KING'S COLLEGE, BUDO

PHYSICS SEMINAR - 15TH JUNE, 2019

PAPER 2 QUESTIONS

SECTION A (Geometrical Optics - Light)

1(a) For a converging mirror define the terms
(i) radius of curvature (1)
(ii) principal focus (1)

(b) With the aid of a ray diagram derive the mirror formula for a convex mirror. (6)

(c) (i) With the aid of a ray diagram, describe the structure and action of a reflecting telescope in normal adjustment. (5)
(ii) State two advantages of a reflecting telescope over a refracting one. (2)

(d) An astronomical telescope with an objective of focal length 84.0 cm and an eyepiece of focal length 8.0 cm. The eyepiece is shifted until the final image is formed at a distance of 64.0 cm from the objective. Find the distance between the two lenses. (5)

[ST. MARK'S COLLEGE, NAMAGOMA]

2(a) (i) Explain the difference between the terms **magnifying power** and **magnification** as applied to optical instruments. (3)

(ii) State what is meant by **normal adjustment** in the case of an astronomical telescope. (1)

(iii) With the aid of a ray diagram, explain how the two lenses of a telescope form, at infinity, a magnified virtual image of a real distant object. (4)

(b) A telescope has an objective of focal length 80cm and an eyepiece of focal length 2.0cm. It is focused on the moon, whose diameter subtends an angle of 8.0×10^{-3} rad at the objective. The eyepiece is adjusted so as to project a sharp image of the moon onto a screen placed 20cm from the eyepiece lens. Calculate:

(i) the diameter of the intermediate image formed by the objective lens. (3)

(ii) the diameter of the image on the screen. (3)

(iii) the separation of the lenses. (2)

(c) Explain, with the aid of a diagram, the formation of the **eye-ring** in a telescope and state why it is the best position for the eye of the observer. (4)

[ST. MARY'S COLLEGE KISUBI]

3(a) (i) What is meant by ***refraction of light***? (1)

(ii) Explain why a pond of clear water appears shallower, than it actually is, to an observer. (3)

(iii) Describe an experiment to determine the refractive index of a liquid using the air-cell method. (6)

(b) A lens forms a sharp image of height h_1 on a fixed screen. As the lens is moved towards the screen another sharp image of height h_2, of the same object, is formed on the screen. If the object position remained the same in both cases, obtain an expression for the height of the object. (4)

(c) A converging lens of focal length 30 cm is placed between an object and a diverging lens of focal length 5 cm. If the object is 6 metres from the converging lens and 6.20 metres from the diverging lens, determine

(i) the position and nature of the image formed. (4)

(ii) the magnification of the image. (2)

[SEETA HIGH SCHOOL – MBALALA CAMPUS]

4(a) (i) State the conditions for total internal reflection. (2)

(ii) Draw a labeled diagram of a named device to show (without description) an application of total internal reflection. (2)

(b) Explain how a fish in a pond is able to enjoy a 180° field of view. (3)

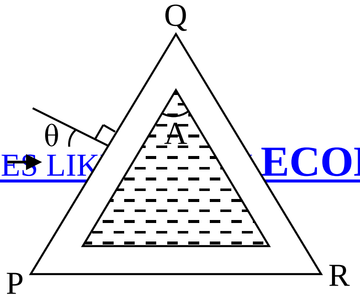
(c) Show that when a ray of light passes through different media separated by plane boundaries

$$n \sin i = \text{constant}$$

where ***n*** is the absolute refractive index of a medium and ***i*** is the angle made by the ray with the normal in the medium. (4)

(d) Describe an experiment to measure the refractive index of glass of rectangular shape, using a pin, by the apparent depth method. (4)

(e) The figure below shows a liquid of refractive index 1.33 enclosed by glass of uniform thickness. A ray of light, incident on face PQ at an angle of incidence, θ, emerges through face QR.



As the angle θ is reduced, suddenly the emergent ray disappears when
$\theta = 16^o$.Find the angle A. (5)

[MT. ST. MARY'S NAMAGUNGA]

SECTION B (Physical Optics – Waves)

1(a) (i) Distinguish between **free** and **damped** oscillations. (2)
(ii) What is a **wave**? (1)

(b) A mechanical wave in a certain medium is represented by the equation

$$\mathbf{y = 0.3\sin 2\pi(35t - 0.4}x\mathbf{)}$$

where all distances are in metres.

