XII PHYSICS

"NUMERICALS"

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"HEAT"

Q.1: (a) The normal body temperature is 98.4^{o}F. What is this temperature on Celsius scale?
(b) At what temperature do the Fahrenheit and Celsius scales coincide?

Q.2: A steel rod has a length of exactly 0.2 cm at 30°C. What will be its length at 60°C?

Q.3: Find the change in volume of an aluminium sphere of 0.4 m radius when it is heated from 0 to 100°C.

Q.4: Calculate the root mean square speed of hydrogen molecule at 800K.

Q.5: (a) Determine the average value of the kinetic energy of the particles of an ideal gas at 0°C and at 50°C.
(b) What is the kinetic energy per mole of an ideal gas at these temperatures?

Q.6: A 2 kg iron block is taken from a furnace where its temperature was 650°C and placed on a large block of ice at 0°C. Assuming that all the heat given up by the iron is used to melt the ice, how much ice is melted.

Q.7: In a certain process 400 J of heat are supplied to a system and at the same time 150 J of work are done by the system. What is the increase in the internal energy of the system?

Q.8: There is an increase of internal energy by 400 joules when 800 joules of work is done by a system. What is the amount of heat supplied during this process?

Q.9: A heat engine performs 200 J of work in each cycle and has efficiency of 20 percent. For each cycle of operation (a) How much heat is absorbed and (b) How much heat is expelled?

Q.10: A heat engine operates between two reservoirs at temperature of 25°C and 300°C. What is the maximum efficiency for this engine?

Q.11: The low temperature reservoir of a Carnot engine is at 7°C and has efficiency 40%. It is desired to increase the efficiency to 50%. By how much degree the temperature of hot reservoir is increased.

EXTRA NUMERICALS

Q.1: In as isobaric process when 200 J of heat energy is supplied to a gas in a cylinder, the piston of area $2x10^{-2}$ m^2 moves through 0.5m under a pressure of $1.01x10^5$ N/m^2, calculate increase in internal energy of the system.

Q.2: A meter bar of steel is correct at 0°C and another at -2.5^{o}C. What will be the difference between their lengths at 30°C? ($\alpha = 1.2x10^{-5}/K$)

Q.3: What is the change in internal energy of 200 g of nitrogen as it is heated from 10°C to 30°C at constant volume?

Q.4: What is the change in entropy of 30g water at 0°C as it is changed into ice at 0°C?

Q.5: A rod of brass and that of iron differ by 5cm in length at all temperatures. What are the lengths at 0°C? (Given linear expansivities for iron and brass are $1.1x10^{-5}$ C^{o-1} and $1.8x10^{-5}$ C^{o-1}, respectively).

Q.6: Water at 20^oC falls a height of 854 meters. If the whole energy is used in increasing the temperature, find out the final temperature.

Q.7: A heat engine works at the rate of 500 kW. The efficiency of the engine is 30%. Calculate the loss of heat per hour.

Q.8: A hole in a brass plate has a diameter of 16 mm. Though what temperature must the temperature be raised for the diameter to become 16.08 mm.

Q.9: A heat engine working between the temperature of 27^oC and 100^oC is 12% efficient. What would be its efficiency if it had been a Carnot heat engine?

Q.10: A Carnot engine whose low temperature reservoir is 200K has an efficiency of 50%. It is desired to increase this to 75%. By how many degrees must the temperature of sink be decreased if higher temperature of the reservoir remains constant?

Q.11: A copper bar is increased by 1.02 cm in length by heating it from 0^oC to 20^oC. Find its original length.

Q.12: An iron ball has a diameter of 5.0 cm and is 0.010 mm too large to pass through a hole in brass plate when the ball and the plate are at a temperature of 30^oC. At what temperature, the same for ball and plate, will the ball just pass through the hole?
($\alpha_i = 1.2 \times 10^{-5}$ /C^o and $\alpha_b = 1.9 \times 10^{-5}$ /C^o for iron and brass, respectively).

Q.13: A tank of oxygen at 0^oC has a volume of 4 dm^3, and the pressure is 5.0 atm. What is the mass of the gas in the tank?

Q.14: Air at room temperature has a density of 1.29 kg/m^3, Calculate molecular speed at 100 kPa.

