



Physics

**Past Paper Questions and
Answers by Topic**

Contents

Multiple Choice Questions

Matching Items

Fill in the Blank Items

1. Introduction to Physics
2. Introduction to Laboratory Practice
3. Measurement
4. Force
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6. Structure and Properties of Matter
7. Pressure
8. Work, Energy and Power
9. Static Electricity
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11. Forces in Equilibrium
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13. Motion in Straight Line
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28. Radioactivity
29. Thermionic Emission
30. Electronics
31. Elementary Astronomy
32. Geophysics

Physics								
Exam Marks per Topic	2011	2012	2013	2014	2015	2016	2017	2018
Multiple Choice Questions	10	10	10	10	10	10	10	
Matching Items	10	10	10	10	10	10	10	
Fill in the Blank Items	10	10	10	10	10	10	10	
1. Introduction to Physics								
2. Introduction to Laboratory Practice								
3. Measurement								
4. Force		10					10	
5. Archimedes Principle and Law of Flotation	10	10			10		5	
6. Structure and Properties of Matter		10					10	
7. Pressure		10	10					
8. Work, Energy and Power			10					
9. Static Electricity				10				
10. Magnetism								
11. Forces in Equilibrium	10					10		
12. Simple Machines							5	
13. Motion in Straight Line								
14. Newton's Laws of Motion		10	10	10		10		
15. Temperature	10							
16. Sustainable Energy Sources								
17. Applications of Vectors				10				
18. Friction					10			
19. Light					10	10	10	10
20. Optical Instruments								
21. Thermal Expansion			10		10	10	10	
22. Transfer of Thermal Energy							10	
23. Measurement of Thermal Energy								
24. Vapour and Humidity			10					
25. Current Electricity	10	10	10		10	10	10	
26. Waves	10			10	10		10	
27. Electromagnetism			10		10	10	10	
28. Radioactivity		10	10	10	10	10	10	
29. Thermionic Emission								
30. Electronics		10					10	
31. Elementary Astronomy					10	10		
32. Geophysics	10	10	10					

Multiple Choice Questions

1 mark each question

2020

1. For each of the items (i) - (x), choose the correct answer among the given alternatives and write its letter beside the item number in the answer booklet provided. **(10 marks)**
 - (i) Which pairs of instruments is used for measuring lengths?
A A ruler and a measuring cylinder
B A micrometer screw gauge and a beam balance
C A vernier caliper and a micrometer screw gauge
D A pipette and a vernier caliper
E A beam balance and a spring balance
 - (ii) What are the two factors that determine Buoyancy?
A Volume of fluid displaced and mass of the object.
B Weight and mass of the object.
C Density of the fluid and weight of the object.
D Volume of the fluid displaced and density of the fluid.
E Mass of the object and density of the object.
 - (iii) Which physical phenomenon is observed when a tea bag is dipped into a cup of hot water?
A Steaming **B Diffusion** C Osmosis
D Evaporation E Boiling
 - (iv) In a light experiment, the results showed that less light was transmitted and the image was distorted. Which type of material was used?
A A translucent material B An opaque material
C A luminous material D A transparent material
E A non-luminous material
 - (v) A stone dropped from the top of a building hit the ground 4 seconds later. What was its velocity when hitting the ground?
A 400 m/s B 45 m/s **C 40 m/s**
D 4.5 m/s E 0.4 m/s
 - (vi) Why is Mercury preferred in clinical thermometers as a thermometric of a liquid to water and alcohol?
A It is denser than other liquids.
B It is opaque and does not need colouring.
C It is more sensitive to temperature.
D It is active and does not wet the glass.
E It is a poor conductor of heat.

- (vii) A rectangular box of mass 10 kg rests on an inclined plane. If the coefficients of static and dynamic frictions are 0.55 and 0.25 respectively, at what angle will the box begin to slide?
 A 14.8° B 24.8° C 28.8° D 38.8° E 48.8°
- (viii) Heat would be lost in the thermos flask if the walls of the glass container were not coated with silver. Which process contributes to the heat loss?
 A Radiation B Conduction C Convection
 D Absorption E Transmission
- (ix) A launderer was thinking about a proper day for washing and drying clothes. Which day would he prefer most among the following?
 A Dry day B Hot day C Windy day
 D Still day E Cold day
- (x) Which process is involved in producing reverberation?
 A Refraction B Multiple reflection C Interference
 D Diffraction E Reflection

2019

- For each of the items (i) - (x), choose the correct answer among the given alternatives and write its letter beside the item number in the answer booklet provided.
- (i) Which pairs of instruments would you use to correctly measure the diameter of a small ball bearing?
 A Measuring tape and vernier caliper
 B Slide rule and micrometer screw gauge
 C Vernier caliper and slide rule
 D Micrometer screw gauge and vernier caliper
 E Metre rule and micrometer screw gauge
- (ii) A piece of cork of volume 100 cm^3 is floating on the surface of water. If the density of the cork is 0.25 g cm^{-3} , what volume of the cork is immersed in the water?
 A 100 cm^3 B 0.25 cm^3 C 25 cm^3
 D 100.25 cm^3 E 0.025 cm^3
- (iii) A layer of colorless water floating on a blue copper (II) sulphate solution becomes blue after sometime. Which physical process supports the observation made?
 A Diffusion B Cohesive C Surface tension
 D Adhesive E Osmosis
- (iv) A pin-hole camera 200 mm long produces an image of 2 mm diameter of the sun. If the sun's distance from the earth is about $1.5 \times 10^8 \text{ km}$, what is the diameter of the sun?
 A $1.5 \times 10^8 \text{ km}$ B $1.5 \times 10^6 \text{ km}$ C $3 \times 10^5 \text{ km}$
 D $7.5 \times 10^4 \text{ km}$ E $3.0 \times 10^3 \text{ km}$
- (v) Which phenomena is a result of the earth being exactly along the same line between the centre of the sun and the moon?
 A Lunar eclipse B Penumbra C Solar eclipse
 D Umbra E Reflection
- (vi) Which metals become strongly magnetized when subjected to a magnetic field?
 A Nickel and copper B Zinc and aluminium C Cobalt and iron
 D Aluminium and lead E Iron and zinc
- (vii) A body moved upward a distance of 20 m. Calculate the time taken to reach the maximum height.
 A 2 s B 5 s C 10 s D 15 s E 11 s

- (viii) The temperature of a certain liquid is measured to be 300K. What will be its temperature in degrees centigrade?
A 273°C B 100°C C 57°C
D 37°C E 27°C
- (ix) Which factors influence friction between tyres of a car moving with constant speed and surface of the road?
A Weight and speed B Speed and nature of the surface
C Nature of the surface and weight D Surface area of the tires and speed
E Acceleration and nature of the surface
- (x) When the sun shines on the dark-coloured driving wheel of a car, the wheel feels warm. Why?
A It is because the sun warms the car by induction.
B It is because the sun gives energy to the wheel by convection.
C It is because the sun radiates thermal energy to the wheel.
D It is because the sun conducts thermal energy to the wheel.
E It is because the sun conducts thermal energy to the wheel.

2018

1. For each of the items (i) - (x), choose the correct answer among the given alternatives and write its letter besides the item number in the answer booklet provided.
- (i) The correct formula to find the elastic force constant (k) of a spring is
A $\frac{\text{tension}}{\text{extension}}$ B $\frac{\text{mass}}{\text{extension}}$ C $\frac{\text{extension}}{\text{mass}}$
D $\frac{\text{extension}}{\text{tension}}$ E $\frac{\text{tension}}{\text{mass}}$
- (ii) Why is oil used as a lubricant?
A has low density B is high viscous C it is flammable
D it is inflammable E it is less viscous.
- (iii) Which one is a characteristic of a plane mirror?
A It forms an image which is real and opaque
B It forms an image which is larger than the object
C It forms an image which is real and laterally inverted
D It forms an image which has the same size as the object
E It forms an image which is small in size than the object.
- (iv) Which one is **not** a region of electromagnetic spectrum?
A radio waves B x-rays C infrared light
D ultraviolet light E invisible light waves.
- (v) What quantity of heat is required to raise the temperature of 25 kg sample of mercury from 20°C to 30°C?
A 1,743,750 J B 348,750 J C 345,750 J
D 1,550,750 J E 413,750 J.
- (vi) When silicon element is doped with phosphorus atoms, it produces
A a p-type semiconductor B a p-n junction diode
C an intrinsic semiconductor D a bipolar semiconductor
E an n-type semiconductor.
- (vii) Which of the following is an example of a scalar quantity?
A Electric current B Force C Velocity
D Displacement E Acceleration.

- (viii) What role does the iris play in the human eye?
 A To hold the lens in position. B To prevent internal reflection.
 C To control the size of the pupil. D To control the thickness of the lens.
 E To protect the eye from light.
- (ix) Asteroids which manage to reach the earth surface are called
 A stars. B meteors. C meteorites.
 D constellations. E comets.
- (x) What will be the resistivity of a wire 2 metres long with a cross-sectional area of 0.50 mm^2 and a resistance of 2.20Ω ?
 A $5.5 \times 10^{-7} \Omega\text{m}$ B $6.5 \times 10^{-7} \Omega\text{m}$ C $2.3 \times 10^{-7} \Omega\text{m}$
 D $1.1 \times 10^{-6} \Omega\text{m}$ E $5.5 \times 10^{-6} \Omega\text{m}$

2017

1. For each of the items (i)-(x), choose the correct answer among the given alternatives and write its letter besides the item number in the answer booklet provided.

- (i) A gas of volume 900 cm^3 at 27°C when warmed at constant pressure to 87°C will occupy a new volume of
 A 900 cm^3 B 720 cm^3 C 1080 cm^3
 D 540 cm^3 E 727 cm^3 .
- (ii) Which of the following scientific statements needs to be proved through scientific research?
 A Hypothesis B Principle C Conclusion
 D Proposal E Measurement.
- (iii) What will be the acceleration of the car while its speed was increasing as shown in Figure 1?

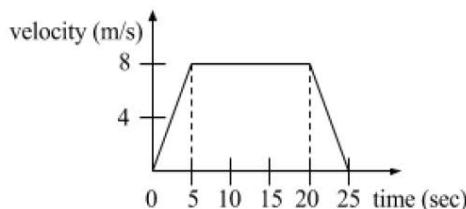


Figure 1

- A 0.8 m/s^2 B 0.4 m/s^2 C 2.5 m/s^2
 D 1.25 m/s^2 E 3.125 m/s^2 .
- (iv) Which of the following electromagnetic waves have largest wavelength?
 A Ultraviolet B Infrared C Gamma rays
 D Radio waves E X-rays
- (v) The device which operates under the principle of total internal reflection of light is called
 A magnifying lens. B plan mirror C telescope.
 D optical fibre. E pin-hole camera.
- (vi) If 120 volts are used to light a 30-watt light bulb, what will be the current flowing through that bulb?
 A 40 A B 30 A C 0.25 A
 D 4 A E 0.30 A

2016

1. For each of the items (i) – (x), choose the correct answer among the given alternatives and write its letter beside the item number in the answer booklet provided.

(i) The position of the centre of gravity of an object has a significant influence in its
A elasticity B plasticity C stability D rigidity
E elastic limit.

(ii) Which statement explain the basis of heliocentric theory?
A The earth was known to revolve around the sun.
B The earth was stationary.
C The sun was known to revolve around the earth.
D The sun was stationary.
E The earth was known to revolve around its axis.

(iii) Which among the following is a reason for the sky to appear blue while being observed from the earth?
A Regular reflection of sunlight B Irregular refraction of sunlight
C Diffuse refraction of sunlight D Selective scattering of sunlight
E Regular diffraction of sunlight.

(iv) The suspended magnetic needle always comes to rest with its axis in a vertical plane called
A geographic meridian B magnetic meridian
C geographic declination D magnetic declination
E geographic north pole.

(v) The correct arrangement of metals in ascending order of their linear expansivities is
A Iron, Copper, Invar, Brass and Nickel
B Nickel, Brass, Invar, Copper and Iron
C Brass, Copper, Nickel, Iron and Invar
D Invar, Iron, Nickel, Copper and Brass
E Nickel, Brass, Iron, Invar and Copper.

(vi) The loudness of a note produced by a vibrating object depends on
A the number of vibrations per second B the overtones present
C the quality of sound D the wavelength between two nodes
E the amplitude of vibration.

(vii) How many number of images will be formed if the angle between two mirrors is 0° ?
A 2 B 3 C 4 D 5 E Infinite.

- (viii) The correct statement about radio waves is that;
 A they have shortest wavelength B they can be produced by comets in space
 C they don't undergo reflection D they require medium on its transmission
 E they have smallest frequency.
- (ix) What is the function of cathode in x-ray tube?
 A To control heat produced on the target.
 B To accelerate the speed of electrons.
 C To conduct heat away from the target.
 D To control brightness on the screen.
 E To focus electrons on the target.
- (x) Which of the following circuit elements has ability to produce gain as used in electronics?
 A inductor B diode C resistor
 D capacitor E amplifier.

2015

- For each of the items (i)-(x), choose the correct answer among the given alternatives and write its letter beside the item number in the answer booklet provided.
- (i) A spiral spring of natural length 1.50m is extended to 1.505m by a force of 0.80N
 What will be its extension when the applied force is 3.20N?
 A 0.005m B 6.020m C 0.020m
 D 4.520m E 1.57.
- (ii) Which of the following electromagnetic waves is used to detect flaws and defects in steel plates?
 A infrared waves B ultraviolet waves C x-rays
 D gamma rays E micro waves.
- (iii) A part of human eye that corresponds to the film in a camera is called
 A cornea B iris C lens
 D pupil E retina.
- (iv) The sun generates its energy by a process called
 A thermonuclear fission B thermonuclear fusion
 C geothermal energy D geothermal fusion
 E geothermal fission.
- (v) What will be the size of the image formed if an object 4cm tall is placed 20cm in front of a concave mirror of focal length 15cm?
 A 60cm B 40cm C 24cm
 D 12cm E 3cm.
- (vi) What is the main function of step up transformer?
 A To change a.c to d.c current B To decrease resistance in a circuit
 C To increase a.c voltage D To decrease a.c voltage
 E To increase a.c current.
- (vii) The most probable radiation forming a well-defined track when passed in a cloud chamber is called
 A gamma-rays B beta rays C cathode rays
 D alpha rays E x-rays.
- (viii) The effect of adding an acceptor impurity to a silicon produce a crystal called
 A P-type B N-type C PN-type
 D NP-type E PNP-type.

- (ix) Colours are produced when white light passes through glass prism because
- A light waves interfere
 - B glass prism colours the light
 - C in glass different colours travel at different speeds
 - D different colours are filtered
 - E diffraction of light occurs.
- (x) Which of the following statements is true when the resistance, R , of a wire is measured using an ammeter, voltmeter and rheostat?
- A the ammeter is in parallel with R
 - B the voltmeter is in series with R
 - C a graph of V against I has a gradient equal to R
 - D a graph of I against V has a gradient equal to R
 - E the rheostat is in parallel with R .

2014

1. For each of the items (i)-(x), choose the correct answer among the given alternatives and write its letter beside the item number in the answer booklet provided.
 - (i) What physical phenomenon is observed when a tea bag is dipped into a cup containing hot water?
 - A Surface tension
 - B Capillary then diffusion
 - C Diffusion
 - D Osmosis then diffusion
 - E Osmosis only.
 - (ii) When a gas is compressed at constant temperature, the gas molecules
 - A move faster than air outside and the pressure is increased
 - B move with uniform speed and the pressure is unchanged
 - C gain more kinetic energy and the pressure is decreased
 - D increase slightly in size and its pressure remains constant
 - E make more impacts per second on the walls of the container.
 - (iii) A car moving at steady speed has a frictional force on its surface whose size depends on its
 - A speed and surface area
 - B speed
 - C surface area
 - D weight
 - E wheels speed.
 - (iv) When illuminated by a certain lamp, the shadow of a table-tennis ball on a white screen is uniformly dark. This is because the lamp used is
 - A very bright
 - B fluorescent
 - C very small
 - D very weak
 - E very large.
 - (v) In a black and white television, the image is formed on the screen by
 - A varying the intensity or brightness of the electron beam
 - B adjusting the number of stations using a remote control
 - C limiting the flow of electrons between the cathode and anode
 - D increasing the grid's voltage to its maximum value
 - E adjusting the antenna to capture waves of short wavelength.

- (vi) A green card with red flowers when viewed in a red light will appear
- completely red
 - completely yellow
 - completely green
 - yellow with red flowers
 - green with red flowers.
- (vii) Figure 1 shows a pattern of waves in a ripple tank traveling from part X to part Y across a plane section Z.

