{2}mv^2 + mgh$ = constant

Answer: (c)

95. If a simple pendulum is falling freely under gravitational force of attraction, its time period will be

(a) $2\pi\sqrt{(l/g)}$

(b) $2\pi\sqrt{g}$

(c) ∞

(d) 0

Answer: (c)

96. Physical quantities which have same units are

(a) Force and work

(b) Pressure and stress

(c) Pressure and strain

(d) Pressure and volume

Answer: (b)

97. The dimensions of constant 'a' in Van der Waal's equation is

(a) MLT^{-2}

(b) $ML^{-1}T^{-3}$

(c) $ML5T^{-2}$

(d) L6

Answer: (c)

98. The diameter of the objective of a telescope is d and light of wavelength λ is being used. What will be the limit of resolution ?

(a) $1.22\lambda/d$

(b) λ/d

(c) $d/(1.22\lambda)$

(d) $1.22d/\lambda$

Answer: (a)

99. When two lenses are in contact, the condition for achromatism is

(a) ω1/f1 = ω2/f2

(b) ω1f1 = ω2f2

(c) ω1/f1 + ω2/f2 = 0

(d) ω1f1 = – ω2f2

Answer: (c)

100. Velocity of sound will be highest in

(a) Air

(b) Water

(c) Vacuum

(d) Steel

Answer: (d)

101. Two sound sources have equations y1 = 0.25 Sin 316 t and y2 = 0.25 Sin 310 t respectively. If the listener hears both together how many beats will be hear per second ?

(a) 6

(b) 6/π

(c) 3/π

(d) 3π

Answer: (c)

102. An AC source (V volts) sends current through a ies L, C, R circuit. If voltages V_L, V_C, V_R are measured across L, C, R, then

(a)

$$V = V_L + V_C + V_R$$

(b)

$$V = V_R + (V_L - V_C)$$

(c)

$$V = [V_R^2 + V_L^2 + V_C^2]^{1/2}$$

(d)

$$V = [V_R^2 + (V_L - V_C)^2]^{1/2}$$

Answer: (d)

103. In photoelectric effect, the rate of emission of photoelectrons depends on

(a) Intensity of radiation

(b) Frequency of radiation

(c) Both (A) and (B) above

(d) None of the above

Answer: (a)

104. If the rms potential difference across a 15 kΩ resistance is 16 V, the maximum current flowing is

(a) 15 mA

(b) 1 mA

(c) 10 mA

(d) 1.5 mA

Answer: (d)

105. A circular coil of N turns and radius r is placed initially with its plane perpendicular to a uniform magnetic field B. It is then rotated through 90°. How much charge flows through the coil ? Coil resistance is R.

(a) Zero

(b) $\pi N^2 r\ B/R$

(c) $2\pi r\ N^2 B/R$

(d) $\pi r^2\ NB/R$

Answer: (d)

106. A light wave enters glass from air. What does not change ?

(a) Frequency

(b) Wavelength

(c) Velocity

(d) All the above change

Answer: (a)

107. A transformer heats up after long use mainly because of

(a) Current in the coils

(b) Hysteresis loss

(c) Electromagnetic radiation

(d) External sources

Answer: (b)

108. The Balmer series of Hydrogen is found in which region ?

(a) Infra-red

(b) Ultraviolet

(c) Visible

(d) X-ray

Answer: (c)

109. A straight wire of length L has current I flowing through it. A constant magnetic field B, parallel to the wire, is applied. What is the force on the wire ?