Q.15: Calculate change in entropy of 50g of water at 0^oC when it is changed into ice at the same temperature. Take Sp. Latent heat of fusion of ice = 3.36×10^5 J/kg.

Q.16: An iron block of mass 2 kg is taken out of a furnace at 500 ^0C. This is kept on a huge ice block at 0 ^0C. Assuming that all the amount of heat rejected by iron block is consumed to melt the ice, Find the amount of ice melted? L_f (ice) = $3.36*10^5$ $J.kg^{-1}$, C (iron) = 499.98 $J.kg^{-1}.K^{-1}$.

EXAMPLES NUMERICALS

11.1: A steel rod has a length of 10 m at a temperature of 25 ^oC. What will be the increase in length if the temperature is raised to 35 ^oC.? Given $\alpha = 1.1 \times 10^{-5}$ K^{-1}.

11.2: An air-storage tank whose volume is 112 litre contains 3 kg of air at a pressure of 18 atmospheres. How much air would have to be forced into the tank to increase the pressure to 21 atmospheres assuming no change in temperature.

11.3: Calculate the volume occupied by a gram-mole of a gas at 0 ^oC and a pressure of 1 atmosphere.

11.4: Calculate the V_{rms} of hydrogen molecules at 0.00 ^oC and 1.00 atmosphere pressure, assuming hydrogen to be an ideal gas. Under these conditions hydrogen has a density ρ of 8.99×10^{-2} kg/m^3.

11.5: A 50 gram piece of metal is heated to 100 ^oC and then dropped into a copper calorimeter of mass 400 gram containing 400 gram of water initially at 20 ^oC. If the final equilibrium temperature of the system is 22.4 ^oC, find the specific heat of the metal. Specific heat of copper is 386 $J.kg^{-1}.k^{-1}$.

11.6: A system absorbs 1000 Joules of heat and delivers 600 joules of work while losing 100 Joules of heat by conduction to the atmosphere. Calculate the change in the internal energy of the system.

11.7: A thermodynamic system undergoes a process in which its internal energy decreases by 300 J. If at the same time, 120 J of work is done on the system, find the heat transferred to or from the system.

11.8: Find the efficiency of the carnot's engine working between 150 ^{o}C and 50 ^{o}C.

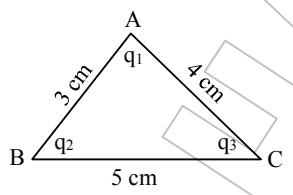
"ELECTROSTATICS"

Q.1: Two unequal point charges repel each other with a force of 0.2 newtons when they are 10 cm apart. Find the force which each exerts on the other when they are:
(i) 1 cm apart (ii) 5 cm apart

Q.2: Two point charges of $+1x10^{-4}$ and $-1x10^{-4}$ coul are placed at a distance of 40 cm from each other. A Charge $+6x10^{-5}$ coul is placed midway between them. What is the magnitude and direction of force on it.

Q.3: Three point charges each of 4μ.C. are placed at the three corners of a square of side 20 cm. Find the magnitude of the force on each.

Q.4: Three charges
$Q_1 = +7x10^{-6}$ C, $Q_2 = -4x10^{-6}$ C, $Q_3 = -5x10^{-6}$ C, are placed at the vertices of a measure 3, 4 and 5 cm. Determined the magnitude and direction of the force on the charge Q_1.



Q.5: Two small spheres, each having a mass 0.1 gm, are suspended from the same point by silk threads each 20 cm long. The spheres are given equal charges and they are found to repel each other, coming to rest 24 cm apart. Find the change on each.

Q.6: Two charges of $+2x10^{-7}$ C and $2x10^{-7}$ C are placed at a distance of 50 cm from each other. Find a point on the line joining the charges at which the electric field is zero.

Q.7: What are the electric field and potential at the centre of a square whose diagonals are 60 cm, each when (a) charges each of 2μc are placed at the four corners. (b) charges of +2μc on other corners:

Q.8: A particle carrying a charge of 10^{-5} C starts from rest in a uniform electric field of intensity 50 Vm^{-1}. Find the force on the particle and the kinetic energy it acquires when it has moved 1 m.