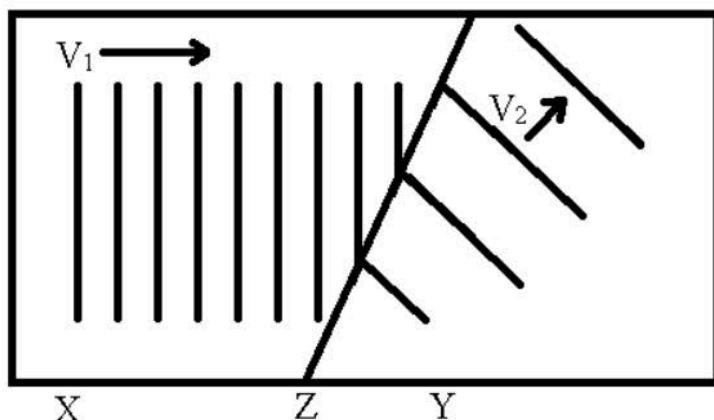


Figure 1

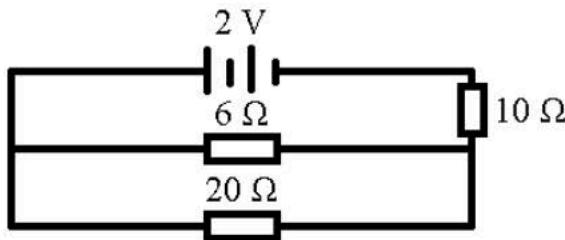
- What observation can be made from Figure 1?
- the total reflection occurs at Z
 - the wavelength in part X is greater than that in part Y
 - the wave speed v_1 in part X is less than v_2 in part Y
 - diffraction occurs across Z
 - The wave changes in frequency as it crosses Z.
- (viii) A solid metal cube has each side doubled to make a solid cube of the same metal eight times bigger in volume. The ratio of *resistivity of the new cube to resistivity of the old cube* is
- 8:1
 - 6:1
 - 1:1
 - 1:6
 - 1:8
- (ix) In a cloud chamber, straight-line trails of vapour are produced by a source emitting
- beta-particles
 - gamma-rays
 - electrons
 - alpha-particles
 - light rays

- (x) Which of the following is the correct weight of a body of mass 48 g when placed on the moon surface?
- A 0.48 N
 - B 4.8 N
 - C 0.80 N
 - D 0.048 N
 - E 80.0 N.

2013

1. For each of the items (i) – (x), choose the correct answer among the given alternatives and write its letter beside the item number.
- (i) Two forces of 5 N and 8 N are acting at the same point and are inclined at an angle of 45° to each other. What will be their resultant force?
- A 11.2 N
 - B 12 N**
 - C 22.4
 - D 1.2 N
 - E 1.12 N
- (ii) Which of the following are good examples of ferromagnetic materials?
- A iron and ceramic
 - B zinc and iron
 - C copper and nickel
 - D nickel and cobalt**
 - E cobalt and ceramic
- (iii) A white shawl wrapped around a baby keeps the baby warm because the shawl
- A is a poor reflector
 - B is a poor radiator
 - C has pockets of air trapped in it**
 - D conducts heat to the baby
 - E stops convection currents.
- (iv) A body is said to be in equilibrium if
- A it moves with uniform speed
 - B the net force acting on it is zero**
 - C the upward and downward forces are equal
 - D its centre of gravity is low positioned
 - E its centre of gravity is high.
- (v) The correct statements about sound waves is that they
- A are transverse waves
 - B can travel in vacuum
 - C can be polarized
 - D cannot be polarized**
 - E do not require medium.

- (vi) In order to produce electrons in a discharge tube the
- A anode should be at a higher potential than the cathode
 - B potential difference at the anode should be low
 - C cathode should be heated indirectly at low voltage supply
 - D electrodes should be at the same potential
 - E electrons must be accelerated at higher potential.
- (vii) The battery in the circuit shown in the following diagram has an e.m.f. of 2 V and negligible internal resistance.



- What will be the current flowing in the $6\ \Omega$ resistor?
- A 0.15 A
 - B 0.64 A
 - C 1.42 A
 - D 0.10 A
 - E 0.33 A
- (viii) The image formed by plane mirrors are always
- A real, magnified and laterally inverted
 - B virtual, laterally inverted and same in size
 - C magnified, virtual and erect
 - D laterally inverted, same in size and real
 - E erect, real and magnified.
- (ix) Which of the following particles is used to cause fission in an atomic reaction?
- A proton
 - B deuteron
 - C neutron
 - D beta-particle
 - E alpha-particle
- (x) The layer in the atmosphere where weather phenomena are formed is called
- A stratosphere
 - B magnetosphere
 - C thermosphere
 - D troposphere
 - E exosphere.

2012

1. For each of the items (i) – (x), choose the correct answer among the given alternatives and write its letter beside the item number.
- (i) One advantage of the lead-acid accumulator is that
- A Its internal resistance is high
 - B Its p.d. is less than 2 V
 - C It can be recharged
 - D Its e.m.f. is more than 10 V
 - E It supplies only a small current.
- (ii) When an object moves around a horizontal circle of centre O with a constant speed its acceleration will be:
- A zero
 - B towards the centre
 - C away from the centre
 - D along the tangent to the circle
 - E along the direction of rotation
- (iii) A total eclipse of the Sun is due to
- A the Moon coming between the Earth and the Sun
 - B the Earth coming between the Moon and the Sun
 - C the Moon reflecting light away from the Earth
 - D the Sun coming between the Earth and the Moon
 - E the Earth reflecting light away from the Moon.
- (iv) Short-sightedness in a human eye is due to
- A eyeball being too short
 - B eyeball being too large
 - C eye lens being too weak
 - D eye lens being smaller than retina
 - E eyeball being larger than retina

- (v) In Figure 1, a hydraulic press P is used to raise a load of 10000 N. A force F of 25 N is applied at the end of a lever pivoted at O to just raise the load.

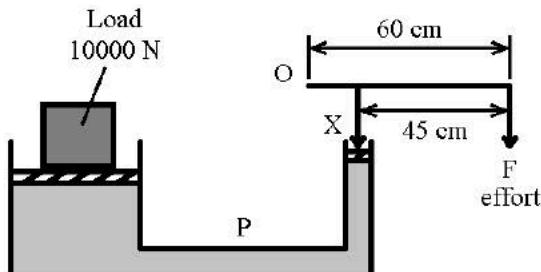


Figure 1

- What will be the value of force X applied to the press?
- A 1500 N
B 100 N
C 1125 N
D 33.33 N
E 13.33 N
- (vi) The note from a plucked guitar will have a low pitch if the string is
- A thick and long
B thick and slack
C thin and slack
D thin and short
E thick and short.
- (vii) Lenz's law can be applied to predict the
- A magnitude of back e.m.f. in a circuit
B magnitude of induced current in a circuit
C direction of applied e.m.f. across the circuit
D direction of induced e.m.f. in a circuit
E direction of the applied e.m.f. within a circuit.
- (viii) The half-life of a certain radioactive element is 12 hours. What fraction of an element will have disintegrated in 72 hours?
- A 1/64
B 1/16
C 1/32
D 1/8
E 1/72
- (ix) The mass of an atom depends on the number of
- A protons only
B neutrons, electrons and protons
C electrons and protons
D neutrons and protons
E electrons and neutrons

- (x) The interior structure of the Earth is composed of three major zones which are:
- A magma, mantle and the core
 - B lava, crust and magma
 - C hypocenter, crust and the mantle
 - D the core, lava and hypocenter
 - E crust, mantle and the core.**

2011

1. For each of the items (i) - (x) choose the correct answer among the given alternatives and write its letter beside the item number.

- (i) The addition of impurities to element like silicon is aimed at
 - A making p-n junction.
 - B increasing the conductivity of the element.
 - C stabilizing the temperature of the element
 - D making the element heavier.
 - E increasing the resistivity of the element.
- (ii) According to the usual transformer notation, which of the following equations is correct?
 - A $I_S / I_P = N_S / N_P$
 - B $I_S / I_P = V_P / V_S$
 - C $I_S / I_P = V_S / V_P$
 - D $N_P / N_S = V_S / V_P$
 - E $V_S / I_P = N_S / N_P$
- (iii) When a person perspires on a hot day
 - A evaporation occurs and helps to cool the body.
 - B heat is conducted away from the body.
 - C latent heat keeps the body warm.
 - D the body is insulated from the warm air.
 - E convection cools the body.
- (iv) Which of the following sources of energy are non-renewable?
 - A Water, wind, wood and natural gas.
 - B Fossils, sun, oil and nuclear.
 - C Natural gas, water, nuclear and wood.
 - D Wind, sun, fossils and oil.
 - E Oil and all natural gas.
- (v) Heat is supplied at equal rates to equal masses of water and aluminium. The temperature of aluminium rises more quickly than that of water because the aluminium has
 - A a lower latent heat.
 - B a higher heat capacity.
 - C a higher specific heat capacity.
 - D a higher latent heat.
 - E a lower specific heat capacity.
- (vi) Which of the following device works on d.c. only?
 - A an electric bell.
 - B a step-down transformer
 - C a transistor
 - D an induction coil
 - E a step-up transformer

- (vii) Which statement is correct regarding alpha particles?
- A They carry a negative charge.
B They are hardly deflected by magnetic fields.
C They travel a long distance in air.
D They are very penetrating.
E They are identical with the nuclei of hydrogen atoms.
- (viii) The cost of electricity for a 2000W electric fire used for 10.30 hours at the rate of shs 8.00 per KWh is
- A shs 160 B shs 80 C shs 168
D shs 1600 E shs 3200
- (ix) The following is an important sign that can be observed before an earthquake occurs:
- A The average temperature keeps decreasing daily.
B Television signals and radio stations are received at a frequency that is below normal.
C The entire animal kingdom becomes highly disturbed and restless.
D The level of water in the ocean decreases by one third.
E Formation of backward rivers due to sudden shaking of the earth.
- (x) Water spreads and wets a surface when spilled on it because the
- A adhesive forces between water molecules and surface molecules are large.
B cohesive forces between water molecules and surface molecules are large.
C adhesive forces between water molecules are small.
D cohesive forces between water molecules and surface molecules are small.
E cohesive forces are greater than adhesive forces.

2010

1. For each of the items (i)-(x), choose the correct answer among the given alternatives and write its letter beside the item number.
 - (i) Which one of the following statements about alpha and beta particles is correct?
 - A They carry the same charge.
 - B Each alpha particle has four times the mass of the beta particle.
 - C Alpha particles have a larger range in air than beta particles.
 - D When in motion, they are deflected in opposite directions by a magnetic field.
 - E Alpha particles cause ionization while beta particles do not.
 - (ii) Light waves differ from sound waves because
 - A light is an electromagnetic wave but sound is a mechanical wave.
 - B sound waves do not travel in water but light waves do.
 - C the speed of light is independent of the medium it travels but the speed of sound depends on the medium.
 - D interference is obtained with light waves but not with sound waves.
 - E the speed of sound waves is greater than that of light waves in the same medium.
 - (iii) In a laboratory, the diameter of a piece of wire can accurately be measured by
 - A Vernier Calliper
 - B Micrometer screw gauge
 - C Engineer's Calliper
 - D Rate meter
 - E A thread wound round it once.
 - (iv) A basic condition for diffraction of a wave when it passes through an opening is that
 - A the wavelength of the incident wave must be greater than the size of the opening.
 - B the amplitude of the wave must be smaller than the size of the opening.
 - C the wavelength of the wave must be shorter than the corresponding size of the opening.
 - D the wavelength of the wave must almost be equal to the size of the opening.
 - E the amplitude of the wave must be greater than the opening.
 - (v) A specific latent heat of fusion of a substance is defined as energy required to
 - A change a unit mass of the substance from solid to liquid.
 - B change a unit mass of a substance from solid to liquid at constant temperature.
 - C change the mass of a substance from solid to liquid at constant temperature.
 - D cause a unit temperature rise of a substance.
 - E cause a unit mass of water to freeze at 0°C.

- (vi) For an oscilloscope just to display the wave form of an a.c supply which controls should be adjusted.
- A Y-shift then X-time base
 - B X-time base then Y-shift
 - C Y-shift then brightness
 - D X-time base then Y-gain
 - E Y-gain then focus.
- (vii) A regular rise and fall in loudness of a music played at a distance is called
- A intensity
 - B timbre
 - C pitch
 - D beats
 - E resonance
- (viii) Which of the following are non-magnetic metals?
- A Iron and steel
 - B Aluminium and Zinc
 - C Nickel and Cobalt
 - D Nickel and steel
 - E Iron and Cobalt
- (ix) The temperature of liquid in a thermos flask remains unaltered for a long time because heat loss by
- A conduction is minimized
 - B convection and radiation are reduced
 - C radiation and convection are minimized
 - D conduction and radiation are reduced
 - E all modes of heat transfer are reduced.
- (x) A body is said to be in equilibrium if
- A the body moves with uniform speed
 - B the net force acting on the body is zero
 - C the upward forces on the body counter balance some of the downward forces
 - D its centre of gravity is low positioned
 - E its centre of gravity is high.

Matching Items

2020

2. Match the functions of the features of cathode ray tube in **List A** with the corresponding features in **List B** by writing the letter of the correct response beside the item number in the answer booklet provided.

List A		List B	
(i)	It produces fast moving electrons when heated at high temperature.	A	Perrin tube
(ii)	Traces the direction of cathode rays in a cathode ray tube.	B	X-plate
(iii)	Deflects the electron beam vertically.	C	Anode
(iv)	Deflects the electron beam horizontally.	D	Cathode
(v)	Accelerates the ejected electrons to the screen	E	Y-plate
		F	Maltese cross tube
		G	Vacuum

(5 marks)

2	LIST A	(i)	(ii)	(iii)	(iv)	(v)	
	LIST B	D	F	E	B	C	

2019

2. Match the properties of radiations in **List A** with the corresponding radiations in **List B** by writing the letter of the correct response beside the item number in the answer booklet provided. The responses might be used more than once.

List A		List B	
(i)	Has weak-moderate ionising power.		
(ii)	Is deflected towards south pole of the magnet.	A	
(iii)	Has high penetrating power but stopped by lead sheet.	B	
(iv)	Has the least penetrating power but stopped by a sheet of paper.	C	
(v)	Has a speed up to 10% times the speed of light in vacuum.		

A sheet of paper Aluminium foil A lead block

2018

2. Match the items in **List A** with responses in **List B** by writing the letter of the correct response beside the item number in the answer booklet provided.

List A	List B
(i) Materials that can strongly be magnetized.	A Paramagnetic
(ii) Substance which are made up of soft iron.	B Temporary magnets
(iii) Materials that cannot be affected by magnets.	C Zinc and Copper
(iv) Objects which are made up of steel.	D Permanent magnets
(v) Groups of magnetic dipoles arranged themselves in a magnetized object.	E Magnetic domains
(vi) Field lines of force used for finding locations of different places.	F Earth's magnetic field
(vii) The process of aligning the domains of atoms in one direction.	G Induced magnetism
(viii) The process of destroying the alignment in a magnetized material.	H Magnetization
(ix) Materials that can redirect field lines of force.	I Demagnetization
(x) The region around a magnet in which magnetic materials are attracted.	J Permeable
	K Neutral point
	L Ferromagnetic
	M Magnetic field

Extract 2.1

1.	i> L	
	ii> B	
	iii> C	
	iv> D	
	v> E	
	vi> F	
	vii> H	
	viii> I	
	ix> J	
	x> M	

2017

2. Match the items in **List A** with responses in **List B** by writing the letter of the correct response beside the item number in the answer booklet provided.

List A	List B
(i) Ability of liquids to rise or fall in a narrow tube.	A. Osmosis
(ii) Tendency of an object to fall or drop to lower level in a fluid.	B. Surface tension
(iii) Capacity of an object to float in a fluid.	C. Matter
(iv) Attraction force between molecules of the same substance.	D. Buoyancy
(v) Movement of particles from high concentration to low concentration.	E. Cohesive
(vi) Tendency of matter to be in a state of random motion.	F. Diffusion
(vii) Movement of particles from low to high concentration.	G. Plasticity
(viii) Force which resists a fluid to flow.	H. Brownian motion
(ix) Attraction force between molecules of different substances.	I. Capillarity
(x) Ability of the surface of a liquid to behave like a fully stretched elastic skin.	J. Viscosity
	K. Adhesive
	L. Elasticity
	M. Sinking

Answers :

- i. I
- ii. M
- iii. D
- iv. E
- v. F
- vi. H
- vii. A
- viii. J
- ix. K
- x. B

2016

2. Match the items in **List A** with responses in **List B** by writing the letter of the correct response beside the item number in the answer booklet provided.

List A	List B
(i) The eye-lens becomes thick when contracted and thin when relaxed.	A. Short sight
(ii) Prevent the internal reflection of light in the eye.	B. Long sight
(iii) The thick and transparent protective cover in front of the eye-lens which refracts light most.	C. Ciliary muscles
(iv) Hold the eye-lens in position.	D. Suspensory ligaments
(v) Provides two images of the same object which are slightly different in perspective.	E. Binocular vision
(vi) The light sensitive area of cells at the back of the eye.	F. Retina
(vii) Images of distant objects which are focused in front of the retina.	G. Aqueous humour
(viii) The circular opening in the iris through which light passes.	H. Vitreous humour
(ix) The most light sensitive spot on the retina.	I. Pupil
(x) The coloured circle round the eye-lens.	J. Fovea centralis
	K. Iris
	L. Cornea
	M. Slim lens
	N. Choroid layer
	O. Fatter lens

2015

2. Match the times in **List A** with responses in **List B** by writing the letter of the correct response beside the item number in the answer booklet provided.