(i) State what each of the symbols x and y represents. (2)

(ii) Find the velocity of the wave (3)

(c) (i) What is meant by **resonance** in waves? (1)
(ii) Describe an experiment to determine the velocity of sound in air using the resonance method. (6)

(d) (i) What is a **harmonic** in sound. (1)

(ii) A string of length 0.50 m and mass 5.0 g is stretched between two fixed points. If the tension in the string is 100 N, find the frequency of the second harmonic.

(Velocity of sound along the string $= \sqrt{\left(\frac{\text{Tension}}{\text{Mass per unit length}}\right)}$) (4)

[GAYAZA HIGH SCHOOL]

2(a) (i) What is meant by interference of waves? (2)

(ii) State the conditions necessary for the observation of interference pattern. (2)

(iii) Describe how interference can be used to test for the flatness of a surface. (3)

(b) Describe with the aid of a labeled diagram, how the wavelength of monochromatic light is measured using Young's double-slit method. (5)

(c) Two microscope slides are in contact at one end and are separated by a thin piece of paper at the other end. Monochromatic light is directed normally on the wedge.

(i) What type of fringes will be observed? (2)

(ii) Explain what will be observed if a liquid is introduced between the slides. (2)

(d) When monochromatic light of wavelength 5.0×10^{-7}m is incident normally on a transmission grating, the second order diffraction line is observed at an angle of 27^0. How many lines per centimeter does the grating have? (4)

[SEETA HIGH – MAIN CAMPUS]

3(a) What is meant by

(i) ***wavelength*** of a wave. (1)

(ii) ***pitch*** of a musical note (1)

(b) (i) A source of sound of frequency f, is moving with velocity u_s away from an observer who is moving with velocity u_o in the same direction. If the velocity of sound is V, derive an expression for the frequency of sound heard by the observer. (5)

(ii) Explain what happens to the pitch of the sound heard by the observer in (b)(i) above when the observer moves faster than the source (2)

(c) (i) A star which emits light of wavelength λ is approaching the earth with velocity v. If the velocity of light is c, write down an expression for the shift in the wavelength of the emitted light. (1)

(ii) Describe how the speed of a star may be measured using the Doppler effect. (4)

(d) Two open pipes of lengths 78 cm and 80 cm are found to give a beat frequency of 5 Hz when each is sounding in its fundamental note. If the end errors are 1.7 cm and 1.5 cm respectively, calculate the;

(i) velocity of sound in air (4)

(ii) frequency of each note. (2)

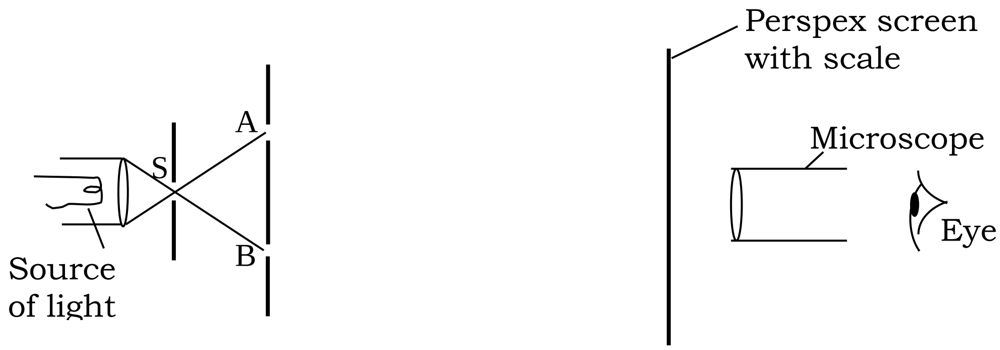
[TRINITY COLLEGE NABBINGO]

4(a) (i) What evidence does suggest that light is a transverse wave while sound is a longitudinal one? (1)

(ii) What is meant by ***division of wavefronts*** as applied to interference of waves? (2)

(b) Two slits X and Y are separated by a distance s and illuminated with light of wavelength λ. Derive the expression for the separation between successive fringes on a screen placed a distance D from the slit. (5)

(c) A source of light, a slit, S, and a double slit (A and B) are arranged as shown below



(i) Describe what is observed on the screen through the microscope when a white source of light is used. (2)

(ii) Explain what is observed when slit S is gradually widened. (3)

(iii) How would you use the set up above to measure the wavelength of red light? (4)

