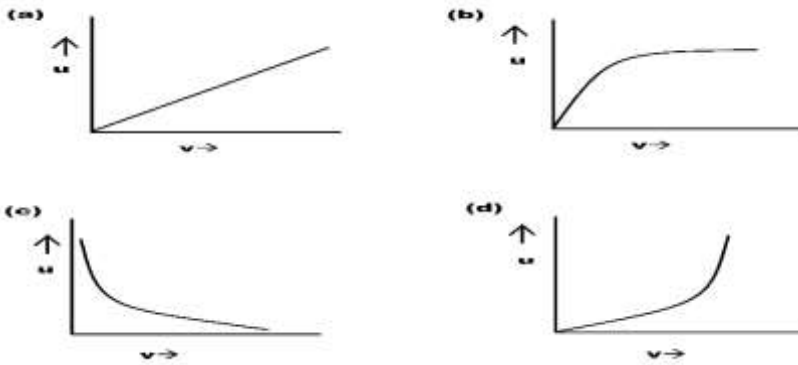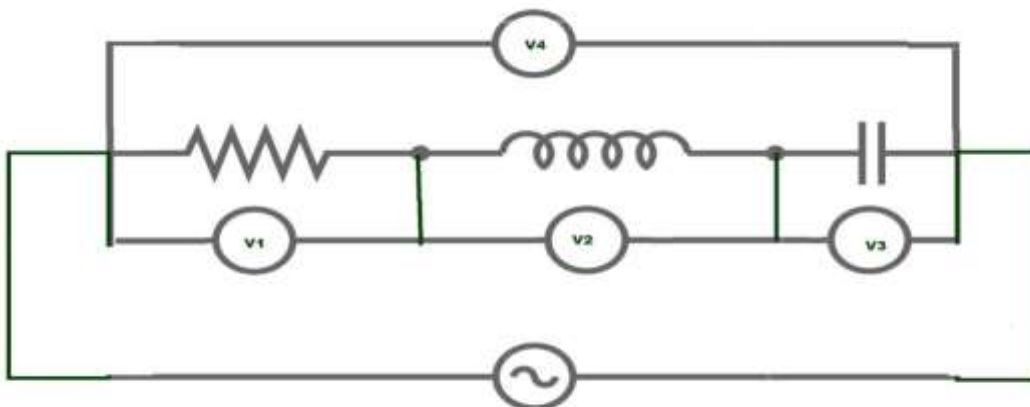# PHYSICS QUESTION PAPER 3

1. Which of the following graphs correctly represents the variation of heat energy (u) produced in a metallic conductor in a given time as a function of potential difference (v) across the conductor?

2. A current of 2 A is passing through a metal wire of cross sectional area 2×10^{-6} m². If the number density of the electrons in the wire is 5×10^{26} m^{-3}, the drift speed of electron is (Given e = 1.6×10^{-19} C)
   (a) 1/16 ms^{-1}
   (b) 1/40 ms^{-1}
   (c) 1/ 80 ms^{-1}
   (d) 1/32 ms^{-1}

3. Magnetic field at a distance r from an infinitely long straight conductor carrying a steady current varies as
   (a) 1/r2
   (b) 1/r
   (c) 1/r3
   (d) $1/\sqrt{r}$

4. An ideal resistance R, ideal inductance L, ideal capacitance C and AC volt meters V_1, V_2, V_3 and V_4 are connected to an AC source as shown. At resonance,


   (a) Reading in V_3 = reading in V_1
   (b) Reading in V_1 = reading in V_2

(c) Reading in V_2 = reading in V_4

(d) Reading in V_2 = reading in V_3

5. In a ruby laser, the color of the laser light is due to ………atom.

(a) Oxygen

(b) Xenon

(c) Aluminium

(d) Chromium

6. 'n' photons of wavelength ' λ' are absorbed by a black body of mass 'm'. The momentum gained by the body is

(a) $h/m\lambda$

(b) mnh/λ

(c) $nh/m\lambda$

(d) nh/λ

7. Intensity level of sound whose intensity is 10^{-8} Wm^{-2} is…………………dB.

(a) 8

(b) 4

(c) 40

(d) 80

8. In this circuit, when certain current flows, the heat produced in 5 Ω is 4.05 J in a time 't'. The heat produced in 2 Ω coil in the same interval is

(a) 5.76

(b) 1.44

(c) 2.88

(d) 2.02

9. A proton and an alpha particle are accelerated under the same potential difference. The ratio of de-Broglie wave length of the proton and the alpha particle is

(a) $\sqrt{8}$

(b) $1/\sqrt{8}$

(c) 1

(d) 2

10. Mass numbers of elements A, B, C & D are 30, 60, 90 and 120 respectively. The specific binding energy of them is 5 MeV, 8.5 MeV, 8 MeV & 7 MeV respectively. Then, in which of the following reactions energy is released?