List A	List B
(i) The region nearest the earth of which most weather phenomenon occur.	A. Stratosphere
(ii) The layer in which the ozone layer is found.	B. Atmosphere
(iii) The boundary which separates stratosphere and other layers.	C. Ionosphere
(iv) The boundary which separates troposphere and stratosphere.	D. Stratopause
(v) The region found in exosphere where satellites orbit the earth.	E. Magnetosphere
(vi) The outermost region of the atmosphere.	F. Troposphere
(vii) The layer which is also known as the upper atmosphere.	G. Exosphere
(viii) The collective name given to troposphere and stratosphere.	H. Thermosphere
(ix) The layer just above the stratosphere in which most meteors burn while entering the earth's atmosphere.	I. Hydrosphere
(x) The layer of gases containing numerous small suspended solid and liquid particles that surrounds the earth.	J. Lithosphere
	K. Mesopause
	L. Mesosphere
	M. Lower atmosphere
	N. Tropopause

Answers :

- i. F
- ii. A
- iii. D
- iv. N
- v. E
- vi. G
- vii. H
- viii. M
- ix. L
- x. B

2014

2. Match the terms in **List A** with responses in **List B** by writing the letter of the correct response beside the item number in the answer booklet provided.

List A	List B
(i) Mass of water vapour which is actually present in a unit volume of air at constant temperature	A. Hygrometry
(ii) Rate at which a material transfers heat energy	B. Bimetallic thermometer
(iii) Measurement of the amount of moisture present in the atmosphere.	C. Latent heat
(iv) Mass of water vapour present in a unit volume of air.	D. Liquid-in-glass thermometer
(v) Difference between readings of the two thermometers.	E. Relative humidity
(vi) A measure of the extent to which the atmosphere contains water vapour.	F. Leslie's cube apparatus
(vii) It can be found by the method of mixture or electrical heating.	G. Specific heat capacity
(viii) Amount of heat energy required to change the state of a substance.	H. Wet bulb depression
(ix) Measures temperature of inaccessible structures.	I. Humidity
(x) Depends on the electrical properties of materials varying with temperature.	J. Thermal conductivity
	K. Latent heat of fusion
	L. Thermistor thermometer
	M. Absolute humidity
	N. Bi-metallic strip
	O. Thermal expansivity
	P. Absolute temperature

Answers :

- I. E
- II. J
- III. A
- IV. M
- V. H
- VI. I
- VII. G
- VIII. C
- IX. B
- X. L

2013

2. Match the items in **List A** with responses in **List B** by writing the letter of the correct response beside the item number.

List A	List B
(i) The lowest energy level where electrons are normally present.	A Light-emitting diode (LED)
(ii) The amplitude levels which usually occurs in any digital signal.	B Transducers
(iii) The energy level where electrons may not occupy.	C Rectification
(iv) Increases the electrical conductivity of a semiconductor.	D Bipolar transistor
(v) Produces an abundance of mobile electrons in the material.	E Semiconductors
(vi) The region near the boundary which is fairly free of majority charge carriers.	F Valence band
(vii) Materials which have significant electrical conductance at room temperature.	G Nodes
(viii) Increases the region or width of the depletion layers and rise the potential barrier.	H Fermi level
(ix) Convert an input signal of one form into an output signal of another form.	I Reverse bias
(x) The relationship between input signal and output signal of an amplifier.	J Transfer function
	K n-type doping
	L Dopants
	M Forbidden
	N Thermistors
	O Depletion layer

Answers :

- i. F
- ii. G
- iii. M
- iv. L
- v. K
- vi. O
- vii. E
- viii. I
- ix. B
- x. J

2012

2. Match the items in **List A** with responses in **List B** by writing the letter of the correct response beside the item number.

List A	List B
(i) The motion of a body through equal distances in equal times	A. Uniform deceleration
(ii) Displacement per unit time	B. Displacement
(iii) Area under velocity-time graph	C. Resultant velocity
(iv) The rate at which an object travels	D. Uniform speed
(v) Constant displacement along the road in equal times	E. Average velocity
(vi) The gradient of displacement-time graph	F. Straight line graph
(vii) Uniform accelerated motion of a body	G. Speed
(viii) The rate of decrease of constant velocity	H. Average acceleration
(ix) A measure of how far a body is from a starting point	I. Uniform velocity
(x) The gradient of velocity-time graph	J. Distance
	K. Retardation
	L. Non-uniform velocity
	M. Velocity
	N. Instantaneous velocity
	O. Constant velocity

Answers :

- i. D
- ii. M
- iii. J
- iv. G
- v. I
- vi. E
- vii. F
- viii. A
- ix. B
- x. H

2011

List A	List B
(i) Mirage	A The force of friction between molecules of the same substance which exist on the surface of water.
(ii) Refractive index	B Caused by total internal refraction of light.
(iii) Critical angle	C Liquids which are difficult to stir and do not flow easily.
(iv) Floating body	D Angle of reflection for which the angle of incidence is 90°.
(v) Brownian movement	E A very thin pipe which enables the hydrometer to float up right in liquid.
(vi) Viscosity	F The ratio of sine of angle of refraction to the sine of angle of incidence.
(vii) The siphon	G Attraction force which allows the moon to move around the earth.
(viii) A couple	H The property of water surface to support the needle.
(ix) Capillarity	I A glass tube used for releasing an accurate amount of liquid.
(x) Surface tension	J Angle of incidence for which the angle of refraction is 90°.
	K Consists of two equal and opposite parallel forces and has turning effect.
	L Force that causes elastic material to twist.
	M Apparent weight is zero.
	N Upthrust of a liquid is equal to the apparent weight of the floating body.
	O The pull that resist the flow of liquids.
	P The ratio of speed of light in air to that in media.
	Q Tendency of a liquid to be drawn into small openings.
	R Random motion of water molecules.
	S The chain and ball flushing tank.
	T Irregular motion of tiny particles suspended in fluid.
	U Bending of light which makes objects appear at incorrect position.

2010

2. Match the items in **List A** with responses in **List B** by writing the letter of the correct response beside the item number.

List A	List B
(i) Newton's 3 rd Law of motion	A Cells with conducting materials used in electrolysis
(ii) Kelvin	B Used in forming thick and real images
(iii) Proton	C A measure of electrical work
(iv) Voltameters	D Can be detected by means of scintillation counter
(v) Kwhr	E Is used in covering wounds in hospitals
(vi) Radiation	F The moon is in penumbra of the shadow of the Earth
(vii) Intrinsic semiconductor	G Action equals reaction
(viii) γ -radiation	H Thermodynamic temperature
(ix) Venus	I The moon is in the umbra of the shadow of the Earth
(x) Total Lunar eclipse	J Rate of change of momentum
	K Degrees centigrade
	L Measure of power generated
	M Heat transfer which requires material medium
	N Applied in construction for reinforcing concrete structures
	O A morning star
	P A positive charge
	Q The heat transfer that does not require matter
	R A shooting star
	S Pure semiconductor in which external impurity is not added
	T Impure semiconductor with a hole

Fill in the Blank Items
1 mark per question

2018

3. For each of the items (i)-(x), fill in the blank spaces by writing the correct answer in your answer booklet.

- (i) The ratio of distance moved by effort to the distance moved by load is referred to as _____.
- (ii) The name given to the heat which is required to raise the temperature of a body by 1 K is _____.
- (iii) The work done when a force of 1 N moves a distance of 1 m in the direction of force is called _____.
- (iv) When a p-type and n-type semiconductors are bounded together they form a single crystal called _____.
- (v) The nuclear reaction which involves joining of lighter nuclei into heavier nucleus is called _____.
- (vi) A device which produces electricity on the basis of electromagnetic induction is called _____.
- (vii) A collision during which the kinetic energy changes is known as _____.
- (viii) The particles in the nucleus of an atom which carry no charge are called _____.
- (ix) The wave which makes particles of the medium to vibrate in a direction perpendicular to the direction of movement of the wave is called _____.
- (x) The sun looks bigger and hotter than other stars because it is near to the _____.

3.	(i) Velocity ratio (VR)
	(ii) Heat capacity
	(iii) A Joule (J)
	(iv) p-n junction
	(v) Nuclear fusion
	(vi) Generator
	(vii) Inelastic collision
	(viii) Neutrons
	(ix) Transverse wave
	(x) Earth

2017

3. For each of the items (i)-(x), fill in the blank spaces by writing the correct answer in the answer booklet provided.
- (i) The velocity of the body as noted by a non-stationary observer is called _____.
 - (ii) Which method of heat transfer does not involve the actual movement of particles from their mean position? _____.
 - (iii) What name is given to the angle of incidence when the angle of reflection is 90° ? _____.
 - (iv) A temperature at which solids change to liquids at constant temperature is referred to as _____.
 - (v) Colours which when mixed in a definite ratio yield white colour are known as _____.
 - (vi) Which type of a resistor is used to convert moving coil galvanometer into voltmeter? _____.
 - (vii) Cathode ray tube is used in the production of _____.
 - (viii) A group of stars that forms a definite shape or pattern when viewed from the earth is called _____.
 - (ix) Which rule summarizes the relation of force, current and the field being mutually perpendicular to each other? _____.
 - (x) Which region in electromagnetic spectrum has lowest frequency? _____.

3/15	Relative velocity
(i)	Radiation
(ii)	Right angle
(iii)	Melting point
(iv)	Complementary colours.
(v)	multiplier
(vi)	Cathode rays.
(vii)	constellations
(viii)	Left Fleming hand rule or Fleming right hand rule
(ix)	radio wave

2016

3. For each of the items (i)-(x), fill in the blank spaces by writing the correct answer in the answer booklet provided.
- (i) Waves which travel perpendicularly to the direction of the vibrations are called _____.
 - (ii) The Wheatstone bridge is a circuit widely used for accurate measurement of _____.
 - (iii) Sugar tongs and tweezers are in which class of levers? _____.
 - (iv) The speech current along the telephone line can be converted into sound waves in the air by means of _____.
 - (v) A blue cable in the three-pin plug of electrical circuit represents _____.
 - (vi) Which quantity is induced whenever there is a change in the magnetic flux linked with a circuit? _____.
 - (vii) The product of mass and velocity of a body is called its _____.
 - (viii) A device that opens and closes a circuit in response to changes in temperature is called _____.
 - (ix) The successive decay of unstable nucleus until a stable fragment is achieved is known as _____.
 - (x) A teapot with a silvery surface keeps the water hot for some time because it conduct heat by _____.

2015

3. For each of the items (i)-(x), fill in the blank spaces by writing the correct answer in the answer booklet provided.
- (i) The rate of change of displacement is called _____.
 - (ii) The process whereby the eye can alter its focal length in order to form images of objects at different distances is known as _____.
 - (iii) The rule used to deduce the direction of the magnetic field lines due to solenoid or a circular coil is called _____.
 - (iv) The function of an induction coil is to produce _____.
 - (v) The wheatstone bridge is an electric device used to measure _____.
 - (vi) A force which causes anticlockwise rotation is said to have a positive _____.
 - (vii) The kinetic theory of matter has been used to account for elasticity, surface tension and _____.
 - (viii) The quality of a note produced by a musical instrument depends on its fundamental frequency and _____.
 - (ix) The name given to the collection of heavenly bodies that revolve around the sun is _____.
 - (x) The increase in the average temperature of the world's atmosphere refers to _____.

Answers :

- i. Velocity
- ii. accommodation of the eye
- iii. cork screw rule/right hand grip rule
- iv. high voltage
- v. resistance of a conductor
- vi. moment
- vii. thermal expansion/diffusion
- viii. overtones/harmonics
- ix. solar system
- x. global warming

2014

3. For each of the items (i)-(x), fill in the blank spaces by writing the correct answer in the answer booklet provided.

- (i) The presence of electric charge in a body can be detected by means of _____.
- (ii) The automatic flushing tank uses the working principle of _____.
- (iii) The simple a.c. generator works on the converse principle of _____.
- (iv) The element that is heaviest of all natural elements is called _____.
- (v) The defects of an image formed by a single lens is called _____.
- (vi) Most stars in the universe which are visible in the night sky are within our own _____.
- (vii) A part of the Earth's mantle and crust containing liquids, crystals and dissolved gases is known as _____.
- (viii) A p-type semiconductor is formed when silicon is replaced by _____.
- (ix) The electric current can pass through an electric component due to the existence of _____.
- (x) The physical state of a substance normally depends on _____.

Answers :

- i.
- ii. Siphon/atmospheric pressure
- iii. electromagnetic induction
- iv.
- v. Aberrations
- vi.
- vii. Magma
- viii.
- ix. Potential difference
- x.

2013

3. For each of the items (i)-(x), fill in blank spaces by writing the correct answer on the space provided.
- (i) What is a term given to a glowing asteroid in space which can be seen with naked eyes? _____
 - (ii) The timbre of a sound is also referred to as _____.
 - (iii) The angle between the horizontal component of the Earth's magnetic field and true north is called _____.
 - (iv) The production of an e.m.f. in a conductor as a result of changing current in the same conductor is referred to as _____.
 - (v) The combination of multiple echoes in the listener's ear produce a louder and more sustained sound called _____.
 - (vi) When the temperature at the surface is below the freezing point, dew takes the form of ice called _____.
 - (vii) The movement of particles from a region of high concentration to one of low concentration is called _____.
 - (viii) Wheelbarrows and bottle openers are in the _____ class of levers.
 - (ix) The process of converting sinusoidal wave forms into unidirectional (non-zero) waveforms is known as _____.
 - (x) A resistor of low resistance used to convert a moving coil galvanometer into an ammeter is called _____.

Answers :

- i.
- ii.
- iii. Angle of declination or the magnetic declination
- iv.
- v. Reverberation
- vi.
- vii.
- viii.
- ix. Rectification
- x. Shunt

2012

3. For each of the items (i)-(x), fill in the blank spaces by writing the correct answer on the answer booklet provided.

- (i) Refractive index is a constant involved in _____.
- (ii) The parallel forces which are equal in magnitude but acting in opposite direction to each other are known as _____.
- (iii) Latent heat of vaporization is responsible for changing the state of a substance from liquid to vapour without changing of _____.
- (iv) The multiple reflection of sound waves when they are placed in an enclosed room or cavity is called _____.
- (v) A radioactive nucleus $^{123}_{60}X$ decays to $^{119}_{58}Y$ by emitting _____.
- (vi) Radiant energy can be detected by means of _____.
- (vii) In order to measure the current passing through an electric component, ammeter is always connected in _____.
- (viii) Geocentric theory under astronomy study was based on _____.
- (ix) X-rays are electromagnetic waves of very short _____.
- (x) A point within the Earth where an earthquake begins is called _____.

Answers :

- i. Snell's law/second law of refraction/refraction of light
- ii. Coplanar forces or couple
- iii. Temperature
- iv. Reverberation
- v. β -particle
- vi. Thermopile
- vii. Series
- viii. Religious/observations/common-sense
- ix. Wavelength
- x. Hypocenter/focus

2011

3. For each of the items (i)-(x) fill in the blank spaces by writing the correct answer on the answer booklet provided.

- (i) _____ is an instrument which can be used in submarines to view distant objects which are out of direct vision.
- (ii) _____ is a coil of low resistance used to control an alternating current.
- (iii) The property of a liquid to form a layer which support a pond skater to walk on it is called _____.
- (iv) According to Archimedes principle upthrust is equal to _____.
- (v) _____ is a refreezing process which demonstrate the effect of pressure on the melting point of ice.
- (vi) To convert a moving coil galvanometer into a voltmeter _____ is connected in series with the coil of the galvanometer.
- (vii) The instrument used to record ground movements caused by an earthquake is called _____.
- (viii) _____ is a large celestial body made up of hot gases known as plasma.
- (ix) The process in which the emission of radiation by the atmosphere warms the earth's surface is called _____.
- (x) _____ of water is the decrease in the density of water as it cooled from 4°C to 0°C.

1. Introduction to Physics

2. Introduction to Laboratory Practice

3. Measurement

4. Force

2017

7. (a) (i) What is the essential of kinetic theory of matter?
(ii) Sketch a graph showing how force applied in a stretched string varies with its extension.
- (b) (i) State Hooke's law.
(ii) List two applications of gamma rays.

2012

4. (a) Why does a solid body weigh more in air than when immersed in a liquid?
- (b) An ordinary hydrometer of mass 27 g floats with 4 cm of its stem out of water. If the cross sectional area of the stem is 0.75 cm^2 calculate:
(i) the total volume of the stem just under the surface of the liquid.
(ii) the relative density of the liquid.
- (c) (i) What do you understand by resolution of a force?
(ii) A metre rule is pivoted at its mid-point. If two objects of weights 1.0 N and 2.0 N are suspended at 30 cm and 90 cm respectively from one end, calculate the position where an upward force of 3.0 N must be applied in order for the metre rule to balance horizontally.