(d) In Young's double-slit experiment, the 8^{th} bright fringe is formed 6mm away from the centre of the fringe system when the wavelength of light used is 6.3×10^{-7} m. Calculate the distance of the screen from the slits if the separation of the two slits is 0.7 mm. (3)

[ST. LAWRENCE SCHOOLS & COLLEGES]

SECTION C (Magnetism and A.C circuits)

1(a) What is meant by the terms:

(i) Magnetic meridian (1)

(ii) Magnetic declination (1)

(b) Explain what happens to the angle of dip as one moves along the same longitude from the Equator to the North pole. (2)

(c) (i) Write down an expression for the magnetic flux density at the centre of a narrow circular coil of radius r having N turns when a current I is flowing in it. (1)

(ii) Describe an experiment to determine horizontal component of the Earth's magnetic flux density at a certain location. (5)

(d) A circular coil of 4 turns and diameter 14.0 cm carries a current of 0.35A. It is placed at the equator with its plane along the magnetic meridian. Calculate the direction and magnitude of the resultant magnetic flux density at the position if the earth's magnetic flux density at the location is 1.8×10^{-5} T. (4)

(e) (i) What is meant by the term ***magnetic moment*** of a coil? (1)

(ii) Explain why a moving coil galvanometer must have the following:

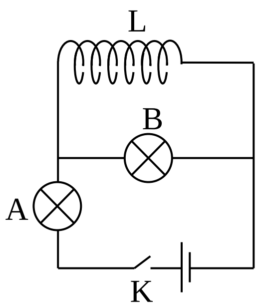
A radial magnetic field,
Fine hair springs,
Large number of turns
A conducting former. (5)

[UGANDA MARTYRS S.S NAMUGONGO]

2(a) What is meant by
(i) self- induction (1)

(ii) eddy current (1)

(b) The diagram shows an iron-cored coil, L, of many turns and negligible resistance with identical bulbs, A and B, connected in a circuit.



(i) When switch K is closed, at first both bulbs A and B light up, but soon B dims out while A becomes brighter. Explain these observations. (3)

(ii) If now K is opened, state and explain what is observed. (3)

(c) (i) Explain the origin of the back emf in a motor. (2)

(ii) A motor, whose armature resistance is 2Ω, is operated on 240V mains supply. If it runs at 3000 rev min^{-1} when drawing a current of 5 A, at what speed will it run when drawing a current of 15 A? (3)

(d) (i) With the aid of a labeled diagram, describe the mode of action of a simple d.c generator. (5)

(ii) Sketch the output against time of a simple d.c generator. (1)

(iii) State two factors that determine the polarity of the output of a d.c generator. (1)

[BUDDO SECONDARY SCHOOL]

3 (a) Define the following terms as applied to voltage in alternating current circuits.
(i) ***Root-mean-square value***. (1)

(ii) ***Peak value***. (1)

(b) Derive the relationship between the root mean square value and the peak value of the alternating current. (4)

(c) With the aid of a labeled diagram, describe the mode of operation of a repulsion type moving iron ammeter. (5)

(d) A source of alternating current voltage of ***frequency f*** is connected across the ends of a pure inductor of ***self -inductance L***. Derive an expression for the inductive reactance of the circuit and explain the phase difference between the voltage and the current that flows. (5)

(e) A pure inductor of inductance 2H, is connected in series with a resistor of 500 Ω across a source of e.m.f 240 $V_{(r.m.s)}$, alternating at a frequency of 50 Hz. Calculate the potential difference across the resistor. (4)

[NABISUNSA GIRLS' SCHOOL]

4 (a) (i) Give two advantages of alternating current over direct current in power transmission. (2)

(ii) Explain the fact that an alternating current continues to pass through a capacitor whereas direct current cannot. (4)

(b) A sinusoidal voltage, $V = V_o \sin 2\pi ft$, is connected across a capacitor of capacitance, C. Derive an expression for the reactance of the capacitor. (4)

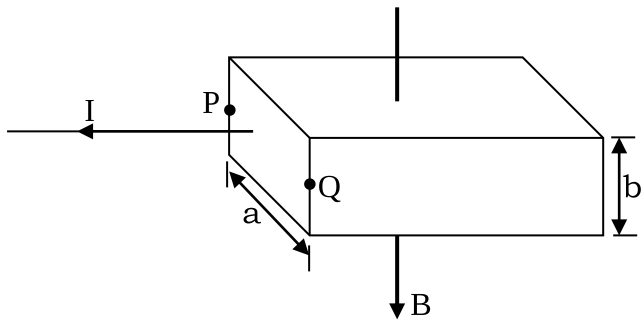
(c) With the aid of a labelled diagram describe the structure and action of a hot-wire ammeter. (6)

(d) Power of 60 kW produced at 120 V is to be transmitted over a distance of 2 km through cables of resistance 0.2 Ω m^{-1}. Determine the voltage at the output of an ideal transformer needed to transmit the power so that only 6% of it is lost. (4)

[MBARARA HIGH SCHOOL]

5 (a) What is a ***magnetic field***? (1)

(b) A magnetic field of flux density B is applied normally to a metal strip carrying current I as shown in the figure below.