(1) D→2B   (2) C→ B + A   (3) B→ 2A

(a) Only in (1)

(b) In (2) & (3)

(c) In (1) & (3)

(d) In (1), (2) & (3)

11. A capacitor of capacitance 10µF is charged to 10V. The energy stored in it is

(a) 100µJ

(b) 500µJ

(c) 1000µJ

(d) 1µJ

12. See the diagram. Area of each plate is 20m^2 and d= 2X10^{-3}m. A charge of 8.85X10^{-8} C is given to Q. Then the potential of Q becomes

   (a) 13V

   (b) 10V

   (c) 6.67V

   (d) 8.825V
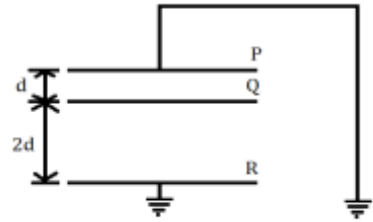
13. The ionization energy of an electron in the ground state of helium atom is 24.6eV. The energy required to remove both the electron is

   (a) 51.8eV

   (b) 79eV

   (c) 38.2eV

   (d) 49.2eV

14. From a fixed support, two small identical spheres are suspended by means of strings of length 1M each. They are pulled aside as shown and then released. B is the mean position. Then the two spheres collide,

   (a) At B after 0.25 second

   (b) At B greater than 0.5 second

   (c) On the right side of B after some time

   (d) On the right side of B when the strings are inclined at 15^0 with B
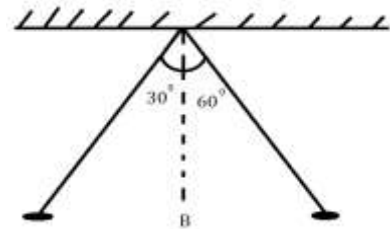
15. The refraction through the prisms are as shown, pick out the WRONG statement from the following .Path of the light ray in
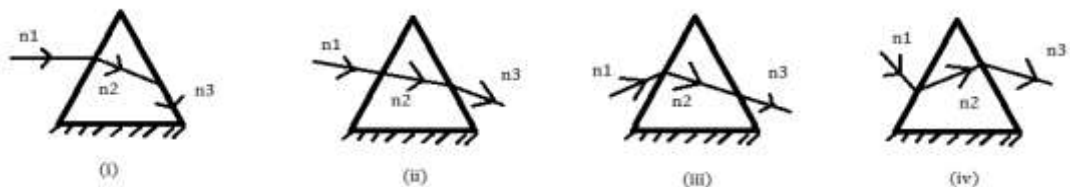
   (a) (I) is correct if $n_2 > n_1$ & $n_2 > n_3$

   (b) (ii) is correct if $n_1 = n_2$ & $n_2 > n_3$

   (c) (iii) is correct if $n_2 < n_1$ & $n_2 = n_3$

   (d) (iv) is correct if $n_1 > n_2$ & $n_2 < n_3$

16. Which of the following phenomena support the wave theory of light?

   (1) Scattering   (2) Interference   (3) Diffraction   (4) Velocity of light in a denser medium is less than the velocity of light in the rarer medium

   (a) 1,2,3

   (b) 1,2,4

   (c) 2,3,4

   (d) 1,3,4

17. A cylindrical tube of length 0.2m & radius R with sugar solution of concentration 'C' produce a rotation of θ in the plane of vibration of a plane polarized light. The same sugar solution is

transferred to another tube of length 0.3m of same radius. The remaining gap is filled by distilled water. Now the optical rotation produced is

(a) θ

(b) $2\dfrac{\theta}{3}$

(c) $3\dfrac{\theta}{2}$

(d) $9\dfrac{\theta/}{4}$

18. The susceptibility of a certain magnetic material is 400. What is the class of the magnetic material?

    (a) Ferromagnetic

    (b) Diamagnetic

    (c) Ferroelectric

    (d) Paramagnetic

19. A series LCR circuit contains inductance 5mH, capacitance 2µF & resistance 10Ω. If the frequency of the A.C. source is varied, what is the frequency at which maximum power is dissipated?