Otp	<p>(a) A solid body weight more in air than when immersed in a liquid because the liquid has an upthrust (upward force) which tends to push the solid upward hence a solid loses some weight.</p> <p>(b)</p> <p>Data given Mass of hydrometer, $M = 27\text{g}$ length of stem, $L = 4\text{cm}$ Cross-sectional area of stem, $A = 0.75\text{cm}^2$</p> <p>(i) Total volume, V = required from Total volume of the hydrometer $= \text{Volume of stem} + \text{Volume of bulb}$</p>
	$1\text{cm}^3 = 1\text{g}$ $27\text{g} = 27\text{cm}^3$ <p>Volume of bulb/stem = length \times Area $= 4\text{cm} \times 0.75\text{cm}^2$ $= 3\text{cm}^3$</p> <p>Total volume, $V = 3\text{cm}^3 + 27\text{cm}^3$ $= 30\text{cm}^3$</p> <p>\therefore The total volume of the hydrometer is 30cm^3.</p> <p>(ii) Relative density = $\frac{\text{density of substance}}{\text{density of water}}$</p>

5. Archimedes Principle and Law of Flotation

2018

4. (a) Briefly explain why hydrometer
(i) is weighed with lead shots.
(ii) has a narrow stem.

(b) A piece of rubber of volume 100 cm^3 and the density of 0.45 g/cm^3 floats in water.

Calculate:

- (i) The volume of rubber that partially immersed in water.
(ii) The force required to immerse the rubber completely.

4. a) i) A hydrometer is weighed with lead shots to make it float upright when immersed in a liquid. This is because the lead shots lower the center of gravity of the hydrometer to make it attain stable equilibrium or stability and hence measure a liquid's relative density accurately.

ii) A hydrometer has a narrow stem so as to increase sensitivity of any change in relative density of a liquid it is immersed in so that small changes in the liquid's relative density show large differences on the hydrometer.

b) Soln: Data Given: Volume (V) = 100 cm^3
Density (ρ) = 0.45 g/cm^3

i) From Law of flotation:
Real weight = Upthrust

$$4. b) i) \rho = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Mass} = \rho \times V$$

$$= 0.45 \text{ g/cm}^3 \times 100 \text{ cm}^3$$

$$= 45 \text{ g}$$

Since Real weight = Weight of water displaced

45 g = Weight of water displaced.

$$\text{But } \rho = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Volume} = \frac{\text{Mass}}{\rho}$$

$$= \frac{45 \text{ g}}{1 \text{ g/cm}^3}$$

$$= 45 \text{ cm}^3$$

\therefore Volume of water displaced = 45 cm^3

But Volume of part of object submerged =
Volume of water displaced

\therefore Volume of immersed part = 45 cm^3

\therefore Volume partially immersed = 45 cm^3 .

4. b) ii) To immerse the body completely:

Volume of body = Volume of water.

100cm^3 = Volume of water.

but $\rho = \frac{\text{Mass}}{\text{Volume}}$

$$1\text{g/cm}^3 = \frac{\text{Mass}}{100\text{cm}^3}$$

$$\text{Mass} = 100\text{g}$$

But, 45g is already displaced.

$$= (100\text{g} - 45\text{g})$$

= 55g has not been displaced.

$$1\text{g} = 0.01\text{N}$$
$$55\text{g} = ?$$

$$= \frac{55\text{g} \times 0.01\text{N}}{1\text{g}}$$
$$= 0.55\text{N}$$

\therefore Force required to immerse
fully = 0.55 N.

2017

5 marks

6.

(b) (i) State the law of floatation.

(ii) Find the fraction of the cork that partially immersed when a piece of cork of density 0.25 g/cm^3 and a mass of 20 g floats in water.

2015

10 marks

4. (a) (i) What effect does an increase in temperature have on the density of most liquids?
(ii) Explain the procedure of using methylated spirit, water and a pendulum bob to find the relative density of spirit.
- (b) (i) State Archimedes' Principle.
(ii) Briefly explain why does a ship sink deeper in fresh water than in sea water?
- (c) When a piece of wood is put in a graduated cylinder containing water, the level of the water rises from 17.7cm^3 to 18.5cm^3 . Calculate the
(i) Mass of a piece of wood.
(ii) Total volume of a piece of wood given that its relative density is 0.60.

4 (a) i) When the temperature increases in a liquid the density of a liquid will decrease due to increase in volume of liquids.

b) (ii) - Measure the weight of a bob in air = W_1
- Put the bob in water and measure the apparent weight of a bob in water using a spring balance = W_2 ,
- Remove the bob from the water
- Put the bob in methylated spirit and measure the apparent weight of the bob when it's in methylated spirit W_3
- Then start calculation
upthrust in water = $W_1 - W_2$
upthrust in methylated spirit = $W_1 - W_3$

$$\text{Relative density of methylated spirit, R.D} = \frac{W_1 - W_3}{W_1 - W_2}$$

$$R.D = \frac{\text{upthrust in methylated spirit}}{\text{upthrust in water}}$$

iii) Archimede's principle state that when a body is totally or partially immersed in a fluid it experiences an upthrust which is equal to the weight of the fluid displaced.

(ii) Because density of sea water is greater than the density of fresh water.

4(c) Solution

$$\text{Initial volume of cylinder } V_1 = 17.7 \text{ cm}^3$$

$$\text{Final volume of cylinder } V_2 = 18.5 \text{ cm}^3$$

$$\text{Density of water } \rho = 1 \text{ g/cm}^3$$

$$(i) \text{ Mass of wood, } m = ?$$

$$\text{Volume of cylinder} = 18.5 - 17.7 \\ v = 0.8 \text{ cm}^3$$

$$\text{From Density, } \rho = \frac{\text{Mass } m}{\text{volume } v}$$

$$m = \rho v = 0.8 \times 1 \\ = 0.8 \text{ g.}$$

\therefore Mass of Wood is 0.8 g.

(ii) Total volume of wood, v

Find the density of wood, x

Given: Relative density of wood = 0.6

$$\therefore R.D = \frac{\text{Density of wood}}{\text{Density of water}}$$

$$0.6 = \frac{x}{1}$$

$$x = 0.6 \text{ g/cm}^3.$$

$$\therefore \text{Volume} = \frac{\text{Mass}}{\text{Density}} = \frac{0.8}{0.6} = 1.33$$

\therefore Volume of wood is 1.33 cm³.

2012

4. (a) Why does a solid body weigh more in air than when immersed in a liquid?
- (b) An ordinary hydrometer of mass 27 g floats with 4 cm of its stem out of water. If the cross sectional area of the stem is 0.75 cm² calculate:
 - (i) the total volume of the stem just under the surface of the liquid.
 - (ii) the relative density of the liquid.
- (c)
 - (i) What do you understand by resolution of a force?
 - (ii) A metre rule is pivoted at its mid-point. If two objects of weights 1.0 N and 2.0 N are suspended at 30 cm and 90 cm respectively from one end, calculate the position where an upward force of 3.0 N must be applied in order for the metre rule to balance horizontally.

2011

10. (a) (i) State the Law of Floatation.
(ii) Mention two conditions that can make an object float.
- (b) (i) Draw a well-labeled diagram of a hydrometer.
(ii) Briefly explain how hydrometer can be used to measure the relative density of a liquid.
- (c) An iron cube of mass 480g and density 8g/cm^3 is suspended by a string so that it is half immersed in an oil of density 0.9g/cm^3 . Find the tension in the string.

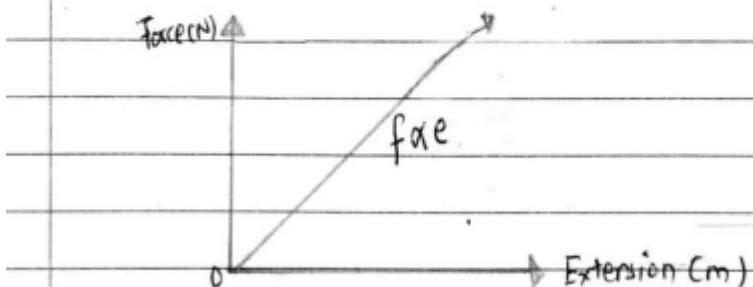
6. Structure and Properties of Matter

2017

7. (a) (i) What is the essential of kinetic theory of matter?
(ii) Sketch a graph showing how force applied in a stretched string varies with its extension.
- (b) (i) State Hooke's law.
(ii) List two applications of gamma rays.

7. a) i.) Kinetic theory of matter states that " particles in a matter are in a state of random, ^{continuous} motion".
- This theory is essential in explaining the thermal expansion of solid, liquid and gases.
 - Also this theory shows how gases molecules cause pressure on the container walls.

7. a) ii.) A GRAPH OF FORCE APPLIED AGAINST EXTENSION.



7. b) i.) Hooke's law states that " The extension of the spring is directly proportional to the force applied, provided that the elastic limit is not exceeded!".

$$7. \text{ b). ii.) Initial force applied} = 2\text{N} * 0.4\text{N} = 2.4\text{N}$$

$$\text{Initial extension, } (e_1) = 24\text{mm}$$

$$\text{Final force } (f_2) = ?$$

$$\text{Final extension } (e_2) = 16\text{mm.}$$

From Hooke's law :

$$F \propto e \quad \text{So, } \frac{F_1}{e_1} = \frac{F_2}{e_2}$$

$$F = ke$$

$$\frac{F}{e} = k \text{ (constant)} \quad F_2 = \frac{F_1 \times e_2}{e_1}$$

$$F_2 = \frac{2.4\text{N} \times 16\text{mm}}{24\text{mm}}$$

$$F_2 = 1.6\text{mm N}$$

But the load = $F_2 - \text{weight of the scale pan}$

$$= 1.6\text{N} - 0.4\text{N}$$

$$\text{The load} = 1.2\text{N}$$

∴ The load to be used is 1.2N

2012

6. (a) (i) Explain how a gas exerts pressure on the walls of its container.
(ii) Give reason why it is not sensible to rub the canvas of a tent in wet weather.
- (b) Explain two situations in which the phenomenon of surface tension is exhibited.
- (c) An oil drop of volume 10^{-9} m^3 spreads out on water to form a film of area 0.2 m^2 .
(i) estimate the length of an oil drop.
(ii) what assumption have you made in calculating part (c) (i) above.

b) i) gas exerts pressure on the wall of its container by the movement of its particle due to kinetic motion they have frequent striking the wall creates pressure on the wall of its container.

ii) It is not sensible to rub the canvas of a tent in wet weather

b) Phenomenon of surface tension is exhibited

i) floating of frogs eggs in water bubbles

ii) floating of skaters in water

c) Data given

$$\text{Volume} = 10^{-9} \text{ m}^3$$

$$\text{Area of film} = 0.2 \text{ m}^2$$

$$\text{Length} \times \text{Area} = \text{Volume}$$

$$L \times 0.2 \text{ m}^2 = 10^{-9} \text{ m}^3$$

$$L = \frac{0.000000001 \text{ m}}{0.2}$$

$$= 0.000000005 \text{ m}$$

$$\therefore \text{Length of oil drop} = 5 \times 10^{-9} \text{ m}$$

c) ii) Volume of any body either fluid or solid is obtained by multiplying the Length and Area of it.

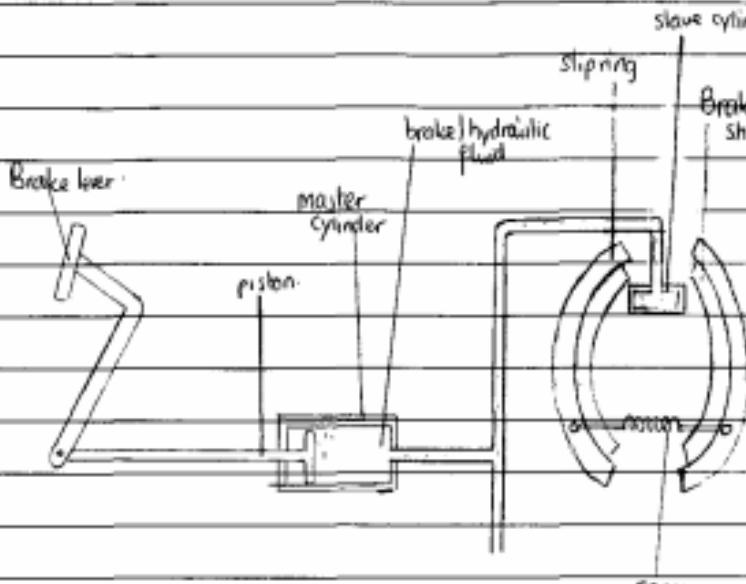
Hence Area of oil film on water \times length of drop
= Volume of oil drop.

7. Pressure

2020

4. (a) Use a well labelled diagram to explain the working principle of a hydraulic braking system.
(6 marks)

- (b) A uniform pencil AB weighing 40 g can be balanced horizontally on a knife edge at 2 cm from the end A when a mass 60 g is hung from this end. What is the length of a pencil?
(4 marks)

4	(a) HYDRAULIC BRAKING SYSTEM.
	
	A labelled diagram showing hydraulic brake system:
	(a) When the brake lever is stepped on it moves the piston in the master cylinder forward creating pressure in the brake fluid forcing it into the pipe to the slave cylinders. The pressure of the slave cylinders make the spring holding the two slip rings to extend making the brake shoe tightly attached to the car wheel and cause braking.

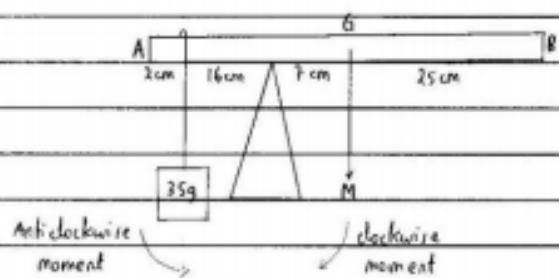
4	(b)	<p>From - (Clockwise = Anticlockwise) moment -</p> $60g \times 2\text{cm} = 40g \times x$ $\left(\frac{+90\text{g cm}}{40g} = \frac{40g \times x}{40g} \right)$ $x = 3\text{cm}$ <p>but length from point A to 40g = $\frac{1}{2}AB$.</p> <p>length A to C.g = $3\text{cm} + 2\text{cm}$ = 5 cm.</p> $5\text{cm} = \frac{1}{2}AB$ $AB = 2 \times 5\text{cm}$ $AB = 10\text{cm}$ <p>\therefore The length of the pencil = <u>10 cm</u>.</p>
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2019

4. (a) Why a bubble of air increases in volume as it rises from the bottom of a pond of water to the surface? Briefly explain. **(5 marks)**
- (b) A half meter rule AB is freely pivoted at 18 cm from end A and balances horizontally when a body of mass 35 g is hung 48 cm from end B. Calculate the mass of the rule. **(5 marks)**

4. (a) A bubble of air increases in volume as it rises from the bottom of a pond of water to the surface because pressure at the bottom of a pond is greater than pressure at the surface and according to Boyle's law, pressure varies inversely proportional to volume hence as the bubble of air rises to the surface, pressure is reduced and volume increases.

(b) Given equilibrium



Using the principle of moments about the pivot,

$$\sum \text{clockwise moments} = \sum \text{anticlockwise moments}$$

$$M \times 7 \text{ cm} = 35 \text{ g} \times 16 \text{ cm}$$

$$M = \frac{35 \text{ g} \times 16 \text{ cm}}{7 \text{ cm}}$$

$$M = \frac{560 \text{ g cm}}{7 \text{ cm}}$$

$$M = 80 \text{ g}$$

\therefore The mass of the rule is 80 g

7. (a) What is an altimeter?
- (b) Briefly explain the reasons for the following:
- A person at great height suffers from nose bleeding.
 - It is painful to walk barefoot on a road that is covered by pebbles.
- (c) A cube of sides 2 cm is completely submerged in water so that the bottom of the cube is at a depth of 10 cm. Calculate:
- the difference between the pressure on the bottom of the cube and the pressure on its top.
 - the weight of water displaced by the cube.

(Qn7- a) Altimeter

- Is instrument that used to measure the pressure of gases.

(b) (i) Because there is high pressure of blood to that person. When, their heart pump blood at very high pressure this will lead for blood to penetrate to the soft place like nose and cause nose bleeding to the person.

(ii) Because pebbles have small area so if a person walk bare foot to road which covered many experience painfull because small area experience high pressure than big area.

