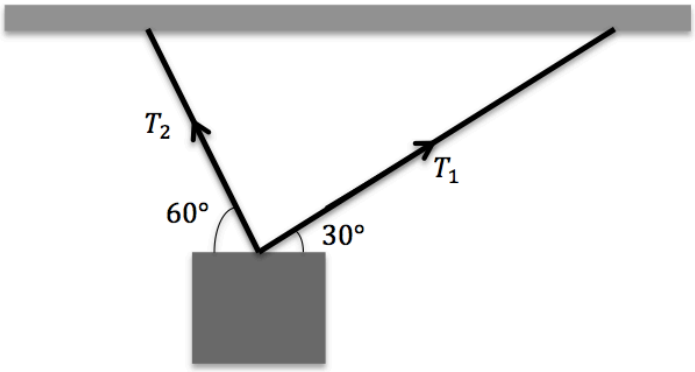
AHMES SECONDARY SCHOOL

FORM VI HOLIDAY PACKAGE

PHYSICS

1. The number of particles n crossing a unit area perpendicular to x-axis in a unit time is given as $n = -D\frac{(n_2-n_1)}{(x_2-x_1)}$ where n_1 and n_2 are the number of particles per unit volume for the values of x_1 and x_2 respectively. What are the dimensions of diffusion constant D? $[\boldsymbol{L^2T^{-1}}]$
2. The period of oscillation of a simple pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$ whereby 100 vibrations were taken to measure 200 seconds. If the least count for the time and length of a pendulum of $1m$ is $0.1s$ and $1mm$ respectively. Calculate the maximum percentage error in the measurement of g. $\boldsymbol{[10.1\%]}$
3. A box weighing $80N$ is supported by two wires with tension T_1 and T_2 as shown in the figure below. Find the tension in each wire. $\boldsymbol{[40N, 69.28N]}$



4. A jet engine on a test bed takes in $40kg$ of air per second at a velocity of $100m/s$ and burns $0.8kg$ of fuel per second. After compression and heating the exhaust gases are ejected at $600m/s$ relative to the aircraft. Calculate the thrust of the engine.

[20480N]

5. A spaceship is launched into a circular orbit close to the earth's surface. What additional velocity has to be imparted to the spaceship in order to overcome the gravitational pull? **[7926.3m/s]**
6. A particle of mass $0.3kg$ moves with an angular velocity of $10rad/s$ in a horizontal circle of radius $20cm$ inside a smooth hemispherical bowl. Find the reaction of the bowl on the particle and the radius of the bowl. **[6.7N, 22.3cm]**
7. A wire of diameter $0.1mm$ and resistivity $1.69\times10^{-8}\Omega m$ with temperature coefficient of resistance of $4.3\times10^{-3}K^{-1}$ was required to make a resistance. What length of the wire is required to make a coil with a resistance of 0.5Ω? If on passing a current of $2A$ the temperature of the coil rises by 10^0C, what error would arise in taking the potential drop as $1.0V$? **[23.22cm, 0.0843V]**
8. Show that the total energy of a satellite in a circular orbit equals half its potential energy.
9. A fireman standing at a horizontal distance of $38m$ from the edge of a burning store building aimed to raise streams of water at an angle of 60^0 into the first floor through an open window which is at $20m$ high from the ground level. If the water strikes on this floor $2m$ away from the outer edge, sketch the diagram of the trajectory. At what speed will the water leave the nozzle of the fire hose? **[24.85m/s]**
10. A heating coil of nichrome wire with cross sectional area of $0.1mm^2$ operate on a $12V$ supply and has a power of $36W$ when immersed in water at $373K$. Calculate the length of the wire. Temperature coefficient of resistance of nichrome is $8\times10^{-5}K^{-1}$.