(i) Account for the occurrence of a potential difference between points P and Q, indicating the polarity of this p.d. (3)

(ii) Derive an expression for the electric intensity between P and Q if the drift velocity of the conduction electrons is v. (3)

(c) (i) With the aid of a labeled diagram, describe the mode of action of a simple d.c generator. (5)

(ii) Sketch the output against time of a simple d.c generator. (1)

(iii) Explain how a back e.m.f is developed in a motor. (3)

(d) A square coil of side 10 cm has 100turns. The coil is arranged to rotate at 3000 rev. min^{-1} about a vertical axis perpendicular to the horizontal uniform magnetic field of flux density 0.8 T. The axis of rotation passes through the mid-points of a pair of opposite sides of the coil. Calculate the e.m.f induced in the coil when the plane of the coil makes an angle of 60^o with the field. (4)

[NAMILYANGO COLLEGE]

6(a) State the laws of electromagnetic induction. (2)

(b) A coil of area A is rotated at a frequency f in a uniform magnetic field of flux density B about an axis which is perpendicular to the field.

(i) Derive an expression for the e.m.f generated. (3)

(ii) Deduce at least four of the factors on which the e.m.f depends. (2)

(iii) State any two factors that reduce the efficiency of an a.c. generator to less than 100% (2)

(c) A rectangular coil of 50 turns is 15.0 cm wide and 30.0 cm long. If it rotates at a uniform rate of 3000 revolutions per minute about an axis parallel to its long side and at right angles to a uniform magnetic field of flux density 0.04T, find the peak value of the emf induced in the coil. (2)

(d) (i) A metallic circular disc of diameter d is in a uniform magnetic field of flux density B and the plane of the disc is perpendicular to the field. If the disc is rotated at a frequency f, derive an expression for the emf developed between its centre and rim. (4)

(ii) Describe an experiment to measure resistance by means of a rotating disc in a magnetic field. (5)

[ST. HENRY'S COLLEGE, KITOVU]

SECTION D (Electricity)

1(a) For a source of electricity, what is meant by

(i) electromotive force (1)

(ii) internal resistance? (1)

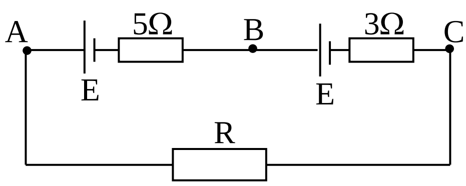
(b) (i) State the factors which determine the resistance of a wire of a given material. (2)

(ii) Explain why the resistance of a metal increases when the temperature of the metal is increased. (2)

(iii) Derive an expression for the equivalent resistance of three resistances, R_1, R_2 and R_3 connected in series. (3)

(c) You are provided with about 1 m of a bare constantan wire, an ammeter, a voltmeter, crocodile clips and some connecting wires.
Describe an experiment you would perform, using all but only the items provided, to determine the internal resistance of a cell. Give a diagram of your setup. (5)

(d) In the circuit shown below, each source has en e.m.f of 2V and negligible internal resistance.



When a voltmeter is connected between A and B, it reads 0V. Find

(i) the value of the resistance R. (4)

(ii) the reading of the voltmeter when connected between B and C. (2)

[MAKERERE COLLEGE SCHOOL]

2(a) Explain why the terminal p.d falls as the current drawn from a source increases. (3)