(c) Pressure at top (P_{top}) = ?

$$\text{Height } (h) = 10 \text{ cm} = 0.1 \text{ m} = 0.1 \text{ m.}$$

$$\text{Gravitational force } (g) = 10 \text{ N/kg.}$$

$$\text{Density of water } (\rho) = 1000 \text{ kg/m}^3.$$

$$P_{top} = \rho g h.$$

$$P_{top} = 0.1 \times 10 \times 1000 \text{ kg/m}^3.$$

$$P_{top} = 1000 \text{ N/m}^2.$$

Pressure at bottom (P_{bottom}) = ?

$$\text{Height } (H) = 8 \text{ cm} = 0.08 \text{ m.}$$

$$\text{Gravitational force } (g) = 10 \text{ N/kg.}$$

$$\text{Density } (\rho) = 1000 \text{ kg/m}^3.$$

$$P_{bottom} = \rho g h.$$

$$P_{bottom} = 0.08 \text{ m} \times 10 \text{ N/kg} \times 1000 \text{ kg/m}^3.$$

$$P_{bottom} = 0.8 \times 1000 \text{ N/m}^2.$$

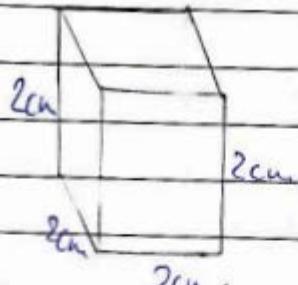
$$P_{bottom} = 800 \text{ N/m}^2.$$

> Difference between pressure at bottom of cube and pressure on its top

$$P_{\text{top}} - P_{\text{bottom}} = (1000 \text{ N/m}^2 - 800 \text{ N/m}^2) \\ = 200 \text{ N/m}^2.$$

∴ Difference between pressure at top and pressure at bottom is 200 N/m²

(ii.)



Volume of cube = Volume of water displaced.

$$\text{Volume of water} = l \times l \times l \\ = l^3. \text{ But } l = 2\text{ cm.} \\ = (2\text{ cm})^3 \\ = 8\text{ cm}^3$$

But

1 m³ Volume of water = 1 kg Mass of water.

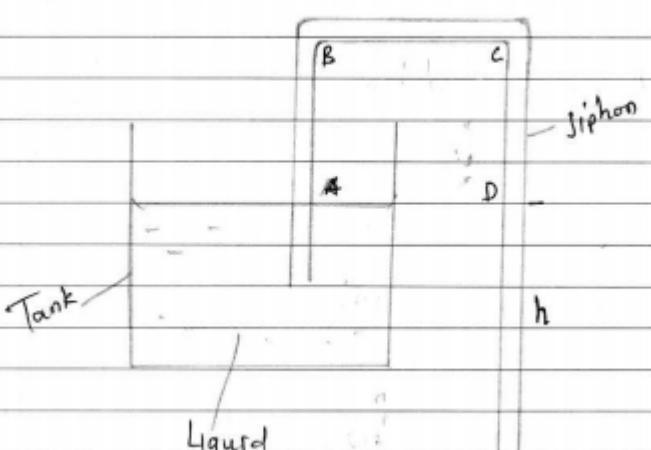
$$1 \text{ cm}^3 = 1 \text{ g.}$$

$$\text{Mass } 8\text{ cm}^3 = 8\text{ g.} \\ = 8\text{ g. or } 0.008\text{ kg.} \text{ But.}$$

$$\text{Weight} = \text{Mass} \times \text{Gravit.} \\ = 8\text{ g. } 0.008\text{ kg} \times 10 \text{ N/kg.} \\ = 0.08\text{ N.}$$

∴ Weight of water displaced is
0.08 N.

11. (a) State the application of each of the following apparatus:
- Manometer
 - Hygrometer
 - Barometer.
- (b) (i) What is a siphon?
(ii) With the help of a labeled diagram explain the principle on which the siphon operates.
- (c) (i) Briefly explain why a bubble of air increases in volume as it rises from the bottom of a pond to the surface.
(ii) A uniform tube 1.0 m long and closed at its upper end is pushed vertically downward into mercury until the liquid rises 0.2 m inside the tube. Calculate the depth of the open end below the mercury surface.

II	a) i) Manometer used in measuring gas pressure .	
	ii) Hygrometer used in measuring humidity of air .	
	iii) Barometer used in measuring atmospheric pressure ..	
II	b) i) Siphon is a tube used principle of atmospheric pressure to draw liquid from one place to another .	
II b) ii)		

ii) (b) i) The pressure at A and D are equal due to atmospheric pressure. The liquid from vessel is drawn by pressure due to ρhg at DE for the liquid to be drawn the height AB and DC must be to be large than barometric height of liquid.

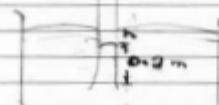
ii) c) i) The bubbles increases as it rises from bottom of pond because as it rises the pressure is reduced. From Boyle's law

$$V \propto \frac{1}{P}$$

Therefore as pressure reduced volume increasing

ii) c) ii) Solution

$$\text{at } 0.8 \text{ m}$$



ii) d) i) From Boyle's law

$$P_1 V_1 = P_2 V_2$$

$$P_1 = 0.76 \text{ mm Hg}$$

$$V_1 = 1 \text{ m} \times A$$

$$P_2 = 0.76 + h$$

$$V_2 = 0.8 \times A$$

$$0.76 \times 1A = 0.8A (0.76 + h)$$

$$0.76 + h = \frac{0.76}{0.8}$$

$$0.76 + h = 0.95$$

$$h = 0.95 - 0.76$$

$$h = 0.19 \text{ m}$$

$$\begin{aligned} \text{length of end of tube below mercury surface} &= 0.19 \text{ m} + 0.2 \text{ m} \\ &= 0.39 \text{ m} \end{aligned}$$

The depth of end of tube below the mercury surface is 0.39 m

8. Work, Energy and Power

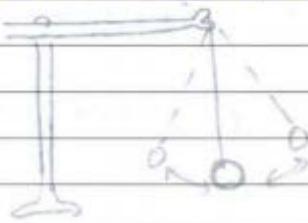
2013

11. (a) Mention two practical examples in our daily life in which the principle of conservation of energy is applied.
- (b) (i) What is a simple pendulum.
(ii) Describe the energy changes that take place when a simple pendulum swings from one side to another.
- (c) Name a machine or an apparatus used to change the following forms of energy.
(i) Heat energy to mechanical energy.
(ii) Mechanical energy to electrical energy.
(iii) Electrical energy to sound energy.
(iv) Sound energy to electrical energy.
(v) Heat energy to electrical energy.

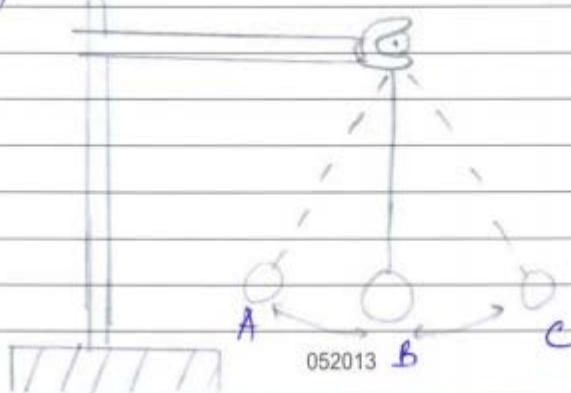
11. (a) (i) When we light in the night using candle, we convert heat energy into Light.

(ii) Production of electricity [electrical energy] from the water fall. Mechanical energy is converted into electrical energy.

(b) (i) Simple pendulum is a instrument made up of bob which is attached to the string that is connected to a clamp of retort stand.



(ii)



11. (b) - At the point B the simple pendulum has high Potential energy than Kinetic energy.

- At the point A and C the simple pendulum has high Potential energy than Kinetic energy since simple pendulum has attained height.

- At the any point Kinetic energy + Potential energy = Constant.

(c) (i) STEAM ENGINE (Train).

(ii) BICYCLE DYNAMO

(iii) SPEAKER or MICROPHONE SPEAKER

(iv) MICROPHONE - SPEAKER MICROPHONE

(v) THERMO COUPLE or THERMOPILE.

9. Static Electricity

2013

6. (a) Briefly explain why
- Nylon clothes crackle when undressed?
 - Petrol road tankers usually have a length of metal chain hanging and touching the ground?
- (b) What would happen when
- an ebonite rod is rubbed with fur?
 - a glass rod is rubbed with fur?
- (c) (i) Define electric current.
(ii) Two cells each of e.m.f. 6 V and internal resistance of $5\ \Omega$ and $6\ \Omega$ respectively are connected in parallel to a resistor of $10\ \Omega$. Find the current flowing in the $10\ \Omega$ resistor.

6@

- (i) Nylon crackles when Unbowed because nylon have static charge which attract to each other when unbowed.
- (ii) In order to avoid explosion by removing charges acquired by friction on moving on a rod to the earth's ground.

6@

- (i) When glass rod rubbed with fur it becomes negatively charged.
- (ii) When glass rod rubbed with fur it becomes Richly charged.

6@ In the Electric current is the rate of flow of electric charge or is the flowing of electric charge per unit time.

6(1)(e)

DATA

Internal resistance = 5Ω and 6Ω

$$\text{Total Internal resistance} = \frac{1}{R_{\text{tot}}} = \frac{1}{5} + \frac{1}{6}$$

$$= \frac{1}{5} + \frac{1}{6} - \frac{6+5}{30} = \frac{11}{30}$$

$$\frac{1}{R_{\text{tot}}} = \frac{1}{11} \text{ Then } R_{\text{tot}} = 11 \Omega$$

Resistance through the 10Ω shunt

Electromotive force is 6V

Apply

$E = I(R_{\text{tot}})$ ohm's law of Ohm's Law

$$6V = I(10 + 11)$$

$$6V = 2 \left(\frac{110 + 10}{11} \right) \text{ ohm}$$

$$6V = I \left(\frac{140}{11} \right) \text{ ohm}$$

$$I = \frac{11}{140} \times 6V$$

$$I = 0.47 \text{ Ampere}$$

Current flowing through the shunt is 0.47 Ampere

10. Magnetism

11. Forces in Equilibrium

2016

10 marks

4. (a) (i) Define turning effect of force and give its SI unit.
(ii) How the moment of force can be increased considerably in practical life? Give two examples.
- (b) (i) List two factors that affect stability of a body.
(ii) Briefly explain why the handle of a door is near its outside edge?
- (c) (i) What is meant by a balanced beam?
(ii) A uniform rod AB of mass 6.0 g is balanced horizontally about a knife edge at a distance of 3cm from end A where a mass of 8.0 g is hanging. Find the length of the rod.

2011

4. (a) (i) Define moment of a couple
(ii) Under what conditions will two forces form a couple?
- (b) (i) When is a body said to be in a stable equilibrium?
(ii) The diameter of a uniform cylinder is 0.2m and its height is 0.4m. The cylinder is placed on an inclined plane. Calculate the maximum angle to the horizontal to which the plane can be inclined before the cylinder falls down.
- (c) (i) State the principle of moment.
(ii) A heavy metal beam AB of mass 25kg is supported at its ends. The beam carries a mass of 150kg at a distance of 0.75m from end A. If the beam is 2m long, determine the thrust at supports A and B.
(iii) What assumption will you make to support your calculations in part (c)(ii) above?

5.

12. Simple Machines

2019

5. (a) Figure 1 shows a simple machine B which has to be used to pull the packing case of 2000 N into the car by an effort of 500 N. Calculate the efficiency of machine B. (5 marks)

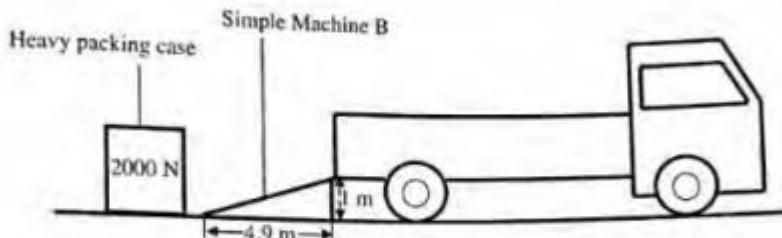


Figure 1

- (b) With the aid of a clearly labelled diagram, describe an experiment to investigate the relationship between the force acting on a body and the acceleration produced. (5 marks)

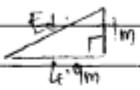
59) Given,

$$L = 2000 \text{ N}$$

$$t = 500 \text{ N}$$

$$F_d = ?$$

$$Ld = 1 \text{ m}$$



From pythagoras theorem

$$c^2 = a^2 + b^2$$

$$F_d^2 = t^2 + Ld^2$$

$$= \sqrt{t^2 + Ld^2}$$

$$= \sqrt{2500 + 1}$$

$$= \sqrt{2501}$$

$$F_d = 50 \text{ N}$$

Then,

$$M \cdot A = \frac{\text{Load}}{\text{Effort}}$$

$$= \frac{2000 \text{ N}}{500 \text{ N}}$$

$$= 4$$

$$M \cdot A = 4$$

$$\text{Also } V \cdot R = F_d$$

$$= \frac{F_d}{Ld}$$

$$= \frac{50}{1}$$

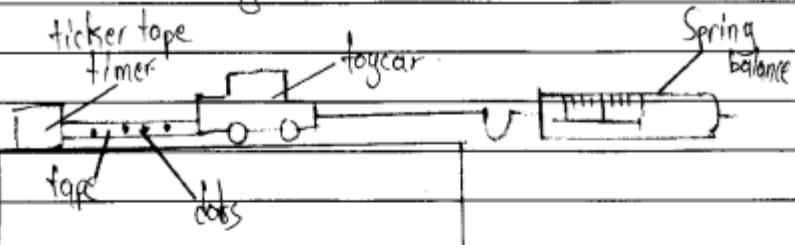
$$V \cdot R = 5$$

$$\text{Finally } E = \frac{M \cdot A \times 100\%}{V \cdot R}$$

$$= \frac{4}{5} \times 100\%$$

$$\therefore \text{Efficiency} = 80\%$$

5b) Consider the diagram,



The relationship can be obtained as follows,

The spring balance is pulled for different forces and they are recorded. The ticker tape time produces dots on some rate. Therefore a higher force produces much acceleration and the dots will be widely spaced. A lower force produces dots nearly spaced. This shows low acceleration.

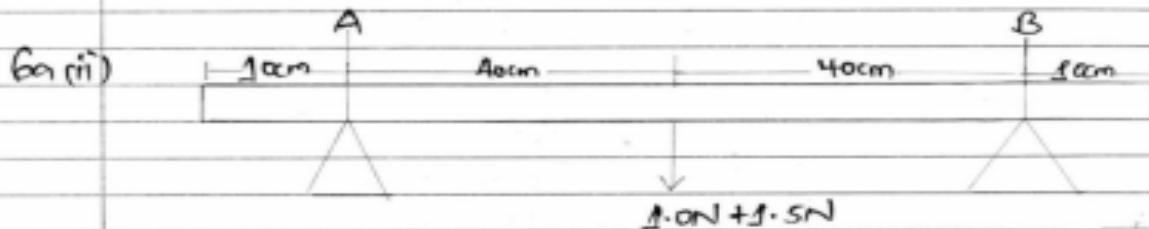
Therefore through frequency of dots the relationship between force applied and acceleration is attained.

2017

5 marks

6. (a) (i) What peculiar property does the effort has in all classes of levers?
(ii) A metre rule of weight 1.0 N is supported horizontally on two knife edges each placed 10.0 cm from its ends. If the weight of 1.5 N is placed at its mid-point, calculate the reaction at the supports.

6(a) The effort work to overcome the load in all classes of level.



From:

$$\begin{aligned} \text{Upward force} &= \text{Downward force} \\ A + B &= 2.5N \end{aligned} \quad (i)$$

Taking the moment about point A.

$$\text{Clockwise moment} = 2.5N \times 40\text{cm}$$

$$\text{Anticlockwise moment} = B \times 80\text{cm}$$

But:

$$\begin{aligned} \text{Clockwise moment} &= \text{Anticlockwise moment} \\ 2.5N \times 40\text{cm} &= B \times 80\text{cm} \quad (ii) \\ B &= \frac{2.5N \times 40\text{cm}}{80\text{cm}} \\ B &= \frac{2.5N}{2} \\ B &= 1.25N \end{aligned}$$

But eqn (i) says $A + B = 2.5N$

$$\therefore A + 1.25N = 2.5N$$

$$A = 1.25N$$

\therefore The two supports A and B each has $1.25N$

Archimedes' law of flotation states that,
 "A floating body displaces its own weight of
 the fluid in which it floats".