(a) Zero

(b) BLI

(c) B^2LI

(d) BL^2I

Answer: (a)

110. Which statement is incorrect ?

(a) Two equipotential surfaces cannot intersect

(b) Line integral of electric field on an equipotential surface is a finite constant

(c) Electric field at surface of a conductor is always perpendicular to it

(d) Work done in moving a charge on an equipotential surface is zero

Answer: (b)

111. After collision of photon with an electron the photon has

(a) Higher frequency

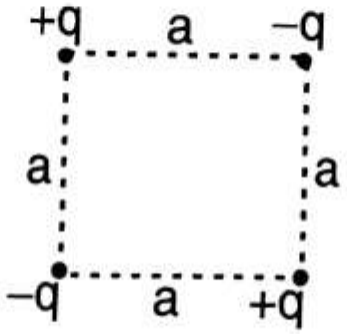
(b) Larger wavelength

(c) More energy

(d) Lesser velocity

Answer: (b)

112. The interaction energy of the charges in the set-up below will be



(a) $q^2/(4\pi\varepsilon 0a)\ (\sqrt{2} - 4)$

(b) $q^2/(4\pi\varepsilon 0a)\ (\sqrt{2} + 4)$

(c) $q^2/(4\pi\varepsilon 0a)\ 2\sqrt{2}$

(d) $q^2/(4\pi\varepsilon 0a)\ 4\sqrt{2}$

Answer: (a)

113. If $\mu 0 = 1.544$ and $\mu_E = 1.558$ then the thickness of a quarter wave plate for $\lambda = 6500Å$ is

(a) 0.25 µm

(b) 0.38 µm

(c) 10.0 µm

(d) 11.6 µm

Answer: (d)

114. For diffraction at a single slit, the width of the central maximum is _____ the wavelength of light.

(a) Proportional to

(b) Proportional to the square of

(c) Inversely proportional to

(d) Independent of

Answer: (a)

115. Water rises to a height of 10 cm in a capillary. Mercury falls to a depth of 3.42 cm in same capillary. If the relative density of mercury is 13.6 and its angle of contact is 135°, the ratio of surface tensions of water and mercury is

(a) 0.05

(b) 0.10

(c) 0.15

(d) 0.20

Answer: (c)

116. The electric field components of a plane electromagnetic wave are

$$E_x = \frac{1}{2}E_0 \cos(\omega t - kz)$$

$$E_y = \frac{\sqrt{3}}{2}E_0 \sin(\omega t - kz)$$

What is the nature of the wave ?

(a) Right elliptical

(b) Left elliptical

(c) Right circular

(d) Left circular

Answer: (a)

117. The mass ratio of two planets is x and the density ratio is y. What is the ratio of the acceleration due to gravity on their surfaces ?

(a) x^2/y

(b)

$$\left(\frac{x^2}{y}\right)^{\frac{1}{3}}$$

(c) x^2y

(d)

$$\left(xy^2\right)^{\frac{1}{3}}$$

Answer: (d)

118. If the values of M and A are experimentally measured as 3.00 units and 2.820 units respectively, what will be the percentage error in the calculated value of Y (=M/A) ?

(a) 0.036%

(b) 0.072%

(c) 0.36%

(d) 0.72%

Answer: (c)

119. If I = I0 $\sin^2$ (2πt/T), then what is the average value of I between t = 0 and t = T/2 ?

(a) √2 I0

(b) I0/√2

(c) I0/2

(d) I0

Answer: (c)

120. A ring of radius R is uniformly charged with charge q. What is the electric potential V at a point on the axis, at a distance x from the centre ?

(a)

$$\frac{q^2}{4\pi\epsilon_0}\frac{1}{(R^2+x^2)^{1/2}}$$

(b)

$$\frac{q}{4\pi\epsilon_0}\frac{1}{(R^2+x^2)^{1/2}}$$

(c)

$$\frac{q}{4\pi\epsilon_0}\frac{1}{(R^2+x^2)^{3/2}}$$

(d)

$$\frac{q^2}{4\pi\epsilon_0}\frac{1}{(R^2+x^2)^{3/2}}$$

Answer: (b)

121. Which of the following is a reversible process ?

(a) Production of heat by passing current through a resistance

(b) Conduction of heat from hot body to cold body

(c) Infinitely slow changes in the pressure and volume of the working substance

(d) Forcing a real gas through a porous plug while keeping them insulated from the environment