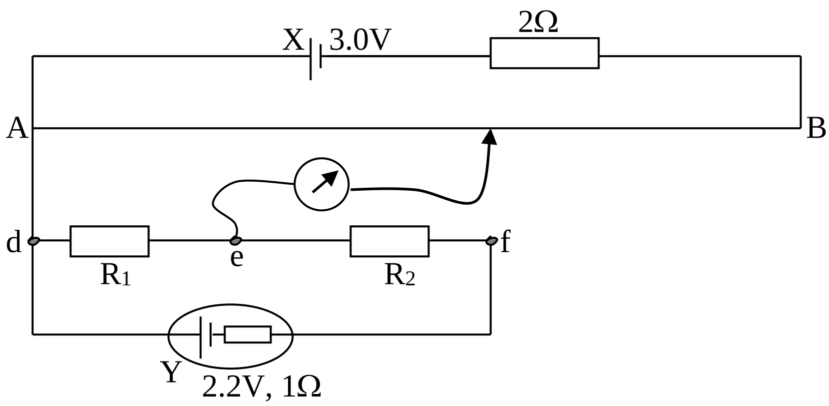
(b) A d.c source of e.m.f 12 V and negligible internal resistance is connected in series with two resistors of 400 Ω and R ohms, respectively. When a voltmeter is connected across the 400 Ω resistor, it reads 4 V while it reads 6 V when connected across the resistor of R ohms. Find the:

(i) resistance of the voltmeter (6)

(ii) value of R (1)

(c) Describe how you would use a slide wire potentiometer to measure the internal resistance of a dry cell. (5)

(d) In the circuit diagram shown below, AB is a slide wire of length 1.0 m and resistance 10 Ω. X is a driver cell of e.m.f 3.0 V and negligible internal resistance. Y is a cell of e.m.f 2.2 V and internal resistance 1.0Ω
When the centre-zero galvanometer is connected in turns to points **e** and **f**, the balance lengths obtained are 45.0 cm and 80.0 cm respectively.
Calculate the:
(i) current flowing through R_1. (3)
(ii) resistances of R_1 and R_2. (2)



[ST. MARY'S S.S KITENDE]

3 (a) Define the following terms as applied to a capacitor.

(i) capacitance (1)

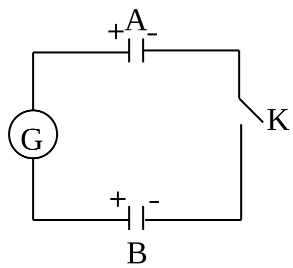
(ii) dielectric strength (1)

(b) Explain the action of a dielectric in a capacitor. (4)

(c) Describe an experiment to show that capacitance is affected by the thickness of the dielectric. (4)

(d) Derive an expression for the energy stored in a capacitor of capacitance C charge to a p.d V. (5)

(e) In the circuit shown below switch K is open, capacitors A and B have respective capacitances of 10μF and 15 μF and are charged to p.ds of 25 V and 20 V respectively.



A ballistic galvanometer G, with sensitivity of 2 divisions per μC joins the positive plates of the capacitors. If K is now closed, what will be the throw on G? (5)

[MENGO SENIOR SCHOOL]

4(a) (i) State Coulomb's law of electrostatics. (1)

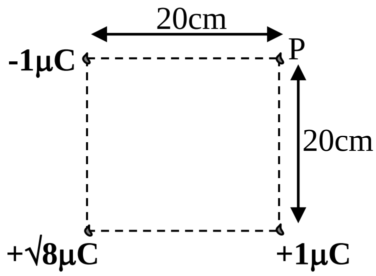
(ii) Define the terms ***electric field intensity*** and ***electric potential at a point***. (2)

(b) (i) Sketch graphs of the variation of electric potential and electric field intensity with distance from the centre of a charged conducting sphere. (2)

(ii) Describe how a conducting body may be positively charged but remains at zero potential. (3)

(iii) Explain how the presence of a neutral conductor near a charged conducting sphere may reduce the potential of the sphere. (3)

(d) Charges of **-1μC**, **+√8μC** and **+1μC** are placed at the corners of a square of side 20 cm as shown below



Calculate the:

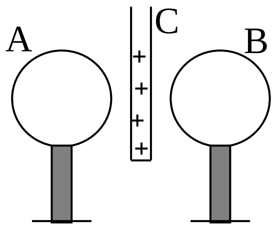
(i) electric potential at P (4)

(ii) electric field intensity at P (5)

[MARYHILL HIGH SCHOOL]

5(a) Explain how objects get charged by rubbing. (3)

(b) The diagram shows two metallic spheres A and B placed apart and each supported on an insulating stand. A positively charged plate C is placed mid-way between them but without touching them.



B is momentarily earthed in the presence of C. Finally C is withdrawn.