Q.9: A proton of mass $1.67 \times {}^{10\text{-}27}$ kg and charge 1.6×10^{-19} C is to be held motionless between two horizontal parallel plates 10 cm apart. Find the Voltage required to be applied between the plates.

Q.10: A small sphere of weight 5×10^{-3} N is suspended by a silk thread 50 mm long which is attached a point on a large charged insulating plane. When a charge of 6×10^{-8} C is placed on the ball the thread makes an angle of 30° with the vertical. What is the charge density on the plane.

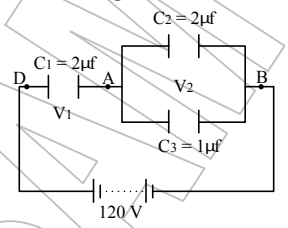
Q.11: How many electrons should be removed from each of the two similar spheres each of 10 g so that electrostatic repulsion be balanced by gravitational force.

Q.12: There is a potential difference of 150 volts between two conductors of a power line. A charge of 600C is carried from one conductor to the other. What work is required? If the time necessary to transport the charge is 1.25 s how much power is used?

Q.13: A metal sphere of 100 mm radius has a charge of $4.25x10^{-9}$ coul. What is the potential? (a) at its surface (b) at its centre. What is the energy of a charge of $2.5x10^{-6}$ C at a point 150 mm from the centre of sphere?

Q.14: An electron having an initial of 10^{+3} cms^{-1} is directed from a distance of 1 mm at another electron whose position is fixed. How close to the stationary electron will the other approach.

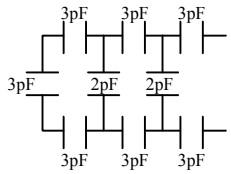
Q.15: Find the equivalent capacitance and charge on each of the capacitor shown in the diagram.



Q.16: Two capacitors of 2μf and 8μf are joined in series and a potential difference of 300 volts is applied. Find the charge and potential difference for each capacitor.

Q.17: A capacitor of 100 pF is charged to a potential difference of 50 volts. Its plates are then connected in parallels to another capacitor and it is found that the potential difference between its plates falls to 35 volts. What is the capacitance of the second capacitor?

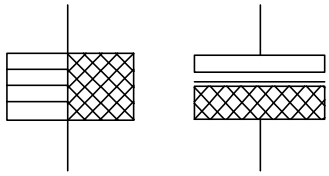
Q.18: Find the equivalent capacitance of the combination shown in the diagram.



Q.19: A parallel plate capacitor has plates 30 cm x 30 cm separated by a distance of 2 cm. By how much the capacitance changes if a dielectric slab of the same area but of thickness 1.5 cm is slipped between the plates. The dielectric constant of the material is 2.

Q.20: Three 1.0 pF capacitors are charged separately to the potential difference of 100, 200 and 300 volts. The capacitors are then joined in parallels. What is the resultant potential difference?

Q.21: Compare the capacitances of two identical capacitors with dielectrics inserted as shown in the diagram. The dielectric constants are K_1 and K_2.



Q.22: A capacitor of 10 μf and one 20 μf are connected across batteries of 600 volts and 1000 volts respectively and then disconnected. They are then joined in series. What is the charge on each capacitor?

Q.23: Attempt the problem 22 with the difference that the capacitors are joined in series after being charged, as before.

"CURRENT ELECTRICITY"

Q.1: A wire carries a current of 1A. How many electrons pass a point in the wire in each second?

Q.2: A silver wire 2 m long is to have a resistance of many coulomb of charge can this battery supply.

Q.3: A current of 6 A is drawn from a 120 V line. What power is being developed? How much energy in joule and in Kwt is expended if the current is drawn steadily for one week.

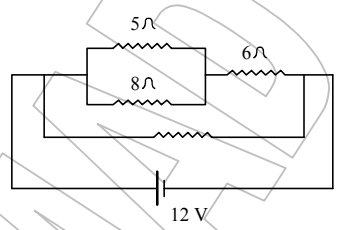
Q.4: Currents of 3 A and 1.5 A flow through two wires, one that has a potential difference of 60 V across its ends and another that has a potential difference of 120 V across its ends. Compare the rate at which energy pass through each wire.

Q.5: A wire carries a current of 1 A. How many electrons pass a point in the wire an each second?