Answer: (c)

122. The mass and radius of the earth are M and R. How long should one day be so that a person feels weightless on the equator ?
(acceleration due to gravity = g)

(a) $2\pi\sqrt{(R/g)}$

(b) $(1/2\pi)\sqrt{(g/R)}$

(c) $(1/2\pi)\sqrt{(g/MR)}$

(d) $2\pi\sqrt{(MR^2/g)}$

Answer: (a)

123. An adiabatic process is also known as

(a) Isoentropic

(b) Isothermal

(c) Isobaric

(d) Isochoric

Answer: (a)

124. A small solid sphere is dropped into a viscous liquid. It finally moves with a constant velocity which is called

(a) Escape velocity

(b) Terminal velocity

(c) Critical velocity

(d) Reynold velocity

Answer: (b)

125. Three vectors $\vec{A}, \vec{B}$ and $\vec{C}$ will be coplanar only if

(a) $\vec{A}.\vec{B} = \vec{B}.\vec{C} = \vec{A}.\vec{C} = 0$

(b) $\vec{A}.(\vec{B} \times \vec{C}) = 0$

(c) $\vec{A} \times (\vec{B} \times \vec{C}) = 0$

(d) $(\vec{A}.\vec{B}) \times \vec{C} = 0$

Answer: (b)

Answer key

Answer key from the U.P. Secondary Education Services Selection Board's official answer key for this sitting. "—" means the key gave none.

Physics

1	**(c)**	2	**(d)**	3	**(b)**	4	**(d)**	5	**(a)**	6	**(c)**
7	**(a)**	8	**(c)**	9	**(c)**	10	**(d)**	11	**(b)**	12	**(b)**
13	**(c)**	14	**(a)**	15	**(c)**	16	**(d)**	17	**(a)**	18	**(d)**
19	**(c)**	20	**(c)**	21	**(d)**	22	**(a)**	23	**(d)**	24	**(c)**
25	**(c)**	26	**(d)**	27	**(c)**	28	**(c)**	29	**(c)**	30	**(d)**
31	**(a)**	32	**(d)**	33	**(a)**	34	**(c)**	35	**(b)**	36	**(b)**
37	**(a)**	38	**(b)**	39	**(c)**	40	**(b)**	41	**(b)**	42	**(a)**
43	**(b)**	44	**(c)**	45	**(c)**	46	**—**	47	**(c)**	48	**(b)**
49	**(b)**	50	**(a)**	51	**(a)**	52	**(b)**	53	**(a)**	54	**(b)**
55	**(d)**	56	**(a)**	57	**(d)**	58	**(a)**	59	**(c)**	60	**(c)**
61	**(d)**	62	**(c)**	63	**(a)**	64	**(d)**	65	**(b)**	66	**(a)**
67	**(c)**	68	**(b)**	69	**(c)**	70	**(d)**	71	**(a)**	72	**(b)**
73	**(d)**	74	**(c)**	75	**(a)**	76	**(c)**	77	**(c)**	78	**(b)**
79	**(c)**	80	**(b)**	81	**(c)**	82	**(a)**	83	**(d)**	84	**(d)**
85	**(b)**	86	**(b)**	87	**(b)**	88	**(d)**	89	**(b)**	90	**(b)**
91	**(c)**	92	**(b)**	93	**(a)**	94	**(c)**	95	**(c)**	96	**(b)**
97	**(c)**	98	**(a)**	99	**(c)**	100	**(d)**	101	**(c)**	102	**(d)**
103	**(a)**	104	**(d)**	105	**(d)**	106	**(a)**	107	**(b)**	108	**(c)**
109	**(a)**	110	**(b)**	111	**(b)**	112	**(a)**	113	**(d)**	114	**(a)**
115	**(c)**	116	**(a)**	117	**(d)**	118	**(c)**	119	**(c)**	120	**(b)**
121	**(c)**	122	**(a)**	123	**(a)**	124	**(b)**	12	**(b)**		