Ques) Given:

$$\text{Density of cork} = 0.25 \text{ g/cm}^3$$

$$\text{Mass of cork} = 20 \text{ g}$$

$$\begin{aligned}\text{Volume of cork} &= \frac{\text{Mass of cork}}{\text{Density of cork}} \\ &= \frac{20 \text{ g}}{0.25 \text{ g/cm}^3} \\ \therefore \text{Volume of cork} &= 80 \text{ cm}^3\end{aligned}$$

$$\begin{aligned}\text{Volume of water displaced} &= \frac{\text{Mass of cork}}{\text{Density of water}} \\ &= \frac{20 \text{ g}}{1 \text{ g/cm}^3} \\ \therefore \text{Volume of water displaced} &= 20 \text{ cm}^3\end{aligned}$$

But Volume of water displaced = Volume of cork immersed in water

$$\therefore \text{Volume of cork immersed in water} = 20 \text{ cm}^3$$

$$\begin{aligned}\text{Fraction of the cork} &= \frac{20 \text{ cm}^3}{80 \text{ cm}^3} \\ &= \frac{1}{4}\end{aligned}$$

$\therefore \text{Fraction of the cork partially immersed in water is } \frac{1}{4}$

13. Motion in Straight Line

14. Newton's Laws of Motion

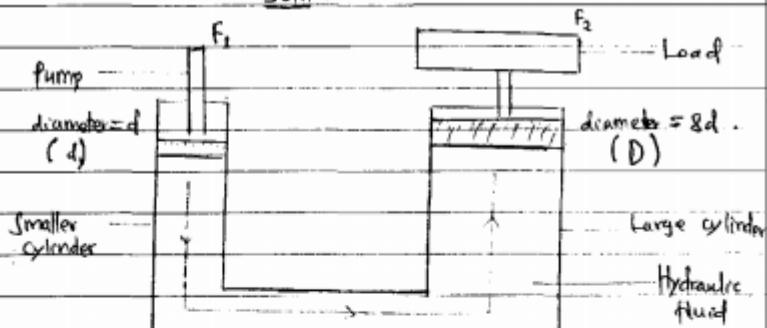
2020

5. (a) Why the recoil velocity of a gun is much less than the velocity of the bullet? Explain by using the principle of conservation of linear momentum. **(5 marks)**
- (b) A hydraulic press consists of a pump, load and two cylinders in which the larger cylinder is eight times the diameter of a smaller one. Use a well labelled cross-sectional diagram of a hydraulic press to determine the value of mechanical advantage of this machine if it is working with efficiency of 90%. **(5 marks)**

5a.	<p>From the principle of conservation of linear momentum which states that "If there is no any external force acting on the colliding collision system, the total momentum after collision is equal to total momentum after collision.</p> <p>Momentum before collision = Momentum after collision.</p> <p>Let, Mass of a gun = M_1.</p> <p>Mass of a bullet = M_2.</p> <p>Velocity of a gun after impact (recoil velocity) = V_1 in opposite direction.</p> <p>Velocity of a bullet = V_2.</p> <p>Initial velocity = $U = 0$.</p> <p>$(M_1 + M_2) \times 0 = M_1 \times V_1 + M_2 \times V_2$.</p> <p>$0 = M_2 V_2 - M_1 V_1$.</p> <p>Let's make V_1 the subject : also V_2 be the subject .</p> <p>$M_1 V_1 = M_2 V_2$.</p> <p>$\frac{V_1}{M_1} = \frac{V_2}{M_2}$</p> <p>$V_1 < V_2$ since the gun has very large mass comparing to the mass of a bullet .</p> <p>\therefore The recoil velocity of a gun is much less than the velocity of a bullet because the gun has large mass than the mass of a bullet .</p>

56

sln.

Given, efficiency (η) = 90%.

Required to find the value of mechanical advantage.

From, Velocity ratio = Area of larger cylinder

Area of smaller cylinder

$$= \frac{D^2}{d^2}$$

$$= \frac{(8d)^2}{d^2}$$

$$V.R = 64$$

$$\text{But, } M.A = \frac{\eta \cdot V.R}{100}$$

$$= \frac{90 \times 64}{100} = 57.6$$

\therefore The mechanical advantage of this machine is 57.6.

2016

10 marks

5. (a) (i) State the law of inertia.
(ii) Use the law in (a) (i) to define force.
- (b) A ticker-tape is moved through a ticker-timer for 5.0 seconds. If the timer is operating at 25 Hz;
(i) How many dots would have been printed on the tape?
(ii) What kind of motion does the tape represent? Give a reason.
- (c) A shell of mass 30 kg is fired at a velocity of 600 ms^{-1} from a gun of mass 7000 kg.
(i) What is the recoil velocity of the gun?
(ii) Briefly explain the significance of the answer obtained in (c) (i) above.

2014

4. (a) Give two practical examples where impulse and momentum play an important role.
- (b) (i) Distinguish between elastic collisions and inelastic collisions.
 (ii) A box of mass 50 kg is raised vertically with a uniform acceleration 'a' when a force of 700 N is acting in a rope. Calculate the uniform acceleration 'a'.
- (c) (i) State Newton's second law of motion.
 (ii) Sand falls gently at a constant rate of 50 g/s onto a horizontal belt moving steadily at 40 cm/s. Find the force in newtons exerted by the sand on the belt. State any assumptions made in your calculation.

4(b)(i) Differences	
Elastic collision	Inelastic collision
I(i) Elastic collision is the type of collision in which the colliding object exist in the same state after the collision as before it	- Inelastic collision is the type of collision in which the colliding objects exist in a different state after the collision from that before the collision
(ii) In elastic collision the kinetic energy is conserved	- In inelastic collision kinetic energy is not conserved, it is converted to other forms of energy such as heat sound or light.
(iii) In elastic collision the colliding objects do not stick together after the collision	- In inelastic collision the colliding objects stick together after the collision and move in the same direction and velocity

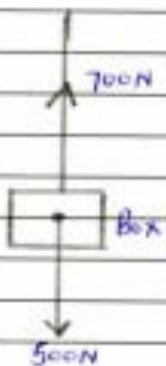
4(b)(ii) Data given

Mass of the object = 50 kg

Force applied = 700 N

Acceleration (a) = ?

4(b)(ii)



$$\begin{aligned}\text{Weight of the box} &= \text{Mass} \times \text{gravity} \\ &= 50\text{kg} \times 10\text{N/kg} \\ &= 500\text{N}\end{aligned}$$

The weight of the box opposes the force applied in the rope. Therefore the net force (F_{net}) causing acceleration will be

$$\begin{aligned}F_{net} &= \text{Force applied} - \text{Weight of box} \\ &= 700\text{N} - 500\text{N} \\ &= 200\text{N}\end{aligned}$$

$$F_{net} = 200\text{N}$$

Then

From Newton's second law

$$F_{net} = m \cdot a$$

$$\frac{F_{net}}{m} = a$$

Then

2013

8. (a) (i) What is meant by impulse of a force?
(ii) Briefly explain why seat-belts are designed to stretch in a collision.
- (b) (i) Define momentum.
(ii) The cork of a bottle of mass 4 g is ejected with a velocity of 10 m/s in 0.1 second. Find the force exerted on the bottle.
- (c) A car of mass 2000 kg is travelling along a straight road at a constant velocity of 10 m/s developing 3.0 kilowatts. If the engine of the car is switched off:
(i) Calculate the energy lost by the car in coming to rest
(ii) Briefly explain the energy changes in the process stated in (c) above.

Q 9) i) Impulse of a force = the product of magnitude of a force and its time of action. Its unit is Ns (Newton-second)

i) The seat-belts are designed to stretch in a collision so as to prevent a person from falling off a seat. Like a car that was in motion collide with another the passengers tends to be thrown forward due to their motion inertia this follows from Newton's first law of motion so if the seat-belts were not designed to stretch in a collision the passenger would fall off the seat resulting into injuries or death.

Q b) i) Momentum
Momentum is the product of mass and its velocity. Its unit is kg m/s .

i) Mass of cork = 4 g
Velocity of cork = 10 m/s
time = 0.1 sec
Force - bottle = ?
From Newton's third law of motion
Force exerted on cork = Force exerted on bottle

8

When the car was moving it had
Kinetic Energy ($K.E.$) equal to $\frac{1}{2}mv^2$
thus

Energy lost by car = Change in K.E.

$$= \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$$

D.L.T

$$\therefore \text{Energy lost by car} = \frac{1}{2}mv^2 = \frac{1}{2}m(v_2^2 - v_1^2)$$

$$= \frac{1}{2} \times 2000 \times (10)^2$$

$$= 10000 \times 100$$

$$= 100 \text{ kJ}$$

\therefore Energy lost by car = 100 kJ

- i) Kinetic energy of the car (100 kJ)
is changed into heat energy (or
a large proportion) and some energy
as heat (car comes to rest).
This is because due to the fact that
work is done to overcome friction
when the engine is switched off and thus
causes production of heat.

$$\therefore \text{force on bottle} = \text{force exerted on cork}$$

$$= \frac{m_e V - m_c u}{t}$$

But initial velocity \rightarrow
 Initial velocity of cork = 0 m/s

Now

$$\begin{aligned}\text{Force on Cork} &= \frac{mV - 0}{t} \\ &= \frac{0.004 \text{ kg} \times 10 \text{ m/s}}{0.1} \\ &= 0.04 \text{ kg m/s} \\ &= 0.4 \text{ N} \\ &= 0.4 \text{ N}\end{aligned}$$

\therefore The force exerted on bottle
 \downarrow 0.4 N

8) e) Mass of law = ~~2000~~ 2000 kg
 Constant velocity = 10 m/s
 Power = 3 kW
Energy lost to come to a rest \Rightarrow

2012

5. (a) Define the following terms:
- (i) Newton.
 - (ii) Inertia.
 - (iii) Linear momentum.
- (b) Two stones are thrown vertically upwards from the same point with the same velocity of 20 m/s but at an interval of 2 seconds. When they meet, the second stone is rising at 10 m/s. Calculate:
(i) the time taken by the second stone in air before they meet
(ii) the velocity of the second stone when they meet.
- (c) A stationary bomb of mass 5 kg explodes into one part A of mass 2 kg flying off with a velocity of 60 m/s and another part B of mass 3 kg flying off with a certain velocity in the opposite direction. Calculate the
(i) velocity of part B
(ii) total kinetic energy produced by the explosion.

5	a) i) Newton is the force which gives the mass of one kilogram (1kg) an acceleration of one metre per second squared 1m/s^2 . $1\text{N} = 1\text{kg} \times 1\text{m/s}^2$.
	ii) Inertia is tendency of the body to resist motion when it is at rest or to continue moving when it is stopped when it is in motion. This is the opposite reaction to motion or rest.
	iii) Linear momentum is the product of the mass of the body and the velocity of the body in motion in straight line. $\text{Momentum} = \text{Mass} \times \text{Velocity. (MV)}$.
b)	$M = 20\text{m/s}$, Time interval $2s$, $v = 20\text{m/s}$, $t = ?$ $g = 10\text{m/s}^2$ (given).

Soln:

From the Newton's first law of motion,

$$v = u + at \quad \text{---(1)}$$

$$10 = 20 + at \quad \text{when } a = -g$$

$$10 = 20 - gt$$

$$gt = 10$$

$$t = 1 \text{ s}$$

i) Time taken by the second stone is
1 second.

2010

9. (a) Define acceleration due to gravity and state Newton's first Law of motion. **(2 marks)**
- (b) An object is seen to fall from an aeroplane and observed to take 15 seconds in reaching the ground. Assuming that air resistance is negligible, calculate:
(i) the height of the plane. **(2 marks)**
(ii) the velocity with which the object strikes the ground. **(2 marks)**
- (c) (i) Find the average force required to stop a train weighing 200 tons traveling at 54 km/h in two minutes from the application of the brakes.
(ii) What distance will the train travel in that time? **(4 marks)**

15. Temperature

2011

5. (a) Heat and temperature are closely related but they are different. State how they are related and how they differ.
- (b) (i) What are the fixed points of a thermometer?
(ii) The temperature of the melting point of ice and that of steam above water boiling at 760mmHg pressure are marked as 20 and 80 respectively on a certain thermometer. Calculate the thermometer reading when the temperature is 60°C.

16. Sustainable Energy Sources

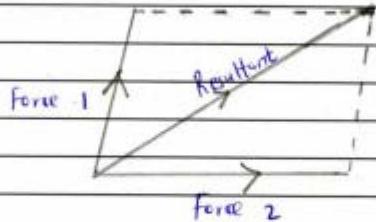
17. Applications of Vectors

2014

10 marks

6. (a) State the parallelogram law of forces.
- (b) (i) Distinguish between absolute velocity and relative velocity.
(ii) Wind is blowing 30° west of north at 20 km/hour. A bird is flying in the wind and its velocity relative to the ground is 90 km/hour at 75° west of north. Calculate the velocity and direction of the bird.
- (c) (i) Define the coefficient of dynamic friction.
(ii) A body of mass 40 kg is placed in a straight track sloping at an angle of 45° to the horizontal. If the body is held from slipping by friction, calculate the normal reaction and the force of friction.

6(a)	Parallelogram law states that, "if two vectors (forces) are represented by the two adjacent sides of a parallelogram then the diagonal drawn from their common starting point represents the resultant of the two forces in magnitude and direction."
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Differences	
Absolute velocity	Relative velocity
- Absolute velocity is the velocity of one body with respect to another stationary body	- Relative velocity is the velocity of one body with respect to another moving body

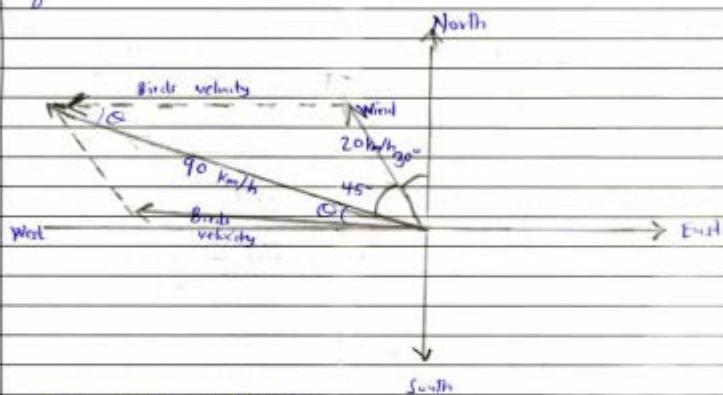
6 (b) Data given

Wind velocity = 20 km/hr

Wind direction = 30° West of North

Relative velocity of bird = 90 km/hr at 75° W of North

D



Let birds velocity = x

Using cosine rule

$$x^2 = (90)^2 + (20)^2 - (2 \times 90 \times 20 \times \cos 45)$$

$$= 8100 + 400 - (3600 \times 0.7071)$$

$$= 8500 - 2545.56$$

$$= 5954.44$$

$$\sqrt{x^2} = \sqrt{5954.44}$$

\therefore Velocity of the bird = 77.717 km/hr

Direction of the bird will be:

Using sine rule

$$\frac{\sin 45}{7.717} = \frac{\sin \theta}{20}$$

$$\sin \theta \times 7.717 = \sin 45 \times 20$$

$$\sin \theta = \frac{\sin 45 \times 20}{7.717}$$

$$\theta = \sin^{-1} \left(\frac{\sin 45 \times 20}{7.717} \right)$$

$$= \sin^{-1} \left(\frac{0.7071 \times 20}{7.717} \right)$$

$$\theta = \frac{14.142}{7.717}$$

$$\theta = 1.83^\circ$$

$$\text{Direction of bird} = 75^\circ + 1.83^\circ$$

$$= 76.83^\circ$$

\therefore Direction of bird = 76.83° West of North

6(c)) Coefficient of dynamic friction is the ratio of the dynamic / kinetic friction (F_k) to the normal reaction (R)

$$\text{Coefficient of dynamic friction } (H_k) = \frac{\text{Dynamic friction } (F_k)}{\text{Normal reaction } (R)}$$

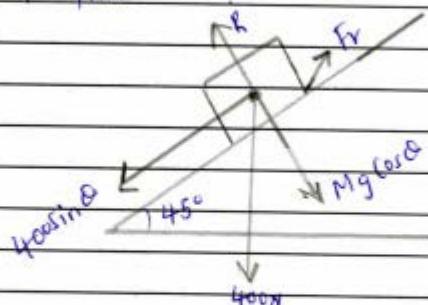
(ii) Data given

$$M_{AB} = 40 \text{ kg}$$

$$\theta = 45^\circ$$

Normal reaction (R) = ?

Force of friction = ?



From the figure

$$\begin{aligned}\text{Normal reaction } (R) &= mg \cos \theta \\ &= 40 \times 10 \times \cos 45^\circ \\ &= 400 \times 0.7071 \\ &= 282.84\end{aligned}$$

$$\therefore \text{Normal reaction} = 282.84 \text{ N}$$

$$\therefore \text{Normal reaction} = 282.84 \text{ N}$$

$$\text{Friction force} = mg \sin \theta$$

$$\begin{aligned}&= 40 \times 10 \times \sin 45^\circ \\ &= 400 \times 0.7071 \\ &= 282.84\end{aligned}$$

$$\therefore \text{Friction force} = 282.84 \text{ N}$$

18. Friction

2014

10 marks

6. (a) State the parallelogram law of forces.

- (b) (i) Distinguish between absolute velocity and relative velocity.
(ii) Wind is blowing 30° west of north at 20 km/hour. A bird is flying in the wind and its velocity relative to the ground is 90 km/hour at 75° west of north. Calculate the velocity and direction of the bird.

- (c) (i) Define the coefficient of dynamic friction.
(ii) A body of mass 40 kg is placed in a straight track sloping at an angle of 45° to the horizontal. If the body is held from slipping by friction, calculate the normal reaction and the force of friction.