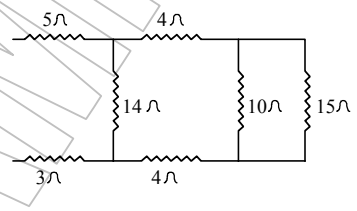
Q.6: An electric drill rated at 400 W is connected to a 240 V power line. How much current does it draw?

Q.7: Resistors of 20 Ω, 40 Ω, 50 Ω are connected in parallel across a 50 V power source. Find the equivalent resistance of the set and the current in each resistor?

Q.8: (a) Find the equivalent resistance of the network shown in figure.
(b) What is the current in 8-Ω resistor if the p.d. of 12V is applied to the network?



Q.9: A 60-V potential difference is applied to the circuit shown below. Find the current in the 10-Ω resistor. [Hint Reduce the circuit bring out the series and parallel combination of the resistors more clearly].



Q.10: A source of what potential difference is needed to charge a battery of 20 V e.m.f and internal resistance of 1 Ω at a rate of 70 A.

Q.11: A battery of 24V is connected to a 10Ω load and a current of 2.2 amp is drawn; find the internal resistance of the battery and its terminal voltage.

Q.12: A 40Ω resistor is to be wound from platinum wire 0.1mm in diameter. How much wire is needed? ($\sigma = 11 \times 10^{-8}$ Ω.m)

Q.13: The battery of a pocket calculator supplies 0.35 A at a p.d. of 6 V. What is the power rating of the calculator?

Q.14: A current of 5 A through a battery is battery is maintained for 30 s and in this time 600 J of chemical energy is transformed into electric energy (a) What is the e.m.f of the battery? (b) How much electric power is available for heating and other uses?

Q.15: A 12 Ω resistor is connected in series with a parallel combination of 10 resistors, each of 200Ω. What is the net resistance of the circuit?

Q.16: Three equal resistors each of 12 Ω can be connected in four different ways. What is equivalent resistance of each combination?

Q.17: Find the resistance at 50^oC of a copper wire 2 mm in diameter and 3 m long.

Q.18: The resistance of a tungsten wire used in the filament of a 60 W bulb is 240Ω when the bulb is hot at a temperature of 2020^oC. What would you estimate its resistance at 20^oC? (Given $\alpha = 0.0046^oC$)

Q.19: A water heater that will deliver 1kg of water per minute is required. The water is supplied at 20^oC and an output temperature of 80^oC is desired. What should be the resistance of the heating element in the water if the line voltage is 220V? (Given sp. Heat capacity of water = 4200 J kg^{-1} K^{-1})

Q.20: Prove that the rate of heat production in each of the two resistors connected in parallel are inversely proportional to the resistance.

Q.21: A 240-V cloth dryer draws a current of 15A. How much energy in kWh and joules does it use in 45 minutes operation and how much will be the cost at the rate of Rs. 1.45 per unit of electric energy?

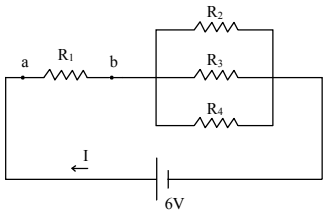
Q.22: A resistor is made by winding on a spool a 40m length of constantan wire of diameter 0.8 mm. Calculate the resistance of the wire at (a) 0^oC (b) 50^oC.
[Assume ρ_o at $0^oC = 49 \times 10^{-8}$ Ω. m. and $\alpha = 1 \times 10^{-5}$ C^{-1}].

EXTRA NUMERICALS

Q.1: Three resistors each of 12Ω can be connected in four different ways. What is the equivalent resistance of each combination?

Q.2: Two resistance of 10 ohms and 50 ohms are connected in series with a 6 volt battery. Calculate
(i) The charge drawn from the battery per minute.
(ii) The power dissipated in 10 ohm resistance.

Q.3: Find the equivalent resistance in the given circuit, current T and potential difference between a and b.
R1 = 5Ω $R_2 = 2\Omega$ $R_3 = 3\Omega$ $R_4 = 6\Omega$



"MAGNETIC & ELECTROMAGNETISM"

Q.1: A horizontal straight wire 5 cm long weighing 1.2 gm^{-1} is placed perpendicular to a uniform horizontal field of 0.6 webers-m^{-2}. If the resistance of the wire is 3.8 Ω m^{-1}. Calculate the potential difference to be applied between the ends of the wire to make it just self supporting.