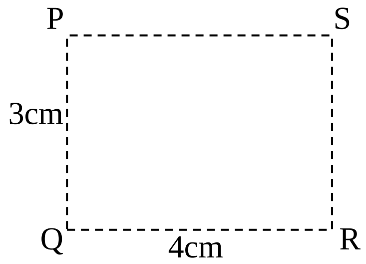
(i) Draw the spheres at the end of the operation and show the charge distribution over them. (2)

(ii) On the same diagram sketch the electric field pattern in the region of the spheres. (2)

(iii) Explain the change in p.d between the spheres as the spheres are moved further apart. (2)

(c) Describe an experiment to show that excess charge resides outside a hollow conductor. (5)

(d) Charges of **-3μC**, **+4μC** and **+3μC** are placed at the corners P, Q and R of a rectangular frame PQRS in which PQ = 3 cm and QR = 4 cm as shown in the figure below



If the charges are in vacuum, calculate the magnitude of the electric intensity at S due to the charges. (6)

[NTARE SCHOOL]

6(a) Define

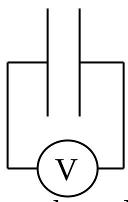
(i) ***capacitance*** (1)

(ii) ***dielectric strength*** (1)

(b) Describe an experiment to show the relationship between capacitor charge and potential difference. (5)

(c) Derive an expression for the equivalent capacitance of three capacitors connected in series. (3)

(d) Two large metal plates, placed parallel to each other and separated by dry air, form a capacitor. The arrangement is given a charge, then isolated and finally an ideal voltmeter is connected across its plates as shown.



Explain what is observed on the voltmeter reading when

(i) an insulating material is inserted in between the plates. (2)

(ii) the separation of the plates is increased. (2)

(e) When two capacitors, C_1 and C_2 are connected in series and the combination connected to a supply V the charge stored by C_1 is 8μC while the p.d. across C_1 is 4V. When the capacitors are connected in parallel to the same supply the total charge stored by the combination is 36μC. Given that $C_1 < C_2$, find;

(i) the capacitances of the capacitors (4)

(ii) the p.d, V, of the supply (2)

[NDEJJE S.S.S]

PAPER ONE QUESTIONS

SECTION A (MECHANICS)

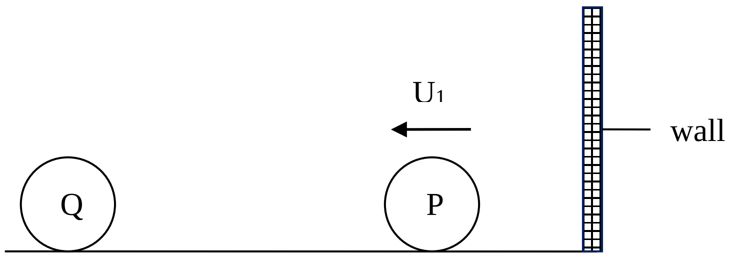
1. (a) (i) What is dissipative force? (1)

(ii) Give three examples of dissipative force (1)

(b) Experiments show that the frequency, f of a turning fork depends on the length, l of the prong, the density ρ and young's modulus Y. Using dimensional analysis,

Show that; $f = \frac{k}{l}\left(\frac{Y}{\rho}\right)^{\frac{1}{2}}$ k is a dimensionless constant.

(c)



The figure above Shows a ball P of mass M_1 and another ball Q of mass M_2 placed on a smooth horizontal table which rests against a vertical wall. Q is stationary, and P moves towards it with a velocity U_1. If both P and Q move with the same speed after P has undergone a collision with Q and then with the wall, and assuming that all collisions are perfectly elastic, show that, $(m_2 - m_1)^2 = m_1(m_1 + m_2)$

(d) A darts player stands 3.0m from a small soft board of mass 0.20kg which is suspended freely. The player throws a dart of mass 0.05kg such that the dart leaves his hand with a horizontal velocity at a point 1.80m above the ground. Assuming that air resistance is negligible, calculate the;

(i) time of flight of the dart

(ii) Initial speed of the dart

(iii) height to which the bottom of the soft board rises after the dart has embedded itself into it.

(NAALYA S.S.S NAMUGONGO)

2. (a) Define the term work hardening as applied to materials. (1)

   (b) A metal bar of length, L, Young's modulus, E, Gross – sectional area, A and Linear expansivity, α, is heated. If the temperature rise is $\theta^0 C$, derive an expression for the force exerted at the ends of the bar. (3)

   (c) Explain three ways of strengthening materials. (3)

   (d) A composite wire 2m long is made of two identical wires each of Young's modulus equal to $1.2x10^{11}Nm^{-2}$ respectively. If it is fixed vertically and made to support a 7kg mass in equilibrium at its free end, find the ratio of energy stored in the composite parts.