19. Light

2020

3. (a) Three plane mirrors are arranged along three sides of a square. A ray of light is incident on the left side mirror at its midpoint with an angle of incidence of 40° so that the ray is afterwards reflected by other mirrors. Draw the appropriate path of the ray and calculate the angle through which the ray is turned at each of the three reflections. **(6 marks)**
- (b) Explain two functions of the shutter in a camera. **(4 marks)**

3(a) Given: Incidence angle for a first mirror = 40°

- From Incident angle = Reflected angle.
= reflected angle = 40°

- At top Mirror
Incidence angle = $90^\circ - 40^\circ$
 $= 50^\circ$

. And Reflected angle at second Mirror = 50°

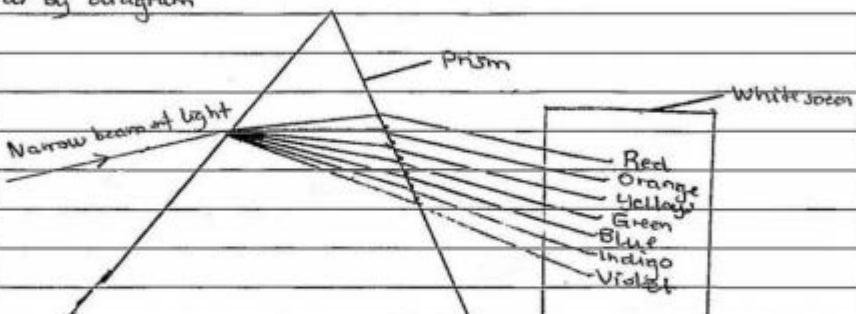
- At right Mirror
incidence angle = $90^\circ - 50^\circ$
 $= 40^\circ$

And Reflected angle = Incident angle
 $\Rightarrow 40^\circ$

3 (b) shutter in camera has following function
 i) To close and open so as to allow light from image to reach the camera films so that the image can be formed
 ii) It control amount of light which should pass to the camera films by varying the size of the gap when light rays are passing in the camera.

2019

3. (a) In a light experiment, a narrow beam of light directed onto a glass prism leaves the prism and falls on a white screen. Draw a labelled diagram to show the experimental set-up and observation seen on a screen. **(5 marks)**
- (b) Explain two ways in which lens cameras differ from the human eye. **(5 marks)**

3.	<p>a/ The narrow beam of light that is directed onto a glass prism will be dispersed by this prism whereby a spectrum (band of colours) will be produced on a screen. Seven colours will be seen on a screen which are Red, Orange, yellow, green, blue, indigo and violet. Its diagram is as follows</p> <p>3 a/ by diagram</p>  <p>b/ i/ Lens cameras form an image at the film through chemical reactions while human eye form the image at the retina through photoreceptor cells.</p> <p>ii/ Lens cameras focus near objects or far objects (accommodation) by changing the distance from the lens to the film while human eye focus near objects or far objects (accommodation) by changing the thickness of lens of eye.</p>
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2018

8. (a) Give two examples which illustrate the rectilinear propagation of light.
- (b) (i) The refractive index of light passing from water to air is $3/4$. Calculate the critical angle.
(ii) Outline two differences between primary and secondary rainbows.
- (c) In Figure 1, identify the names of colours labeled A, B, C, D, E, F and G.

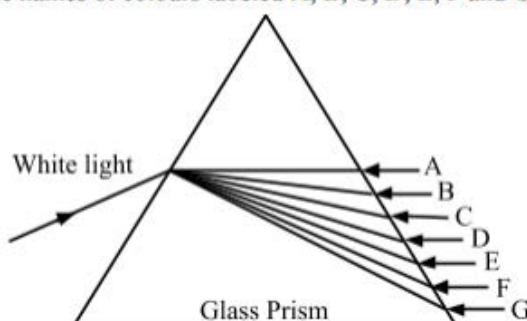


Figure 1

.8(a) (i) Shadow and.
(ii) Eclipse.

(b) (i) Given refractive index is $\frac{3}{4}$.
Critical angle occur at refracted ray of angle 90° .

from

$$\text{refractive index } (\eta_w) = \frac{\sin \text{ of } r^\circ}{\sin \text{ of } i^\circ}$$

$$\frac{3}{4} \text{ But from water to air } (\eta_a) = \frac{\sin i^\circ}{\sin r^\circ}$$

$$\frac{3}{4} = \frac{\sin i^\circ}{\sin 90^\circ}$$

$$\sin i^\circ = \frac{3}{4} \times 1$$

$$\sin i^\circ = 0.75$$

$$\sin^{-1}(0.75) = i^\circ
= 48^\circ 35'$$

∴ From incidence angle that produce ~~emit~~ 90° angle of r is the critical angle.

∴ Critical angle is $48^\circ 35'$

(i)	Primary rainbow.	Secondary rainbow
	(i) Undergoes only single total internal reflection.	(i) Undergo double int total internal reflection

(ii)	It is more bright and easily seen with red colour on the outside curve.	(ii) It faintly coloured and not easily seen with red forming the inner curve.
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C A - Red.

B - Orange

C - Yellow

D - Green

E - Blue

F - Indigo

G - Violet

2017

10 marks

5. (a) (i) Why convex mirrors are used as driving mirrors? Give two reasons.
(ii) Calculate the critical angle for the light emerging from a glass of refractive index 1.50.
- (b) (i) How people with short-sighted defect differ from those with long-sighted defect?
(ii) Calculate the focal length of a lens when a projector is used to produce a sharp image of an object being at a distance of 120 cm from the screen.

5	(a) (i) The convex mirror are used as driving mirror because (a) They sight behind to avoid accidents. (b) The polished surface that allows easy penetration of image
	(ii) The critical angle. From $\text{refractive index} = 1.50$. $1.52 = \frac{\sin i}{\sin r}$

	(b) (i) The people with short-sighted defect can not sight to the far distance while long-sighted defect can sight in near distance.
	(ii) Focal length. From the lens formula. $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$ $\frac{1}{f} = \frac{1}{100} + \frac{1}{120}$ $\frac{1}{f} = \frac{1}{80}$.

2016

6. (a) (i) Distinguish between light spectrum and dispersion of light.
 (ii) Briefly describe how a light ray passes through an equilateral glass prism.
- (b) Study Figure 1 which represents three primary colours combined together and answer the questions that follow:

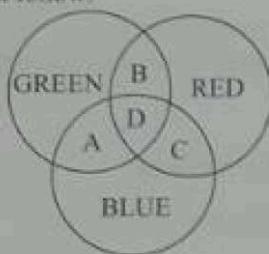


Figure 1

- (i) Identify the colours represented by the letters A, B, C and D.
 (ii) What general name is given to the colours obtained by mixing two primary colours?
 (iii) Name the colour produced as a result of mixing three primary colours.

2015

6. (a) (i) State two ways in which the image formed in plane mirror differs from that in a pin hole camera.
(ii) What is the effect of moving the pinhole camera closer to the object?
- (b) (i) List three rules used to locate images in curved mirrors.
(ii) Give two similarities and two differences that exist between the human eye and a lens camera.
- (c) A mirage is often seen by a motorist as a pool of water on the road some distance ahead.
(i) Draw a sketch diagram to show the formation of such a mirage.
(ii) Briefly explain how mirage is formed.

6 a) i) \rightarrow Image in plane mirror is upright and left-right reversed WHILE image in a pinhole camera is upside down reversed

\rightarrow Image in a plane mirror is of the same size as the object WHILE the image in pinhole camera is diminished.

ii/ Moving the pinhole camera closer to the object cause the image to increase in size.

b) ii) \rightarrow The light rays travelling parallel to principal axis will be reflected through the principal focus.

\rightarrow The light rays travelling through the principal focus will be reflected parallel to principal Axis.

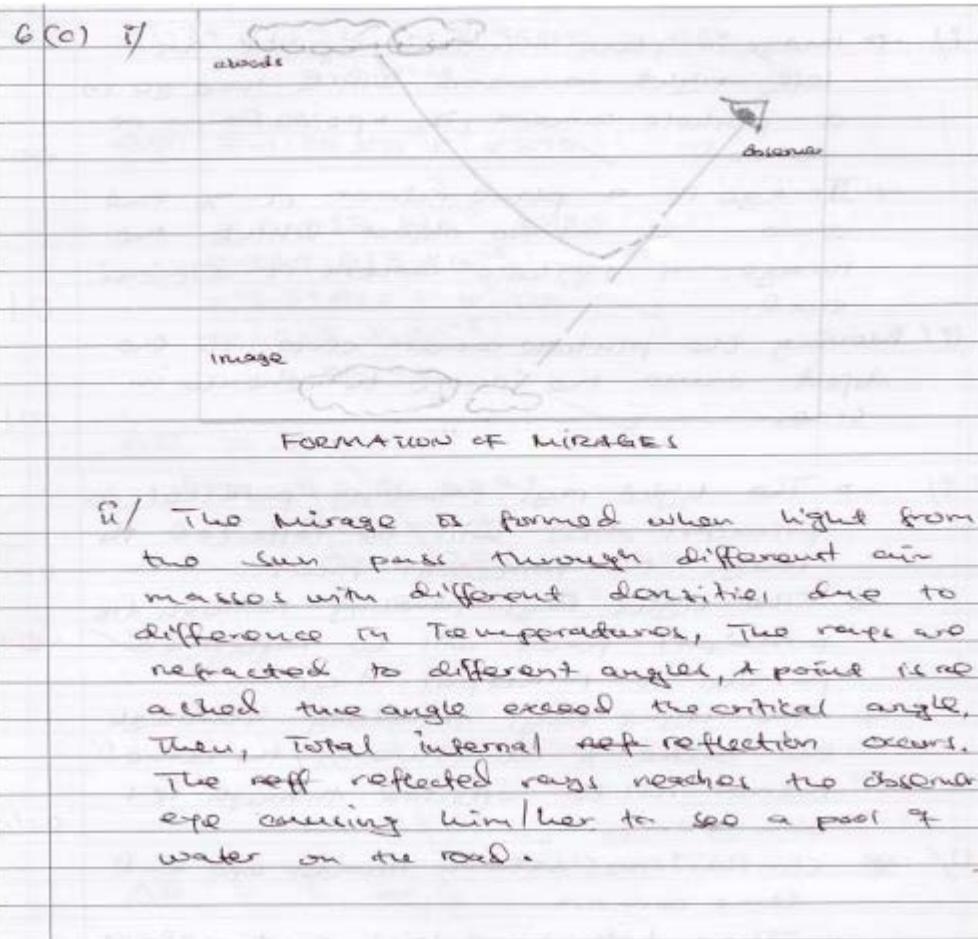
\rightarrow The light rays travelling through the centre of curvature of the curved mirror will be reflected through its own path.

ii/ ~~* Similarities between Human eye and lens camera.~~

\rightarrow They both have lens that refract light

\rightarrow All produce diminished image

Human Eye	Lens camera
Image is formed at Retina	Image is formed in film.
produce upside down reversed image	produce upright image



2014

7. (a) (i) What is meant by refraction of light?
Mention three points to be considered when drawing a ray diagram to show the formation of images on a concave mirror.

- (b) (i) Briefly explain why part of the road ahead of a person apparently looks as if it has a pool of water on a sunny day?
(ii) A pin is at the bottom of a vessel 16 cm deep. When the vessel is filled with water the pin appears to rise when viewed from above. Find the height to which the pin appears to rise.

- (c) Paraffin has a greater refractive index than water. What can you say about the
 - (i) relative velocity of light in paraffin and in water?
 - (ii) path of a ray of light when passing from water into a layer of paraffin?

2010

4. (a) (i) Explain the terms opaque and translucent and give an example of each. (2 marks)
- (ii) Danger signs along the road as well as tail and brake lamps of motor vehicles rear are painted red. Briefly explain the reason behind. (1 mark)
- (b) What is the basic difference between real and virtual image as formed by curved surfaces. (2 marks)
- (c) (i) Give two reasons why convex mirror are used as driving mirror? (2 marks)
- (ii) A convex mirror of focal length 18cm produces an image on its axis 6cm away from the mirror. Calculate the position of the object. (3 marks)

20. Optical Instruments

21. Thermal Expansion

2020

6. (a) Carefully study Figure 1. Explain what will happen to the bulbs P and Q in relation to the water levels X and Y when the heater is turned on. (5 marks)

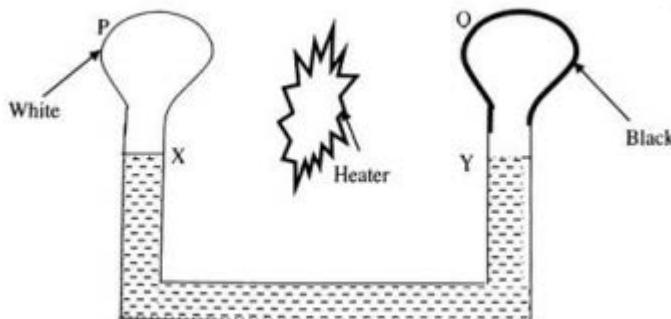


Figure 1

- (b) How would the dimensions of a newly constructed Tanzania standard gauge rail line change during the summer and winter days? (5 marks)

6 (a) → the bulb Q will absorb more heat than bulb P because of its black colour as bulb P will highly reflect it.

- The raise in temperature in bulb Q

More than in bulb P makes exertion of

more air pressure in bulb Q

as Pressure \propto Temperature in gases.

→ There will be rise in water level X and fall in water level Y due to the atmospheric pressure which compresses water from bulb Q.

(b) The changes are such that the dimensions will increase during summer and due to thermoexpansion as there is more temperature and they will decrease during winter due to the thermo contraction as it is a cold period. due to the formula;

$$\text{Length, } L = \frac{\alpha L_0 \Delta T}{L - L_0} \text{ of thermoexpansion}$$

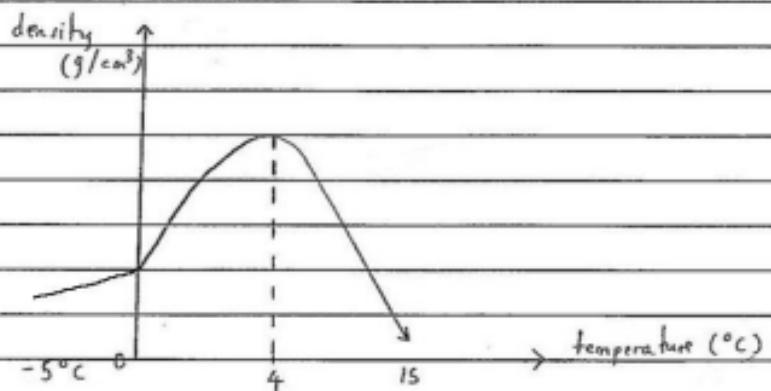
2019

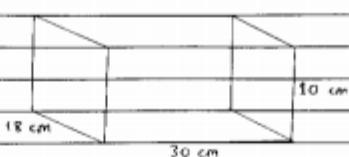
6. (a) A beaker containing ice is heated from -5°C to 0°C and then from 0°C to 15°C . With the aid of a diagram, explain the variation of density with temperature. (5 marks)

- (b) A brick at 20°C has a dimension of 30 cm, 18 cm and 10 cm for length, width and height respectively. If a brick is heated to a new temperature of 150°C , calculate the new dimensions.

(5 marks)

6. (a) When ice at -5°C is then heated to 15°C , its density will increase from the temperature of -5°C to 4°C and then will return to normal or linearly after the temperature of 4°C .



6.	do Given a brick
	
	$\alpha = 1.2 \times 10^{-5} \text{ K}^{-1}$
	from $l_t = l_0 (1 + \alpha \Delta \theta)$
	$\Delta \theta = \theta_f - \theta_i$
	$\Delta \theta = 150^\circ\text{C} - 20^\circ\text{C}$
	$\Delta \theta = 130^\circ\text{C}$
	New length
	$l_t = l_0 (1 + \alpha \Delta \theta)$
	$l_t = 30 (1 + 1.2 \times 10^{-5} \times 130)$
	$l_t = 30 (1 + 1.56 \times 10^{-3})$
	$l_t = 30 (1 + 1.56 \times 10^{-3})$
	$l_t = 30 (1 + 1.56 \times 10^{-3})$
	$l_t = 30 + 0.0468$
	$l_t = 30.0468 \text{ cm}$
	New width,
	$l_t = l_0 (1 + \alpha \Delta \theta)$
	$l_t = 18 (1 + 1.2 \times 10^{-5} \times 130)$
	$l_t = 18 (1 + 1.56 \times 10^{-3})$
	$l_t = 18 + 0.02808$
	$l_t = 18.02808 \text{ cm}$

6.	(b) New height,
	$l_t = l_0 (1 + \alpha \Delta \theta)$
	$l_t = 10 (1 + 1.2 \times 10^{-5} \times 130)$
	$l_t = 10 (1 + 1.56 \times 10^{-3})$
	$l_t = 10 + 0.0156$
	$l_t = 10.0156 \text{ cm}$
	\therefore The new dimensions of the brick are 30.0468 cm , 18.02808 cm and 10.0156 cm for length, width and height respectively.