Q.2: A cathode ray tube is set up horizontally with its axis N-s and surrounded by a magnetic shield. If the voltage across the tube is 900 volts, the distance from electron gun to the screen is 10 cm and vertical component of earth's field is $0\text{-}45\times10^{-4}$ webers/m^2. Calculate by how much the spot is removed. Given that e/m = 1.8×10^{11} Ckg^{-1}

Q.3: What is the flux density at a distance of 0.1 m in air from a long straight conductor carrying a current of 6.5 amperes? Hence calculate the force per meter on a similar parallel conductor at a distance of 0.1 m from the first and carrying a current of 3 amperes. Will the wires attract or repel, if the directions of currents in the two wires are opposite to each other? Explain how the expression of force between two such conductors is used to define ampere.

Q.4: A straight metal rod 50 cm long can slide with negligible friction on parallel conducting rails. It moves at right angles to a magnetic field 0.72 webers-m^2. The rails are joined to a batter of emf 3 volts and a fixed series resistance of 1.6 Ω. Find the force required to hold the rod at rest.

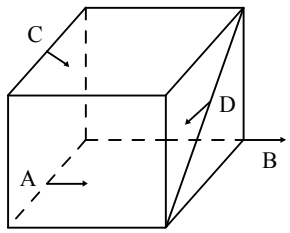
Q.5: It is required to produce inside a toroid a field of 2×10^{-3} webers-m^3. The toroid has a radius of 15 cm and 300 turns. Find the current required for this purpose. If toroid is wound on an iron core of permeability 300 times the permeability of free space what increase in B will occur for the same current.

Q.6: A proton is accelerated by a potential difference of 6×10^5 volts. It then enters a uniform field B = 0.3 webers-m^2 in a direction making an angle of 45° with the magnetic field, what will be the radius of the circular path?

Q.7: Two parallel metal plates separated by 5 cm of air have a potential difference of 220 volts. A magnetic field B = 5×10^{-3} webers-m^2 is also produced perpendicular to electric field. A beam of electrons travel undeflected through these crossed electric and magnetic fields. Find the speed of electrons.

Q.8: A coil of 50 turns wound on a rectangular ivory frame 2 cm x 4 cm is pivoted to rotate in a magnetic field of 0.2 webers m^{-2}. The face of the coil is parallel to the field. How much torque acts over the coil when a current of 0.5 amp passes through it? What will be the torque when the coil is rotated by 60° from its initial position?

Q.9: A cube 100 cm on a side is placed in a uniform magnetic field of flux density 0.2 webers-m^{-2}, as shown in the diagram. Wires A, C and D move in the directions indicated, each at a rate of 50 cm.s^{-1}, determine the induced emf in each wire.



Q.10: What is the mutual Inductance of a pair of coils if a current change of 6 amps in one coil causes the flux in the second coil of 2000 turns to change by 12×10^{-4} webers-m^{-2}.

Q.11: An emf of 45 m.volt is induced in a coil of 500 turns, when the current in a neighbouring coil changes from 10 amps to 4 amps in 0.2 seconds.
(a) What is the mutual Inductance of the coils?
(b) What is the rate of change of flux in the second coil?

Q.12: An iron core solenoid with 400 turns has a cross section area of 4.0 cm^2. A current of 2 amp passing through it produces B = 0.5 webers-m^{-2}. How large an emf is induced in it. What is the self Inductance of the solenoid?

Q.13: The current in a coil of 325 turns is changed from zero to 6.32 amps, there by producing a flux of 8.46×10^{-4} webers. What is the self Inductance of the coil?

Q.14: A 100 turns coil in a generator has an area of 500 cm^2 rotates in a field with B = 0.06 webers-m^{-2}. How fast must the coil rotated in order to generate a maximum voltage of 150 volts?

Q.15: A step down transformer at the end of a transmission line reduces the voltage from 2400 volts to 1200 volts. The power output is 9.0 K.W and over all efficiency of the transformer is 95%. The primary winding has 400 turns. How many turns has the secondary coil? What is the power input, what is the current in each of the coils?