[0.37m]

11. A simple pendulum is suspended from the ceiling of a car taking a turn of radius $10m$ at a speed of $36kmh^{-1}$. Find the angle made by the string of the pendulum with the vertical if this angle does not change during the turn. **[45.6^0]**
12. A hemispherical bowl of radius R is rotating about its axis of symmetry, which is kept vertical. A small block is kept in the bowl and rotates with it without slipping. If the

surface of the bowl is smooth and the angle made by the radius through the block with the vertical is θ, show that the angular speed of the bowl is given by $\sqrt{\frac{gcos\theta}{R}}$

13. Prove that at a very small temperature difference, $\Delta T = T_b - T_s$ Newton's law of cooling obeys Stefan's law whereby T_b is the temperature of the body and T_s is the temperature of the surrounding.
14. One mole of a gas expands from volume V_1 to a volume V_2. If the gas obeys the Van der Waal's equation: $\left(P + \frac{a}{v^2}\right)(v - b) = RT$, derive the formula for workdone in this process.
15. Show that the total energy of a body executing S.H.M is independent of time. Assume the initial phase is zero and the displacement equation is given by: $y = \text{A}\sin\ \omega t$.
16. If the earth were made of lead of relative density 11.3, what would be the value of acceleration due to gravity on the surface of the earth? Radius of the earth is $6400km$ and $G = 6.67\times10^{-11}Nm^2kg^{-2}$. $[\mathbf{20.2ms^{-2}}]$
17. The period T of oscillation of a body is said to be $(1.5 \pm 0.002)s$ while its amplitude A is $(0.3 \pm 0.005)m$ and the radius of gyration K is $(0.28 \pm 0.005)m$. If the acceleration due to gravity g was found to be related to T, A and K by the equation: $\frac{gA}{4\pi^2} = \frac{A^2+K^2}{T^2}$, find the numerical value and percentage error in g.

$[\mathbf{(9.8393 \pm 0.5293)ms^{-2}, 5.38\%}]$

18. Suppose the slope of the best-fit line is 1.0 and slopes of maximum and minimum worst lines are 1.16 and 0.81 respectively. Estimate the value of slope of the graph.

$[1.0 \pm 0.18]$

19. A block of mass, $m = 100g$ is placed on a rough inclined plane. The plane makes an angle $\theta = 30^0$ with the horizontal. Determine the value of friction force that is required to keep the block at rest. **[0.49N]**
20. Due to change in main voltage the temperature of an electric bulb rises from $3000K$ to $4000K$. What is the percentage change in electric power consumed? **[216%]**
21. An insect is released from rest at the top of a smooth bowling ball such that it slides over the ball. Prove that it will lose its footing with the ball at an angle of about 48^0 with the vertical.

22. A ball is projected with a velocity v at an angle θ to the horizontal. It passes through a vertical point y and horizontal point x. If R is the horizontal range, prove that $tan\theta = \frac{y}{x}(\frac{R}{R-x})$
23. Show that for elastic collision the kinetic energy is conserved.
24. A particle moving in S.H.M along the straight line has a velocity of $4m/s$ when its displacement from the mean position is $3m$ and $3m/s$ when the displacement is $4m$. Find the time taken to travel $2.5m$ from the positive extremity of its oscillation.

[$1.047s$]

25. A particle executes S.H.M with amplitude A. At what distance from the mean position its K.E is equal to its P.E? **[$A/\sqrt{2}$]**
26. A simple pendulum consists of small sphere of mass m carrying positive charge q and suspended by a thread of length l. The pendulum is placed in a uniform electric field of strength E directed vertically upwards. If the electrostatic force acting on the sphere is less than the gravitational force, show that the period of oscillation is given by: $T = 2\pi\sqrt{\frac{l}{(g-qE/m)}}$
27. Imagine a tunnel is dug along a diameter of the earth. Show that a body dropped from one end of the tunnel executes S.H.M. What is the time period of this motion? Assuming the earth to be a sphere of uniform density $\rho = 5520kgm^{-3}$ and $G = 6.67\times10^{-11}\ Nm^2kg^{-2}$. **[$5059.45s$]**
28. In the first second of its flight a rocket ejects $\frac{1}{60}$ of its mass with a relative velocity of $2400ms^{-1}$. Find its acceleration. What is the final velocity if the ratio of initial to final mass of the rocket is 4 at a time of 60 seconds? **[$30ms^{-2},\ 2727ms^{-1}$]**
29. A model airplane X has a mass of $0.5kg$ and has a control wire OX of length $10m$ attached to it when it flies in horizontal circle with wings horizontal. The wire OX is inclined 60^0 to the horizontal and fixed to a point O and X takes $2s$ once round its circular path. Calculate the tension in the control wire and the upward force on X due to the air. **[$49.35N, 47.64N$]**