(a) $\dfrac{2}{\pi} \times 10^5 \, Hz$

(b) $\dfrac{10^5}{\pi} \times Hz$

(c) $\dfrac{5}{\pi} \times 10^3 \, Hz$

(d) $\dfrac{10^{-5}}{\pi} \times Hz$

20. Measurements of x,y& z are 1%, 2% & 4% respectively. What is the percentage error in the quantity Q?

    (a) 11%

    (b) 4%

    (c) 1%

    (d) 3%

21. Which of the following is not a vector quantity?

    (a) Momentum

    (b) Weight

    (c) Potential energy

    (d) Nuclear spin

22. A force $\vec{F} = 5\hat{i} + 2\hat{j} - 5\hat{k}$ acts on a particle whose position vector is $\vec{r} = \hat{i} - 2\hat{j} + \hat{k}$. What is the torque about the origin?

(a) $8\hat{i} - 10\hat{j} - 8\hat{k}$

(b) $8\hat{i} + 10\hat{j} + 12\hat{k}$

(c) $10\hat{i} - 10\hat{j} - \hat{k}$

(d) $8\hat{i}+10\hat{j}-12\hat{k}$

23. What is the source temperature of the Carnot engine required to get 70% efficiency? Given sink temperature is 27 °C
    (a) 270 °C
    (b) 1000 °C
    (c) 727 °C
    (d) 90 °C

24. A flow of liquid is streamlined if the Reynold number is
    (a) Between 2000 to 3000
    (b) Less than 1000
    (c) Between 4000 to 5000
    (d) Greater than 1000

25. A cycle tyre bursts suddenly. What is the type of this process?
    (a) Isochoric
    (b) Isothermal
    (c) Isobaric
    (d) Adiabatic

26. What is the nature of Gaussian surface involved in Gauss law of electrostatics?
    (a) Magnetic
    (b) Scalar
    (c) Vector
    (d) Electrical

27. In Wheatstone's network P=2Ω, Q= 2Ω & S=3Ω. The resistance with which is to shunted in order that the bridge may be balanced is
    (a) 2Ω
    (b) 6Ω
    (c) 1Ω
    (d) 4Ω

28. If there is no torsion in the suspension thread, then the time period of a magnet executing SHM is
    (a) $T = \dfrac{1}{2\pi}\sqrt{\dfrac{I}{MB}}$

    (b) $T = 2\pi\sqrt{\dfrac{MB}{I}}$

    (c) $T = \dfrac{1}{2\pi}\sqrt{\dfrac{MB}{I}}$

    (d) $T = 2\pi\sqrt{\dfrac{I}{MB}}$

29. If ε_o and μ_o are the permittivity and permeability of the free space and ε & μ are the corresponding quantities for a medium, then the refractive index of the medium is
    (a) $\sqrt{\dfrac{\mu\varepsilon}{\mu_o\varepsilon_o}}$

(b) Insufficient information

(c) $\sqrt{\dfrac{\mu_o \varepsilon_o}{\mu \varepsilon}}$

(d) 1

30. The average power dissipated in a pure inductor is

   (a) VI^2

   (b) Zero

   (c) $\dfrac{1}{2}VI$

   (d) $\dfrac{VI^2}{4}$

31. A radioactive decay can form an isotope of the original nucleus with the emission of particles

   (a) one α and two β

   (b) four α and one β

   (c) one α and four β

   (d) one α and one β

32. A red LED emits light at 0.1 watt uniformly around it. The amplitude of the electric field of the light at a distance of 1m from the diode is

   (a) 5.48v/m

   (b) 7.75v/m

   (c) 1.73v/m

   (d) 2.45v/m

33. From solid sphere of mass M and radius R a cube of maximum possible volume is cut. Moment of inertia of cube about an axis passing through its centre and perpendicular to one of its faces is

   (a) $\dfrac{4MR^2}{9\sqrt{3}\pi}$

   (b) $\dfrac{4MR^2}{3\sqrt{3}\pi}$

   (c) $\dfrac{4MR^2}{32\sqrt{2}\pi}$

   (d) $\dfrac{4MR^2}{16\sqrt{2}\pi}$

34. A signal of 5 kHz frequency is amplitude modulated on a carrier wave of frequency 2MHz. The frequencies of the resultant signal is/are