   (e) Explain why an aero plane has to slant in air in order to turn along a bent horizontal part.

   (f) A car of width 170cm goes round a horizontal bend of radius 200m. If its centre of gravity is 50cm above the ground, calculate the maximum safe speed for it not to topple. (3)

(OUR LADY OF AFRICA S.S.S)

3. (a) (i) Account for the existence of inter molecular forces. (2)

   (ii) Sketch a graph of potential energy against separation of two molecules in a substance. (3)

   (b) (i) Define surface tension. (1)

   (ii) Use the molecular theory to account for the surface tension of a liquid. (3)

(iii) Show that the excess pressure, P, in a soap bubble inside a liquid over outside pressure is given by $P = \frac{4\gamma}{r}$ where r is the radius of the bubble and ɣ its surface tension.

(4)

A soap bubble of diameter 1cm is formed at the top of a capillary tube of diameter 1mm dipping into a beaker of water. If the surface tensions of water and soap solution are $7.0x10^{-2}$ $Nm^{-1}$and $3.0x10^{-2}Nm^{-1}$ respectively. Calculate the height of water in the capillary tube above the water and state any assumptions you have made.

(5)

(d) Explain why large mercury drops flatten out where as small ones assume spherical shapes.

(NAALYA S.S.S, BWEYOGERERE)

4. (a) (i) Distinguish between lamina and turbulent flow.

(2)

(ii) Describe an experiment to demonstrate the two types of fluid flow.

(4)

(b) State Bernoulli's principle

(1)

(c) Water enters a house through a pipe with an inside diameter of 2.0cm at a pressure of $4.0x10^5Nm^{-2}$. The pipe leading to the second floor bathroom 5.0m above is 1.0cm in diameter. When the flow velocity at the inlet pipe is $4.0ms^{-1}$, find;

(i) the flow velocity

(ii) the pressure, in the bathroom.

(d) (i) State the factors on which the volume of a liquid issuing from a pipe per second depends.

(ii) Show that the volume of a liquid issuing from a pipe per second, V is given by

$$V = \frac{KPa^4}{\eta l}$$, where K is a dimensionless constant (4)

(e) Explain the origin of viscosity in a liquid. (3)

(SEROMA CHRISTIAN HIGH SCHOOL)

SECTION B (HEAT)

5. (a) Describe changes that occur when a gas undergoes:

(i) A reversible isothermal expansion (2)

(ii) A reversible adiabatic expansion. (2)

(b) State the first law of thermodynamics and explain how the law is applied when the gas is;

(i) heated at constant volume

(ii) compressed adiabatically (3)

(c) Derive an expression relating molar heat capacity at constant pressure, C_P and molar heat capacity at constant volume, C_V. (4)

(d) Given that helium gas is an ideal gas and monatomic of molecular mass 4.0, derive an expression for the total translational kinetic energy of the molecules of 1.0g of helium at temperature 1K, hence calculate the principal heats of the gas. Use molar gas constant R as 8.3 $Jmol^{-1}K^{-1}$.

(e) A container at a temperature of 27°C contains air and saturated vapour. The total pressure inside the container is $1.0x10^5$Pa. If the saturated vapour pressure of water at 27°C is $2.1x10^3$Pa and the total pressure inside the container is $1.184x10^5$Pa at a temperature of 80°C. Find the saturated vapour of water at 80°C. (4)

(ST. JOSEPH OF NAZARETH HIGH SCHOOL)

6. (a) What assumptions are necessary in the derivation of the kinetic theory expression for the pressure of an ideal gas? (4)

(b) A beam of 2×10^{20} nitrogen atoms each of mass 2.32×10^{-26} kg is incident normally on a wall of a cubical container of edge 5.0cm. The beam is reflected through 180°. If the mean speed of the atoms is 500ms^{-1}, find the pressure exerted by the Nitrogen gas.

(4)

(c) (i) State Dalton's law of partial pressures. (1)

(ii) Two containers A and B of volume 3×10^{3} cm^3 and 6×10^{3} cm^3 respectively contain Helium gas at a pressure of 1.0×10^{3} Pa and temperature 300K. Container A is heated to 373K while container B is cooled to 273K. Find the final pressure of the Helium gas.