Q.16: The overall efficiency of a transformer is 90%. The transformer is rated for an output of 12.5 KM. The primary voltage is 1100 volts and the ratio of primary to secondary turns is 5:1. The iron losses at full load are 700 watts. The primary coil has a resistance of 1.82 ohms.
(a) How much power is lost because of the resistance of the primary coils?
(b) What is the resistance of the secondary coils?

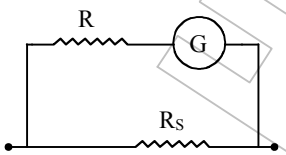
"ELECTRICAL MEASURING INSTRUMENTS"

Q.1: A galvanometer has a resistance of 50 Ohms and it deflects full scale when a current of 10 milliamperes flows in it. How can it be converted into an ammeter of range 10 amperes?

Q.2: A galvanometer whose resistance is 40 Ohms deflects full-scale for a potential difference of 100 millivolts across its terminals. How can it be converted into an ammeter of 5 ampere range?

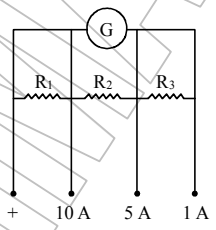
Q.3: The coil of a galvanometer which has a resistance of 50 ohms and a current of 500 micro amperes produces full-scale deflection in it. Show by a diagram how it can be converted to (a) an ammeter of 5 ampere range and compute the shunt resistance. (b) a volt meter of 300 volt range and compute the series resistance.

Q.4: A galvanometer of resistance 2.5 ohms deflects full-scale for a current of 0.05 amperes. It is desired to convert this galvanometer into an ammeter reading 25 amperes full-scale. The only shunt available is of 0.03 ohm. What resistance R must be included in series with the galvanometer coil as shown in figure for using this shunt?



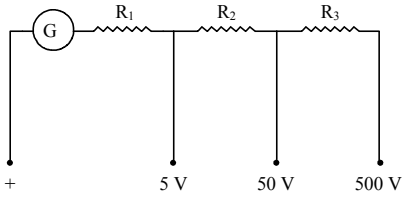
Q.5: An ammeter deflects full-scale with a current of 5 amperes and has a total resistance must be connected to it to measure 25 amperes full-scale?

Q.6: A moving coil galvanometer G has a resistance of 50 ohms and deflects full-scale with a current of 0.005 ampere. What resistance R_1, R_2 and R_3 must be connected to it as shown in figure to convert into a multi-range ammeter having ranges of 1A, 5A and 10A.



Q.7: A 300-volt voltmeter has a total resistance of 20,000 ohms. What additional series resistance must be connected to it to increase its range to 500 volt?

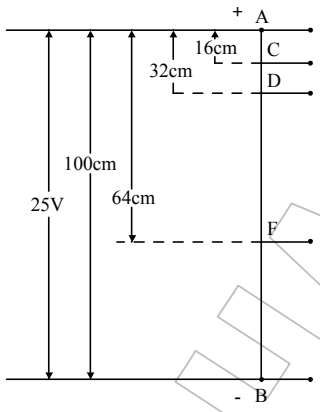
Q.8: The resistance of a moving-coil galvanometer is 25 ohms and current of 1 milliampere causes full-scale deflection in it. If is to be converted into a multi-range voltmeter. Find the series resistance R_1, R_2 and R_3 to give the range of 5 volts, 50 volts and 500 volts at the range terminals as shown in figure.



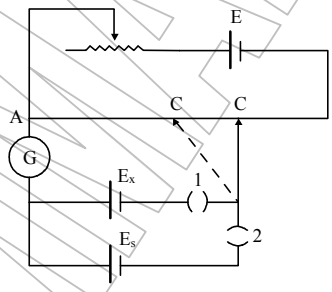
Q.9: The galvanometer of the Ohmmeter in figure has a resistance of 25 ohms and deflects full scale with a current of 2 milliamperes in it. The e.m.f. E of its cells is 1.5 volts.
(a) What is the value of the series resistance R?

(b) To what values of x connected to its terminals do the deflection of 1/5, 1/2 and 4/5 full-scale correspond?
(c) Is the scale of the Ohmmeter linear?