   (a) 2005kHz,2000kHz and 1995 kHz

   (b) 2000 kHz and 1995 kHz

   (c) 2MHzonly

   (d) 2005 kHz and 1995 kHz

35. As an electron makes a transition from an excited state to the ground state of a Hydrogen like atom /ion
    (a) Kinetic energy decreases, potential energy increases but total energy remains same.
    (b) Kinetic energy and total energy decreases but potential energy increases.
    (c) Its kinetic energy increases but potential energy and total energy decreases
    (d) Kinetic energy potential energy and total energy decreases

36. A Square of side $\sqrt{2}$ M has charges of +2X10^{-9}C, 1X10^{-9}, -2X10^{-9}C and -3X10^{-9} C respectively at its corners. Potential at the centre of the square is
    (a) +8v
    (b) -8v
    (c) +18v
    (d) -18v

37. The magnetic flux across a loop of resistance 10ohm is given by $\Phi=5t^2-4t+1$ weber. How much current is induced in the loop after 0.2s?
    (a) 0.4A
    (b) 0.2A
    (c) 0.04
    (d) 0.02A

38. A lens is made of flint glass (refractive index=1.5). When the lens is immersed in a liquid of refractive index 1.25, the focal length
    (a) Increases by a factor of 1.25
    (b) Increases by a factor of 2.5
    (c) Increases by a factor of 1.2
    (d) Decreases by a factor of 1.2

39. A doctor advises a patient to use spectacles with a convex lens of focal length 40cm is contact with a concave lens of focal length 25cm. what is the power of the combination?
    (a) -6.5D
    (b) -1.5D
    (c) 6.5D
    (d) 1.5D

40. A research satellite of mass 200kg circles the earth is an orbit of average radius 3R/2, where R is the radius of the each. Assuming the gravitational pull on a mass of 1kg on the earth's surface to be 10N, the pull on the satellite will be
    (a) 880N
    (b) 889N
    (c) 890N
    (d) 892N

41. Water from a tap emerges vertically downwards with an initial speed of 1.0m/s. The cross-sectional area of tap is 10^{-4} m^2. Assume that the pressure is constant throughout the stream
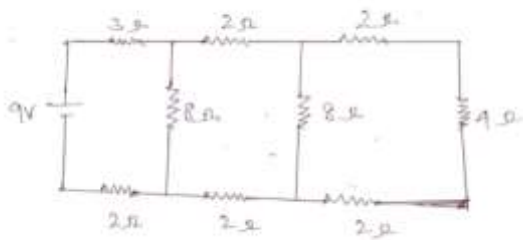
of water and that the flow is steady, the cross-sectional area of stream 0.15m below the tap is

    (a) $5.0 \times 10^{-4} m^2$

    (b) $1.0 \times 10^{-4} m^2$

    (c) $5.0 \times 10^{-5} m^2$

    (d) $2.0 \times 10^{-5} m^2$

42. Let m_p be the mass of proton m_n the mass of neutron. M_1 the mass of (20/10) Ne nucleus and M_2 the mass of (40/20) Ca nucleus. Then:

    (a) $M_2 = 2M_1$

    (b) $M_2 > 2M_1$

    (c) $M_2 < 2M_1$

    (d) $M_1 < 10(m_n + m_p)$

43. In the circuit shown in the current through:

    (a) The 3Ω resistance is 0.50A

    (b) The 3Ω resistor is 0.25A

    (c) The 4Ω resistor is 0.50A

    (d) The 4Ω resistor is 0.25A

44. A Small square loop of wire of side 'l' is placed inside a large square loop of wire of side L(L>>l). The loops are coplanar and their centres coincide. The mutual inductance of the system of proportional to

    (a) l/L

    (b) l^2/L

    (c) L/l

    (d) L^2/l

45. A given quantity of an ideal gas is at pressure P and absolute temperature T. The isothermal bulk modulus of the gas is:

    (a) 2/3 P

    (b) P

    (c) 3/2p

    (d) 2P

46. A Spherical surface of radius of curvature R, separates air(refractive index 1.0) from glass (refractive index 1.5). The centre of curvature is in the glass. A point object-P placed in air is found to have a real image or in the glass. The line PQ cuts the surface at a point O and PO=OQ. The distance PO is equal to:
    (a) 5R
    (b) 3R
    (c) 2R
    (d) 1.5R