30. Prove that minimum height at which the body has to be released on a smooth loop-looping apparatus in order for it to successfully complete the circular loop is given by $\frac{5}{2}R$, where R is radius of the loop.
31. An artificial satellite of mass M travels around the earth just above the surface (very close to earth's surface). Find the length of the simple pendulum that will have the same period as that of the satellite. (Give your answer in terms of the diameter of the earth). $[\boldsymbol{l = D/2}]$
32. Use work-energy theorem in rotational motion to show that torque for a rotating rigid body is given by: $\tau = I\alpha$
33. An aluminium foil of relative emittance 0.2 is placed between two concentric spheres at temperatures $300K$ and $200K$ respectively. Calculate the temperature of the foil after the steady state is reached. Also calculate the rate of energy transfer between one of the spheres and the foil. Stefan's constant, $\sigma = 5.67\times10^{-8}Wm^{-2}K^{-4}$.
$[\boldsymbol{263.9K, 36.85Wm^{-2}}]$
34. What amount of heat is to be transfer to nitrogen in an isobaric heating so that the gas may perform $2J$ of work? Atomicity, $\gamma = 1.4$ $[\boldsymbol{7J}]$
35. Show that the slope of an adiabatic curve is always greater than that of an isothermal curve.
36. Show that the drift velocity acquired by electrons in a conductor is given by: $v_d = \frac{I}{neA}$ where all symbols carry their usual meaning.
37. Briefly explain three techniques applicable for improving plant environment for better plant growth.
38. The reading of a pressure meter attached with closed water pipe is $4\times10^5 N/m^2$. On opening the valve of the pipe, the reading of pressure meter is reduced to $3.2\times10^5 N/m^2$. Calculate the speed of water flowing in the pipe. $[\boldsymbol{12.65ms^{-1}}]$
39. A hydrometer has a cylindrical glass stem of diameter $0.50cm$. It floats in water of density $1000kg/m^3$ and surface tension 7.2×10^{-2}N/m. A drop of liquid detergent added to the water reduces the surface tension to $5.0\times10^{-2}N/m$. What will be the change in length of the exposed portion of the glass stem? Assume that the relevant angle of contact is always zero. $[\boldsymbol{1.8mm}]$

40. A heavy rigid bar is supported horizontally from a fixed support by two vertical wires A and B, of the same initial length and which experience the same extension. If the ratio of diameter of A to that of B is 2 and the ratio of Young's modulus of A to that of B is 2. Calculate the ratio of the tension in A to that in B. If the distance between the wires is d, calculate the distance of wire A from the center of gravity of the bar.

[8, $d/9$]

41. Parallel metal plates 3mm apart carry equal and opposite charge densities of $\pm 2\mu C/m^2$. A proton is released from rest at the positive plate. What is the speed of proton just as it strikes the negative plate? Mass of proton, $m_p = 1.67\times10^{-27}kg$ and $e = 1.6\times10^{-19}C$.

42. The equation $y = a\sin(\omega t - kx)$ represnts a plane wave travelling in a medium along x direction, y being the displacement at the point x at time t. Deduce whether the wave is travelling in the positive or in the negative x direction. If $a = 1.0\times 10^{-7}m$, $\omega = 6.6\times10^{3}rads^{-1}$ and $k = 20m^{-1}$, calculate the speed of the wave, the maximum speed of the particle of the medium due to the wave and the phase difference between two positions of the same particle in an interval of $0.25s$.