Q.10: A constant potential difference of 25 volts is applied across a uniform resistance wire AB, 100 cm long. Terminals are soldered to three points C.D.F on the wire respectively 16, 32 and 64 cm from A, figure. Find the potential differences (between each pair of points given in the subscripts) (i) V_{AC} (ii) V_{AD} (iii) V_{AF} (iv) V_{CD} (v) V_{CF} (vi) V_{DF} (vii) V_{CB} (viii) V_{DB} (ix) V_{FB}.



Q.11: A potentiometer is set up to measure the emf, E_x of cell (figure). The potentiometer wire is 120 cm long. E_s is the emf of a standard cadmium cell equal to 1.018 volts. When the key 1 only is closed to include the emf E_x in the galvanometer circuit, the galvanometer gives no deflection with the sliding contact at C,56.4 cm from A. When the key 2 only is closed to include the emf E_s in the galvanometer circuit the balance is obtained at C′,43.2 cm from A.



"ELECTROMAGNETIC WAVES & ELECTRONICS"

Q.1: Light is said to be a transverse wave phenomenon. What is that varies at right angles to the direction in which a light wave travel.

Q.2: A radar sends out 0.05 μs pulses of microwaves whose wave length is 2.5 cm. What is the frequency of these microwaves? How many waves does each pulse contain?

Q.3: A nanosecond is 10^{-9}s (a) What is the frequency of electromagnetic wave whose period is 1ns? (b) What is it's wave length? (c) To what class of electromagnetic waves does it belong?

Q.4: With a sketch explain the working of (i) Half wave rectifier (ii) Full wave rectifier?

Q.5: Explain the difference between the band structure of a semiconductor and that of a metal. Why does a semiconductor acts as an insulator at 0°K and why does it's conductivity increases with increasing temperature?

"ADVENT OF MODERN PHYSICS"

Q.1: In the inertial frame of a pendulum the time period is measured to be 3 s. What will be the period of the pendulum for an observer moving at a speed of 0.95 C with respect to the pendulum?

Q.2: What will be the length of a bar in the stationary frame if its length along the x′-direction is 1 m and the motion is with a velocity 0.75 C with respect to the observer at rest.

Q.3: Given $m_oc^2 = 0.511$ MeV. Find the total energy E and the kinetic energy K of an electron moving with a speed v = 0.85 c.

Q.4: The total energy of a proton of mass 1.67×10^{-27} kg is three times its rest energy. Find
(a) Protons rest energy.
(b) Speed of the proton.
(c) Kinetic energy k of proton in eV.

Q.5: A particle of rest mass m_o has a speed $\upsilon = 0.8c$, Find its relativistic momentum, its kinetic energy and total energy?

Q.6: What will be the velocity and momentum of a particle whose rest mass is m_o and whose kinetic energy is equal to its rest mass energy?

Q.7: The sun radiates energy at a rate 3.8×10^{26} w. At what rate the mass of sun diminishes?

Q.8: What will be the work function of a substance for a threshold frequency of 43.9×10^{13} Hz?

Q.9: What will be the value of $\lambda_{min} = hc / eV_o$, if $h = 6.63 \times 10^{-34}$ J.S, $c = 3 \times 10^8$ ms^{-1}. $e = 1.6 \times 10^{-19}$ C and $V_o = 10^4$ V.

Q.10: In a Compton scattering process, the fractional change in work length of x-ray photons is 1% at an angle $\theta = 120^o$, find the wavelength of x-ray used in the experiment.

Q.11: Find the wave length of a 2.0 g light ball moving with a velocity:
(a) 1.0 mm per century (b) 1.0 ms^{-1}

Q.12: An electron exist with in a region of 10^{-10} m. Find its momentum, uncertainly and the approximate kinetic energy.
Given:
$h = 1.05 \times 10^{-34}$ J.S and $m = 9.1 \times 10^{-31}$ kg

Q.13: Sodium surface is shined with light of wave length 3×10^{-7} m. If the work function of Na = 2.46 eV, find the K.E of the photoelectrons and also the cut off wave wave length $\lambda c = hc/Ø$.
Given: ($1eV = 1.6 \times 10^{-19}$J)

Q.14: X-rays of wave length λ_o are scattered from a carbon block at an angle of 45° with respect to theincident beam. Find the shift in wave length.
Given:
$h = 6.63 \times 10^{-34}$ J.S, $m = 9.11 \times 10^{-31}$ kg and $c = 3 \times 10^8$ ms^{-1}).