47. The SI unit of the inductance, the henry can be written as:
    (a) weber/ampere
    (b) volt-second/ampere
    (c) Joule/ampere^2
    (d) ohm-second

48. The ratio of the speed of sound in nitrogen gas to that in helium gas at 300K is
    (a) $\sqrt{2/7}$
    (b) $\sqrt{1/7}$
    (c) $\sqrt{3}/5$
    (d) $\sqrt{6}/5$

49. Order of magnitude of density of uranium nucleus is (m_p=1.67x10^{-27} kg)
    (a) 10^{20}kg/m^3
    (b) 10^{17}mg/m^3
    (c) 10^{14}kg/m^3
    (d) 10^{11}/kg/m^3

50. ^{22}Ne nucleus, after absorbing energy, decays into two α-particles and an unknown nucleus, the unknown nucleus is
    (a) nitrogen
    (b) carbon
    (c) boron
    (d) oxygen

51. In hydrogen spectrum the wavelength of Hα line 656nm; whereas in the spectrum of a distant galaxy Hα line wavelength is 706nm. Estimated speed of galaxy with respect the earth is:
    (a) 2x10^{8}m/s
    (b) 2x10^{7}m/s
    (c) 2x10^6 m/s
    (d) 2x10^{5}m/s

52. In a wave motion Y=a sin(kx – wt), Y can represent,

(a) electric field

(b) magnetic field

(c) displacement

(d) pressure

53. The plots of intensity versus wavelength for three black bodies at temperatures T_1, T_2 & T_3 respectively are as shown. Their temperatures are such that

(a) $T_1 > T_2 > T_3$

(b) $T_1 > T_3 > T_2$

(c) $T_2 > T_3 > T_1$

(d) $T_3 > T_2 > T_1$

54. A particle of charge 'q' and mass 'm' moves in a circular orbit of radius 'r' with angular speed 'w'. the ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

(a) w and q

(b) w, q & m

(c) q & m

(d) w and m

55. The dimension of $1/2\varepsilon_o E^2$ (ε_o: permittivity of free spce; E: electric field) is

(a) MLT^{-1}

(b) ML^2T^{-2}

(c) MLT^{-2}

(d) ML^2T^{-1}

56. In a compound microscope, the intermediate image is

(a) Virtual, erect and magnified

(b) real, erect and magnified

(c) real, inverted and magnified

(d) virtual, erect and reduced

57. Two radioactive materials X_1 & X_2 have decay constants 10λ & λ respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of X_1 to X_2 will be 1/e after a time.

(a) $1/10\lambda$

(b) $1/11\lambda$

(c) $11/10\lambda$

(d) $1/9\lambda$

58. Two monoatomic ideal gases 1 and 2 of molecular masses m1 and m2 respectively are enclosed in separate container kept at the same temperature. The ratio of the speed of sound in gas 1 to that in gas 2 is given by

(a) $\sqrt{\dfrac{m1}{m2}}$

(b) $\sqrt{\dfrac{m2}{m1}}$

(c) $\dfrac{m1}{m2}$

(d) $\dfrac{m2}{m1}$

59. The electron emitted in beta radiation originates from:

    (a) inner orbits of atoms

    (b) free electron existing in nuclei

    (c) decay of a neutron in a nucleus

    (d) photon escaping from the nucleus

60. A Particle executes simple harmonic motion between X=-A and X=+A. The time taken for it to go from 0 to A/2 is T_1 and to go from A/2 to A is T_2

    (a) $T_1 < T_2$

    (b) $T_1 > T_2$

    (c) $T_1 = T_2$

    (d) $T_1 = 2T_2$

Physics Yellow Answers

1	D	31	A
2	C	32	D
3	B	33	A
4	D	34	A
5	D	35	C
6	D	36	D
7	C	37	B
8	C	38	B
9	A	39	B
10	A	40	B
11	B	41	C
12	C	42	C,D
13	A	43	D
14	B,C	44	B
15	C,D	45	B
16	C	46	A
17	A	47	ABCD
18	A	48	C
19	C	49	B
20	A	50	B
21	C	51	B
22	B	52	ABCD
23	C	53	B
24	B	54	C
25	D	55	NONE
26	C	56	C
27	B	57	D
28	D	58	B
29	A	59	C
30	B	60	A