[$Positive\ x-direction, 330ms^{-1}, 6.6\times10^{-4}ms^{-1}, 1650rad$]

43. Four charges of $+4, -3, +2$ and $+3$ coulomb are placed at the corners of a square of each side $1m$. Find the electric field at the centre of the square. Permittivity of free space, $\varepsilon_0 = 8.85\times10^{-12}Fm^{-1}$. **[$1.138\times10^{11}NC^{-1}$]**

44. A police car's siren emits a sinusoidal wave with frequency $300Hz$. The speed of sound is $340m/s$ and the air is still. Find the wavelength of the waves in front of and behind the siren if the car is moving at $30m/s$. **[$1.03m, 1.23m$]**

45. The face of lens has radius of curvature of $50cm$. It is placed in contact with flat plate and Newton's rings are observed normally with reflected light of wavelength $5x10^{-6}cm$. Calculate the radii of the fifth and tenth bright rings.

[$0.034cm, 0.049cm$]

46. A radioactive source in the form of a metallic sphere of radius $1.0cm$ emits β particles at the rate of 5×10^{10} particles per second. If the source is electrically insulated, ho long will it take for its electric potential to be raised by $2V$? Assuming

that 40% of the emitted β particles escape the source. Given $\varepsilon_0 = 8.85\times10^{-12}Fm^{-1}$, $e = 1.6\times10^{-19}C$ **[$0.46ms$]**

47. A small speaker emitting a note of frequency $250Hz$ is placed over the open upper end of a vertical tube that is full of water. When the water is gradually run out of the tube the air column resonates. If the initial and final positions of water surface below the top are $0.31m$ and $0.998m$ respectively, calculate the speed of sound in air and the end correction of the tube. **[$334ms^{-1}, 0.034m$]**
48. A lagged copper rod is uniformly heated by a passage of an electric current. Show by considering a small section dx that the temperature θ varies with distance x along a rod in a way that, $H = -k\left(\frac{d^2\theta}{dx^2}\right)$ where k is the thermal conductivity and H is the rate of heat generation per unit volume.
49. A cup of tea kept in a room with a temperature of 22^0C cools from 66^0C to 63^0C in $1\ minute$. How long will the same cup of tea take to cool from the temperature of 43^0C to 40^0C under the same condition? **[$2.2min$]**
50. A capacitor C_1 is charged to a potential difference V_1. The charging battery is removed and the capacitor is then connected to uncharged capacitor C_2. What is the final potential difference V across the combination? Find the stored energy before and after the switch is thrown and the energy loss.

[$V = \frac{C_1V_1}{(C_1+C_2)}$, $E_i = \frac{C_1V_1^2}{2}$, $E_f = \frac{C_1V_1^2}{2(C_1+C_2)}$]

51. The spherical shell of Van de Graff generator is to be charged to a potential of 10^6V. Calculate the minimum radius of the shell if the dielectric strength of air is $3\times10^6Vm^{-1}$. **[$0.33m$]**
52. In a Van de Graff generator, the shell electrode is at 25×10^5V. The dielectric strength of the gas surrounding the electrode is $5\times10^7Vm^{-1}$. Calculate the minimum radius of the spherical shell. **[$5cm$]**
53. Sketch a graph to show how a charge Q varies with time t during discharging process of a capacitor. What is the significance of the gradient at any point along the graph?

[*Gradient represents discharge current*]

54. A cell of e.m.f E and internal resistance r is used to drive current I through a load resistance R. Show that for maximum electric power to be transferred to the load, a load resistance R must be equal to the internal resistance r of the cell.
55. An open pipe of length $15cm$ and a pipe of length $11.5cm$ closed at one end are both surrounding their first overtones. If their notes are of the same frequency, what will be the end correction of the two pipes? State assumption made in arriving at your answer. $[\mathbf{0.5cm, Assumption: Pipes\ are\ of\ the\ same\ radius}]$
56. A particle rests on a horizontal platform that is moving vertically in simple harmonic motion with amplitude of $50mm$. If above a certain frequency the particle ceases to remain in contact with the platform throughout the motion. Determine the lowest frequency at which this situation will occur. At what position will the particle cease to remain in contact with the platform? $[\mathbf{2.23Hz, At\ highest\ position}]$
57. A capacitor of capacitance $300\mu F$ is connected in parallel with another capacitor of unknown capacitance C. The combination discharges through a resistor of 360Ω with a time constant of 180 seconds. Calculate the value of unknown capacitance C. What will be the time constant if the capacitors above are connected in series?