Q.15: If the electron beam in a T.V picture tube is accelerated by 10,000 V what will be the deBrogle's wave length?

Q.16: What minimum energy photon can be used to observe an object of size 2.5×10^{-10} m.

Q.17: What will be the deBroglie's wave length associated with a mass of 0.01 kg moving with a velocity 10 ms^{-1}?

Q.18: Certain excited state of hydrogen atom have a life time $2.5x10^{-19}$s. What will be the minimum uncertainly in energy?

Q.19: X-rays are scattered from a target material. The scattered radiation is viewed at an angle of 90° with respect to the incident beam. Find the Compton shift in wave length.

Q.20: Find the frequency of a photon when an electron of 20 KeV is brought to rest in a collision with a heavy nucleus.

"THE ATOMIC SPECTRA"

Q.1: Calculate the following (a) the orbit radius (b) the angular momentum (c) the linear momentum (d) the kinetic energy (e) the potential energy (f) the total energy for the Bohrs hydrogen atom in ground state.

Q.2: What is the wavelength of the radiation that is emitted when a hydrogen atom undergoes a transition from the state n = 3 to n = 1.

Q.3: Light of wavelength 486.3 nm is emitted by a hydrogen atom in Balmer series, what transitions of the hydrogen atom is responsible for this radiation.

Q.4: In the hydrogen atoms an electron experiences a transition from a state whose binding energy is 0.54 eV to another state whose excitation energy is 10.2 eV (a) What are the quantum numbers for these states? (b) Compute the wavelength of the emitted photon. (c) To what series does this line belong?

Q.5: Photon of 12.1 eV absorbed by a hydrogen atom, originally in the ground state, raises the atom to an excited state. What is the quantum number of this state:

Q.6: Find the wavelength of the first three lines of the Lyman series of hydrogen.

Q.7: In an experiment, the excitation potentials of hydrogen are found at 10.21 V and 12.10 V, three different spectral lines are emitted. Find their wavelengths.

Q.8: What minimum energy is needed in an X-ray tube in order to produce X-rays with a wavelength of 0.1×10^{-10} m.

Q.9: A certain atom emits spectrum lines at 300, 400 and 1200 nm. Assuming that three energy levels are involved in the corresponding transitions; calculate the quantum of energy emitted at each wave length.

Q.10: Calculate the energy of a photon whose frequency is
(a) (i) 4×10^{14} Hz (ii) 20 GHz (iii) 30 MHz, Express your answer in ev.
(b) Describe the corresponding wavelengths for the photons described in (a)

"THE ATOMIC NUCLEUS"

Q.1: When the chorine atom of mass number 35 and charge number 17, is bombarded by proton, the resulting atom disintegrates, emitting an α-particle. Write the equation representing the reaction.

Q.2: The half life of Radon is 3.80 days what would be its decay constant?

Q.3: The atomic weight of Bromine is 79.938u and it is composed of two isotopes of mass 78.943u and 80.942u compute the percentage of each isotopes.

Q.4: The half life of $_{104}Po^{210}$ is 140 days. By what percent does its activity will decrease per week?

Q.5: If a neutron would be entirely converted into energy, how much energy would be produced? Express your answer in Joules as well as electron volts.

Q.6: Find the binding energy of $_{52}Te^{126}$,
Given:
$m_p = 1.0078u$, $m_n = 1.0086u$, $m_{Te} = 125.9033u$ & 14 = 931.5 MeV

Q.7: If the number of atoms per gramme of $_{88}Ra^{226}$ is $2.66x10^{21}$ and it decays with a half life of 1622 years. Find the decay constant and the activity of the sample.

Q.8: What will be the maximum energy of the electron in the beta decay of $_1H^3$ through the reaction.
$_1H^3$ --------- $_2He^3 + \beta^- + \gamma^-$

Q.9: Find the Q-value for the nuclear reaction.
$_{20}Ca^{42}$ (P, d) $_{20}Ca^{41}$

Q.10: Find the energy released when two deuterium ($_1H^2$) nuclei fuse together to form an alpha particle ($_2He^4$).