(5)

(d) (i) Use the kinetic theory of gases to explain the effect of increasing temperature on saturated vapour pressure.

(3)

(KING'S COLLEGE, BUDO)

7. (a) With the aid of a diagram, discuss briefly variations of temperature gradient for a steel bar when the bar is;

(i) Unlagged (ii) Lagged

(b) (i) In the determination of thermal conductivity of a poor conductor such as cork, the substance is made thin and fairly of large cross-sectional area. Explain why this is so.

(2)

(ii) Describe how the thermal conductivity of cork can be determined.

(5)

(c) A pan of diameter 20.0cm and thickness 2.0mm is filled with water and heated such that the water boils producing steam at a rate of 5.0gs^{-1} at steady state conditions. Taking the coefficient of thermal conductivity of the material of the pass to be 380Wm^{-1}K^{-1} and the specific latent heat of vaporization of steam as 2.26x10^{6}Jkg^{-1}

(i) Calculate the temperature of the external surface of the pan. (4)

(ii) State the assumptions made. (1)

(d) (i) State Stefan's law of black body radiation.

(1)

(ii) As a piece of charcoal is steadily heated up, it appears reddish in colour before turning white. Explain this observation.

(3)

(e) (i) State Prevost's theory of heat exchange. (1)

(ii) The ratio of the distance of the earth from the sun to Venus from to the sun is $1:0.72$. Assuming they all radiate as black bodies, calculate the approximate mean temperature of Venus if that of the earth is 15°C.

(GREEN HILL ACADEMY)

SECTION C (MODERN PHYSICS)

8. (a) Define the following terms as applied to radioactivity

(i) Radioactive decay

(ii) Decay constant

(iii) Activity

(iv) Half life.

(b) State the decay law

(ii) Using the decay law derive the expression $N = N_o e^{-\lambda t}$, hence or otherwise, derive the expression relating half-life and the decay constant. (All symbols have their usual meanings).

(c) Briefly explain how half-life can be obtained from an activity – time graph for short-lived isotopes.

(d) Amass of 4g of the nuclide $^{25}_{11}Na$ decays by emission of β – particle. Its half-life is 71 seconds. Find the;-

(i) Number of $^{25}_{11}Na$ atoms initially present.

(ii) Initial activity of the sample.

(ii) Number of $^{25}_{11}Na$ atoms present after 20 minutes.

(BULOBA HIGH SCHOOL)

9. (a) (i) State the conditions under which photoelectric emission occurs.

(iii)Describe an experiment to determine the work function of a metal surface.

(b) The work function of tungsten is 4.49eV ultraviolet radiation of wave length 250nm falls on the surface. Calculate

(i) Cut off wave length for photo emission

(ii) Stopping potential.

(c) (i) Briefly describe how cathode rays are produced.

(ii) State the differences between cathode rays and X-rays.

(d) A beam of electrons is accelerated through a p.d of $2.5x10^3$V. It is directed midway between two horizontal plates of length 4.0cm and separation 2.0cm. Determine the flux density of a magnetic field which, when made co-terminate with the electric field, compensates for the electric field deflection (p.d between the plates is 1000V).

(KING'S COLLEGE, BUDO)

10. (a) Define:

(i) Unified atomic mass unit

(ii) Dead time

(b) (i) Describe the structure and action of a Geiger – Muller tube.

(ii) Why is the anode thin in b(i) above?

(iii) Draw the characteristic curve for a Geiger – Muller tube. Identify giving reasons, the part of the characteristic curve where the tube is normally operated.

(c) A nucleus of Uranium disintegrates to Thorium (Th) with emission of an alpha particle. Given that mass $^{238}_{92}U = 238.1294U$ mass of $^{234}_{90}Th$ = 234.11650U, mass of α-particle = 4.00387U

(i) Write a balanced equation for the reaction above.

(ii) Calculate the velocity of the alpha particle

(d) State two hazards of radiation.

(e) Explain the occurrence of:

(i) absorption line spectrum

(ii) emission line spectrum

(f) The ground state of a Hydrogen atom is 13.4eV and the next two energy levels are -3.34eV and -1.5eV respectively. A Hydrogen atom is excited from the level -1.5eV to the ground state.

(i) Calculate the wave length of the radiation emitted and state the part of the electromagnetic spectrum in which it lies.

(ii) State and explain the ionization potential.

(ST. JOSEPH GIRLS' NSAMBYA)

END