$[\mathbf{200\mu F, 43.2s}]$

58. Show that the unit of CR (time constant) is seconds and prove that for a discharging capacitor it is the time taken for the charge to fall by 37%.
59. A capacitor of $12\mu F$ is connected in series with a resistor of $0.7M\Omega$ across a $250V$ dc supply. Calculate the initial charging current and potential difference across the capacitor after4.2 seconds. $[\mathbf{0.36mA, 98.4V}]$
60. Prove that if two spherical shells of a spherical capacitor have their radii approximately equal, the device approximates a parallel plate capacitor.
61. Ice is forming on the surface of a pond. When it is $4.6cm$ thick the temperature of the ice in contact with the air is $260K$ while the surface in contact with the water is at temperature $273K$. Find the rate at which the thickness of the ice is forming. Given $\rho_{ice} = 920kgm^{-3}, k_{ice} = 1.6Wm^{-1}K^{-1}$ and $L_{ice} = 334{,}000Jkg^{-1}$

$[\mathbf{1.47\times10^{-6}ms^{-1}}]$

62. Two spherical soap bubbles of radii $30mm$ and $10mm$ coalesce so that they have a common surface. If they are made from the same solution and the radii of the bubbles

remain the same after they join together, derive the formula for radius of curvature of their common interface and find its value. $[\boldsymbol{r = \frac{r_1 r_2}{r_1 - r_2}\ , 15mm}]$

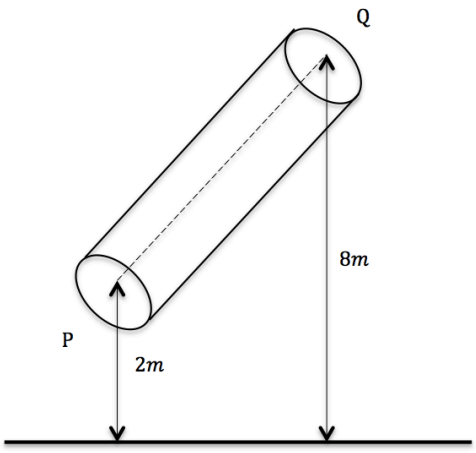
63. An electron beam passes through parallel plate capacitor with a velocity of $10^7 ms^{-1}$. The length of each plate is $10cm$ while the distance between the plates is $5cm$. Calculate the deflection angle of the beam if the electric intensity between the plates is $20Vcm^{-1}$. Given $e = 1.6\times10^{-19}C$ and $m_p = 1.67\times10^{-27}kg$ $[\boldsymbol{\theta = 19.37^0}]$
64. A stationary wave is given by $y = 5sin\frac{\pi x}{3}cos40\pi t$, where x and y are in cm and t is in seconds. What are the equations of the component waves whose superposition gives rise to the above wave? $[\boldsymbol{y_1 = \frac{5}{2}\sin\left(\frac{\pi}{3}x - 40\pi t\right), y_1 = \frac{5}{2}\sin\left(\frac{\pi}{3}x + 40\pi t\right)}]$
65. The e.m.f (in microvolts) in a lead-iron thermopile, one junction of which is at 0^0C is given by $V = 1784t - 2.4t^2$, where t is the temperature of the hot junction. Calculate the neutral temperature. $[\boldsymbol{3717^0C}]$
66. A uniform spring has a certain mass suspended from it and its period for vertical oscillation is T_1. The spring is now cut into two equal halves and the same mass is suspended from one of the halves. The period of vertical oscillation is now T_2. Calculate T_2/T_1? $[\boldsymbol{\sqrt{1/2}}]$
67. Two similar balls of mass m are hung from silk threads of length a and carry similar charge q. Assume θ is small enough that $tan\theta = sin\theta$. To this approximation, show that: $x = (\frac{q^2 a}{2\pi\varepsilon_0 mg})^{\frac{1}{3}}$ where x is the distance of separation.
68. Show that the radial heat flow across the coaxial cylinder is given by $H = \frac{2\pi KL(T_2 - T_1)}{ln\left(\frac{r_2}{r_1}\right)}$ where K is the thermal conductivity, L is the length of the cylinder, r_1 and r_2 are the radii of inner and outer parts of the cylinder respectively.
69. There are two angles of projection for which the horizontal range is the same. Show that the sum of the maximum heights for these two angles is independent of the angle of projection.
70. A large open tank has two holes in the wall. One is a square of side l at a depth y from the top and the other is a circular hole of radius r at a depth $4y$ from the top.

When the tank is completely filled with water the quantities of water flowing out per second from both holes are the same. Find the value of the radius. $[\boldsymbol{l/\sqrt{2\pi}}]$

71. If the energy required to blow a soap bubble of radius r is E, show that the extra energy needed to double the radius of the bubble is given by $\Delta E = 24\pi\gamma r^2$ where γ is the surface tension.
72. A horizontal tube A of length $50cm$ and radius of $0.1mm$ is joined to another horizontal tube B of length of $40cm$ and radius $0.2mm$. If a liquid passing through the tubes enters A at a pressure of $85cm$ of mercury and leaves B at a pressure of $76cm$ of mercury. What the pressure in Nm^{-2} at the junction of tubes?

$[\boldsymbol{1.019\times10^5 Nm^{-2}}]$

73. Ultrasound of frequency $4.0MHz$ is incident at an angle of 30^0C to a blood vessel of diameter $1.6mm$. If a dopper shift of $3.2kHz$ is observed. Calculate the blood flow velocity. Assume that the speed of ultra sound is $1.5km/s$. $[\boldsymbol{0.69ms^{-1}}]$
74. An X-ray unit operating at $100kV$ produces a current of $20mA$. Use this information to calculate:
    (i) The number of electrons striking the target per second $[\boldsymbol{1.27\times10^{17} electrons/s}]$
    (ii) The speed of electrons incident on the target. $[\boldsymbol{1.87\times10^8 m/s}]$
    (iii) The lowest wavelength of the continuous X-ray spectra. $[\boldsymbol{1.24\times10^{-11} m}]$
75. The half-life of $Strontium-90$ is $28.8years$. Find
    (i) Its decay constant in seconds. $[\boldsymbol{7.63\times10^{-10} s^{-1}}]$
    (ii) The initial activity of $4g$ of strontium. $[\boldsymbol{2.04\times10^{13} Bq}]$
    (iii)How much activity will be remaining after 4 half lives. $[\boldsymbol{1.275\times10^{12} Bq}]$
76. A non-viscous fluid of constant density $1000kg/m^3$ flows in a streamline motion along a tube of variable cross-section. The tube is kept inclined in the vertical plane as shown in figure below. The area of cross-section of the tube at two points P and Q at heights $2m$ and $5m$ are respectively $4\times10^{-3}m^2$ and $8\times10^{-3}m^2$. The velocity of the fluid at point P is $1m/s$. Find the work done per unit volume by gravity and pressure forces as the liquid flows from point P to Q. $[\boldsymbol{29025 Jm^{-3}}]$



77. A vertical capillary tube $10cm$ long tapers uniformly from an internal diameter of $1mm$ at the lower end to $0.5mm$ at the upper end. The lower end is just touching the surface of a pool of liquid of surface tension $6\times10^{-2}N/m$, density $1200kgm^{-3}$ and zero angle of contact with the tube. Calculate the capillary rise, justifying your method. $[\mathbf{2.3cm}]$

78. A long straight conductor P carrying a current of $2A$ is placed parallel to a short conductor Q of length $0.05m$ carrying a current of $3A$. The two conductors are $0.1m$ apart. Calculate the flux density due to P at Q and the approximate force on Q. $[\mathbf{4\times10^{-6}T, 6\times10^{-7}N}]$

79. An electron moving along the $+x\ axis$ at a speed $v = 5.5\times10^{6}m/s$ enters a uniform magnetic field that makes an angle of $72°$ with the $+x\ axis$. If the magnitude of magnetic field is $0.32T$, calculate:
    (i) The pitch $[\mathbf{0.19mm}]$
    (ii) The radius of trajectory $[\mathbf{0.093mm}]$
    (iii) The time required for one trip around the helix $[\mathbf{1.12\times10^{-10}s}]$

80. Find the current through a loop need to create a maximum torque of $11.8Nm$. The loop has 100 square turns each of length $22cm$ and placed in a uniform magnetic field of magnitude $0.96T$. $[\mathbf{40.63A}]$

81. A toroid of 1200 turns with an air core has a radius of $15cm$ and cross section area of $12cm^2$. What is the self inductance of the coil? $[\mathbf{2.3\times10^{-3}H}]$

82. (i) What are the sources of heat energy within the interior of the earth?

(ii) What are the factors that influence the flow of heat from the interior of the earth?

83. A transmitting antenna at the top of the tower has a height of $32m$ and that of receiving antenna is $50m$.What is the maximum distance between them for the satisfactory communication in line of sight? **[45536.8m]**

84. Consider a common base transistor, prove that:

$$Power\ gain = Current\ gain \times Voltage\ gain$$

85. When light of frequency $5.4\times10^{14}Hz$ is shone on metal surface the maximum energy of the electons emitted is $1.2\times10^{-19}J$. If the same surface is illuminated with light of frequency $6.6\times10^{14}Hz$, the maximum enegy of the electrons emitted is $2.0\times10^{-19}J$. Calculate the value of Plank's constant and work function in eV.

[$6.67\times10^{-34}Js, 1.5eV$]

86. Consider the alpha decay equation: ${}^{226}_{88}Ra \rightarrow {}^{222}_{86}Rn + {}^{4}_{2}He + Q$

Given the masses are $226.0254u$ for ${}^{226}_{88}Ra$, $222.0175u$ for ${}^{222}_{86}Rn$ and $4.0026u$ for ${}^{4}_{2}He$.

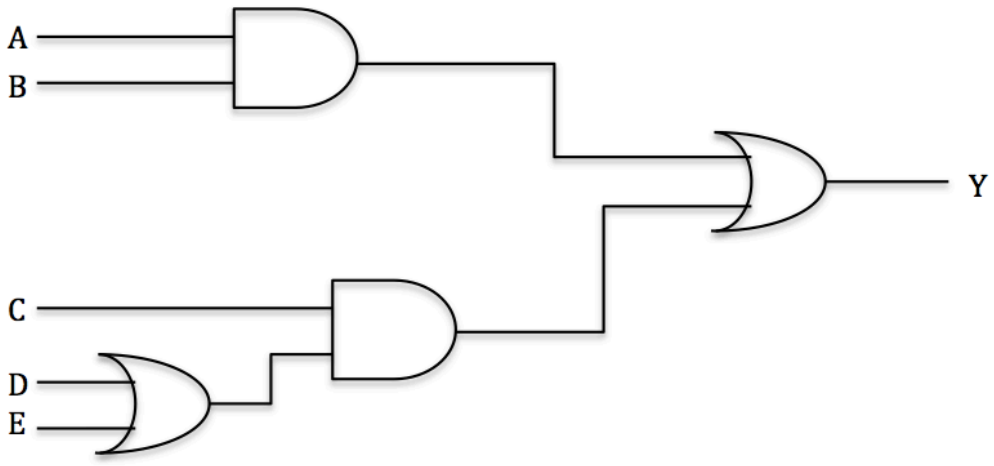
(i) Calculate the Q value for this process. **[$4.94MeV$]**

(ii) Calculate the kinetic energy of the alpha particles from this decay process.

[$4.85MeV$]

(iii) Why are the answers in (i) and (ii) different?

87. Write down the Boolean Expression for Y from the figure below.



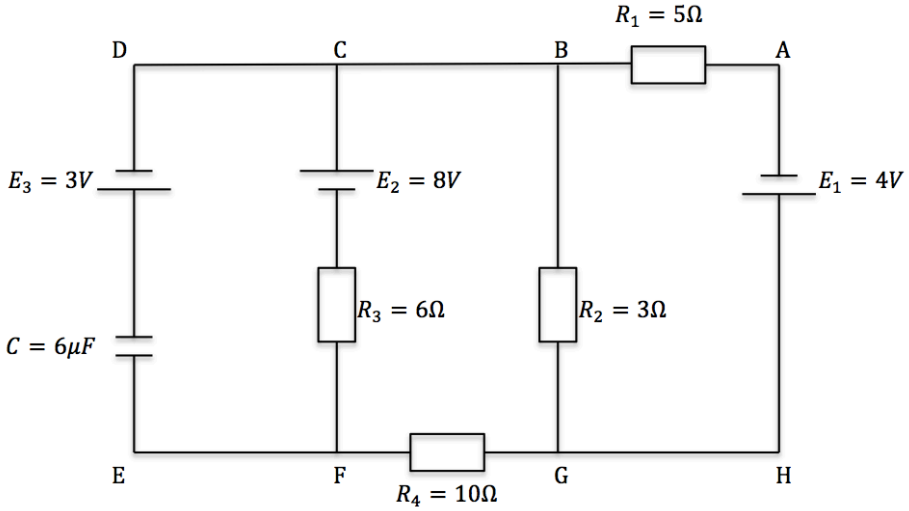
88. Two garages have a common gate that needs to open automatically when a car

is detected to enter either of the garages. Draw a truth table and its equivalent logic gate circuit.

89. Show that de-Broglie wavelength of an electron that has been accelerated through a potential difference V from rest is approximately given by:

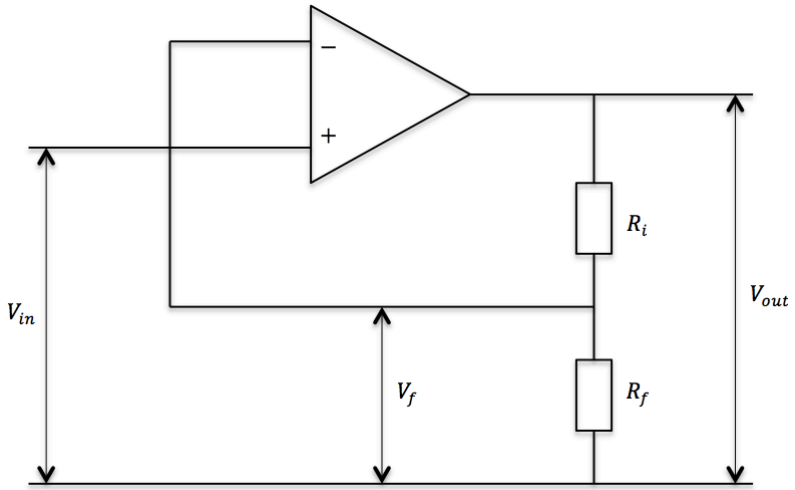
$$\lambda = \frac{12.27}{\sqrt{V}}\text{Å}$$

90. The circuit diagram below contains a capacitor, resistors and three cells of negligible internal resistance. Compute the current passing through the 3Ω resistor and the charge on the capacitor. $[\mathbf{0.168A, 46.86\mu C}]$



91. Explain conduction of electricity of electricity in gases

92. Study the figure below then answer the questions that follow.



(i) Show that the gain is given by: $A = 1 + \frac{R_i}{R_f}$

(ii) Suppose that $R_i = 9k\Omega$ and $R_f = 1k\Omega$. Calculate the output voltage if the input voltage is $0.5V$. **[5V]**

'Happy holidays'