2018

11. (a) (i) What is meant by the term thermal expansion?
(ii) Mention two applications of thermal expansion of solids.
- (b) (i) List three areas where bimetallic strips are used.
(ii) Why a bimetal strip made of brass and invar is curved outside with brass?
- (c) Describe how simple fire alarm system operates.

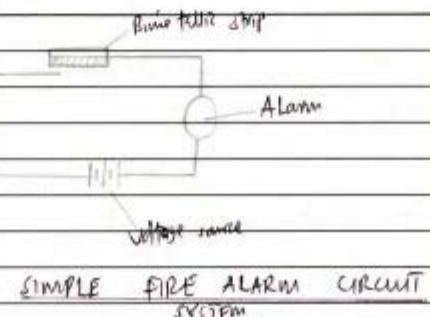
11. (a) (i) Thermal expansion is the increase in the dimensions of a material due to change in temperature of the material. OR Is the increase in the dimensions of the material per unit change in temperature.	
(ii) A. Used in designing railway lines whereby the gaps are left between two successive bars (metallized bars) to allow for expansion. B. Used in riveting of metals..	
(b) (i) A. In security fire alarms. B. In electric irons. C. In thermostats.	

11. (b) (i) A bimetal strip made up of brass and invar is curved outside with brass BECAUSE brass has a higher linear thermal expansivity value than invar that it EXPANDS faster and more than the invar making the outside of the curve of the bimetal strip.

(c) Simple fire alarm system works/operates using the principle of thermal expansivity and curving of a bimetallic strip due to temperature change.

The simple fire alarm system consists of bimetallic strip in circuit with the alarm. The bimetallic strip acts as the switch of the circuit.

When α the temperature rises due to the fire outbreak, the bimetallic strip EXPANDS and curves when it curves it completes the circuit of the alarm circuit and fire alarm rings to alert a fire outbreak.



2017

4. (a) Mention four applications of thermal expansion of solids.
- (b) Briefly explain why holes are left below the chimneys of kerosene lamp or kitchen.
- (c) A steel tyre of diameter 150 cm at 10°C is to be fitted on to a train wheel of diameter 151 cm. What temperature must the tyre be heated to just fit the wheel?

4 (a) i) Construction of roads

ii) Construction of Bridges

iii) Used in construction of Roads or houses

iv) Used in construction of Overheading Telephone wires.

(b) Holes are left below the chimneys of Kerosene lamp or Kitchen in order to allow soot to be go away and air to enter in order to support combustion.

(c) Data Given

$$\text{Initial diameter } (d_i) = 150\text{ cm}$$

$$\text{Initial Temperature } (\theta_i) = 10^\circ\text{C}$$

$$\text{Final Diameter } (d_f) = 151\text{ cm}$$

$$\text{Linear expansivity } (\alpha) = 0.000011/\text{K}$$

$$\text{Required Final Temperature } (\theta_f) = ?$$

From

$$\alpha = \frac{d - d_i}{d_i(\theta_f - \theta_i)}$$

$$0.000011 = \frac{151 - 150}{150(\theta_f - 10)}$$

$$151 - 150 = 0.000011 \times 150(\theta_f - 10)$$

$$1 = 0.00165(\theta_f - 10)$$

$$\theta_f = \left(\frac{1}{0.00165} \right) + 10$$

$$\theta_f = 606.01 + 10$$

$$= 616.01^\circ\text{C}$$

$$\approx 616^\circ\text{C}$$

∴ Final Temperature is 616°C .

2016

7. (a) What is meant by the terms:
(i) Bimetallic strip.
(ii) Linear expansivity of the solid.
- (b) Briefly explain on the following observations:
(i) In cold weather the metal blade of a knife feels cooler than the wooden handle.
(ii) A cool breeze blows from the sea on a hot summer day.
- (c) (i) Define latent heat of fusion of a substance.
(ii) A copper block of mass 0.68 kg is suspended in a freezing mixture at -50°C for some time and then transferred to a large volume of water at 0°C . Calculate the mass of ice formed.

2015

5. (a) Define the following terms:
(i) Coefficient of superficial expansion.
(ii) anomalous expansion of water.
- (b) (i) How much heat is needed to change 340g of ice at 0°C to water at 0°C ?
(ii) What is the name of heat lost by ice in (b) (i) above?
- (c) An iron rivet of radius 8.95mm at 20°C is to be inserted into the hole of iron plate of radius 8.92mm at 20°C . What temperature must the rivet be heated in order to fit into the hole?

5 (iii) Coefficient of superficial expansion is the fractional increase in area of the material per degree rise in temperature. It is also called 'the areal expansivity'.

(iv) Anomalous expansion of water is the phenomenon that explains the increase in volume of water as it is cooled between 4°C to 0°C . Example, water is denser at 4°C than at 0°C when it is cooled and contracts.

(b)(ii) Data:

$$\text{Heat} = ? = H$$

$$\text{Mass of ice (m)} = 340\text{g}$$

$$\text{constant temperature} = 0^{\circ}\text{C}$$

$$\text{Specific latent heat of fusion of ice } (L_f) = 336\text{J/g}$$

solution

$$H = m L_f = (340 \times 336)\text{J} = 114240\text{J}$$

∴ The required heat is 114240 J.

(v) The heat above in b(i) is not lost; but it is gained to form water by ice. The heat gained is called LATENT HEAT OF FUSION of ice.

$$(c) \text{Iron rivet} = 8.95\text{mm} (20^{\circ}\text{C})$$

$$\text{Iron plate} = 8.92\text{mm} (20^{\circ}\text{C}), \text{hole}$$

5 (a) The temperature of the rivet is not to increase because the hole is thinner than that of the hole-rivet. Therefore, either the hole is to be heated to expand or, the rivet is to be cooled to fit the diameter. Considering the heating or cooling of the rivet;

$$\Delta L = 8.95\text{mm} - 8.92\text{mm} \quad (\text{change in length}) \\ = 0.03\text{mm}$$

$$\text{But } 1\text{m} = 1000\text{mm}$$

$$x = 0.03\text{mm} \rightarrow x = 0.03 \times 10^{-3}\text{m} \\ = 3 \times 10^{-5}\text{m}$$

$$\Delta L = 3 \times 10^{-5}\text{m}$$

But if ΔT = change in temperature, L_1 = original length and α = linear expansivity of iron;

$$\therefore \Delta L = \alpha L_1 \Delta T; \alpha = 1.24 \times 10^{-5}$$

$$\therefore \Delta T = \frac{\Delta L}{\alpha L_1} \Rightarrow \Delta T = ?; L_1 =$$

$$\therefore \Delta T = \frac{3 \times 10^{-5}}{1.24 \times 10^{-5} \times 8.92 \times 10^{-3}}$$

$$= \frac{3 \times 10^{-5}}{1.24 \times 8.92} + 8 = \frac{3}{1.24 \times 8.92} \times 10^3$$

$$= \frac{3 \times 10^3}{1.1408} = \frac{3}{1.1408} \times 10^3$$

$$= 0.33 \times 10^3 = 330^{\circ}\text{C}.$$

$$\text{But } \Delta T = 1000^{\circ}\text{C} - 20^{\circ}\text{C} = 980^{\circ}\text{C}$$

∴ The rivet is cooled or alternatively the hole is heated to 980°C or 980K

2014

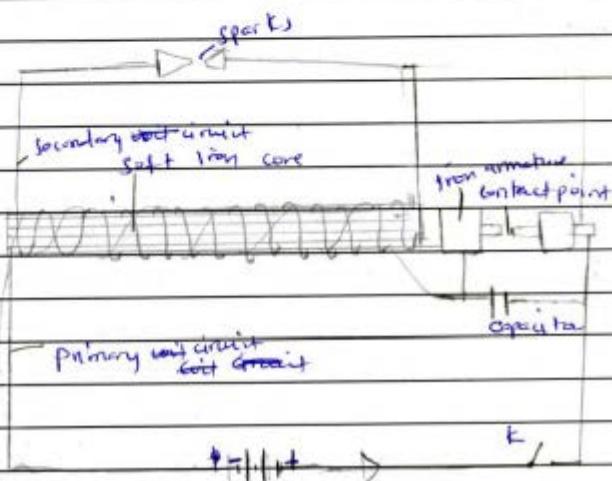
11. (a) (i) Use the kinetic theory to explain why solids expand when heated.
(ii) Mention two experiments which can be done in the laboratory to verify thermal expansion of solids.
- (b) Explain how each of the following works:
(i) a bimetallic thermostat.
(ii) a bimetallic thermometer.
- (c) (i) What is an induction coil?
(ii) Describe the structure of an induction coil and briefly explain its mode of action.

11:	<p>(a)(i) According to kinetic theory of matter solids are made up with molecules which are in constant vibration all the time. When heat energy is supplied to the solid its particles will gain kinetic energy and increased their vibration and velocity, continues supplying heat energy to the solid lead to increasing mean free velocity of particles, which can result into increasing in its dimension, such as length, area and volume that is what we call it expansion.</p> <p>(ii) Experiments to verify thermal expansion in solids are (i) a Ball and a ring experiment (ii) A Bar and gap experiment. (iii) Bar and a gap experiment;</p> <p>(b)(i) A bimetallic thermostat is made up with two different metals such as iron and brass. It is used to control the amount of heat energy in the device, such as electrical iron. When the heat is supplied to a thermostat it will reach the temperature whereby both metals will expand differently to form a curve which will complete the circuit and when the current will start flowing through circuit but then when the temperature decreases, after the metal contract because the circuit here action occurs continuously which enable to control amount of heat in a device.</p> <p>(ii) A bimetallic thermometer used to measure the temperature. It is made up of two different metals such as iron and brass which is connected to the pointer and scale. When heat is supplied to the thermometer, it will tend to expand and complete the circuit.</p>
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to close loop on the scale, through clockwise motion and measure the temperature of a body.

(c) Induction coil is the electrical system which can produce large voltage from small alternating voltage through two electrical circuits connected on the same iron core.

(ii) Structure of an induction coil.



Mode of action

The induction coil is made up of primary coil which has small number of turns and secondary coil which has large number of turns. When the switch K is closed then the current will flow in the primary coil and cause magnetization of the left iron core which will attract the iron armature and break the primary circuit. After then it demagnetized and iron armature rotated.

2013

4. (a) Mention three differences between boiling and evaporation.
- (b) Briefly explain reasons for the following:
- (i) When a cold bottle is brought into a warm room, it becomes misted over
 - (ii) Frost is more likely to occur on a clear night than on a cloudy night.
- (c) (i) Define coefficient of linear expansion and give its SI unit.
(ii) A metal pipe which is 1 m long at 40°C increases in length by 0.3% when carrying a steam at 100°C. Find the coefficient of expansion of the metal.

4 a) The differences between boiling and evaporation.	
Boiling	Evaporation
- Boiling takes place at a specific temperature normally in its boiling point	- Evaporation takes place at any temperature in a liquid
- It takes place through out the liquid	- It takes place on the surface of the liquid.
- It has a cooling effect	It has no cooling effect.
b) i) When a cold bottle is brought into a warm room it becomes misted over because within a bottle there is a warm cold air which condenses on bringing it into a hot and warm room. & condensed air tends to evaporate and form a misted over	
(ii) Frost is more likely to occur on a clear night than on a cloudy night because on a clear night the earth surface loses heat to the atmosphere and hence no reflection of heat back to the earth. This creates a form of dew below the freezing	

4b) point but on clear cloudy nights There is reflection of heat to the earth and hence frost is not more likely to occur.

(d) Coefficient of linear expansion- Is the fractional increase in length per degree rise Centigrade in temperature.

The SI unit of linear expansion is $^{\circ}\text{K}$ i.e. per kelvin or per centigrade.

i) Data given.

$$\text{Original length} = 1\text{m.}$$

$$\text{Initial temperature} = 40^{\circ}\text{C}$$

$$\text{Percentage increase} = 0.3\%$$

$$\text{Final temperature} = 100^{\circ}\text{C}$$

$$\text{Final length} = 0.3 + 1 = \frac{1.003}{100}$$

To find the coefficient of expansion of the metal.

Solution.

$$\alpha = \frac{\Delta l}{l_0 \theta}$$

$$\alpha = \frac{1.002 - 1}{1\text{m} \times (100 - 40)}$$

$$= \frac{0.002}{1 \times 60}$$

4c) (iii) Coefficient = $\frac{0.002}{60}$

$$= 0.00005/\text{K.}$$

\therefore The coefficient of expansion of the metal = $0.00005/\text{K.}$

22. Transfer of Thermal Energy

2016

7. (a) What is meant by the terms:
(i) Bimetallic strip.
(ii) Linear expansivity of the solid.
- (b) Briefly explain on the following observations:
(i) In cold weather the metal blade of a knife feels cooler than the wooden handle.
(ii) A cool breeze blows from the sea on a hot summer day.
- (c) (i) Define latent heat of fusion of a substance.
(ii) A copper block of mass 0.68 kg is suspended in a freezing mixture at -50°C for some time and then transferred to a large volume of water at 0°C . Calculate the mass of ice formed.

2010

3. (a) What is meant by the terms heat capacity and specific heat capacity? State how they are related. **(3 marks)**
- (b) Explain briefly how heat losses have been prevented in a vacuum flask. **(3 marks)**
- (c) A heater of 500W is used to raise the temperature of 50 kg of material of specific heat capacity of 960J/kg K, from 18°C to 38°C . Assume that all of the heat from the heater is given to the material. Calculate:
(i) heat capacity of the material **(2 marks)**
(ii) the time taken in seconds. **(2 marks)**

23. Measurement of Thermal Energy

2010

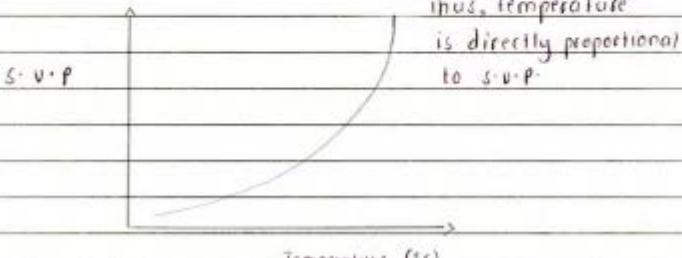
3. (a) What is meant by the terms heat capacity and specific heat capacity? State how they are related. **(3 marks)**
- (b) Explain briefly how heat losses have been prevented in a vacuum flask. **(3 marks)**
- (c) A heater of 500W is used to raise the temperature of 50 kg of material of specific heat capacity of 960J/kg K, from 18°C to 38°C . Assume that all of the heat from the heater is given to the material. Calculate:
(i) heat capacity of the material **(2 marks)**
(ii) the time taken in seconds. **(2 marks)**

24. Vapour and Humidity

2018

5. (a) List four factors which affect the rate of evaporation of liquids.
- (b) (i) Define relative humidity.
(ii) Calculate the relative humidity given that the reading on dry bulb hydrometer is 24°C and the wet bulb temperature reading is 16°C .
- (c) With the aid of a sketched graph, explain how temperature affects the saturated vapour pressure of water.

S. a) Factors that affect the rate of evaporation in liquids; i) Wind. ii) Humidity. iii) Temperature. iv) Surface area.	b) i) Relative humidity is the humidity expressed in percentage of the ratio of the actual humidity present in the atmosphere to the normal humidity found in the atmosphere when air is saturated. $\text{Relative humidity} = \frac{\text{Actual water vapour in the atmosphere}}{\text{Water vapour when air is saturated}} \times 100\%$
ii) Data given; Reading on the dry bulb hydrometer = 24°C Reading on the wet bulb hydrometer = 16°C	<u>Soln:</u> $\text{R-Humidity} = \frac{W-B-H \text{ reading} - W-B-H \text{ reading}}{D-B-H \text{ reading}} \times 100\%$ $= \frac{24^{\circ}\text{C} - 16^{\circ}\text{C}}{24^{\circ}\text{C}} \times 100\%$ $= \frac{8^{\circ}\text{C}}{24^{\circ}\text{C}} \times 100\%$

5.	$= 33.3\%$ The relative humidity is 33.3%	
	<p>c) As the temperature increases, more evaporation takes place thus increases the saturated vapour pressure of water</p> 	

2013

4. (a) Mention three differences between boiling and evaporation.
- (b) Briefly explain reasons for the following:
- (i) When a cold bottle is brought into a warm room, it becomes misted over
 - (ii) Frost is more likely to occur on a clear night than on a cloudy night.
- (c) (i) Define coefficient of linear expansion and give its SI unit.
 (ii) A metal pipe which is 1 m long at 40°C increases in length by 0.3% when carrying a steam at 100°C . Find the coefficient of expansion of the metal.

25. Current Electricity

2020

7. (a) In Figure 2, the labels A, B, C and D are identical electric bulbs connected in a circuit. Explain what will happen to the bulbs A, B and D when bulb C blows off and the key K is closed. (4 marks)

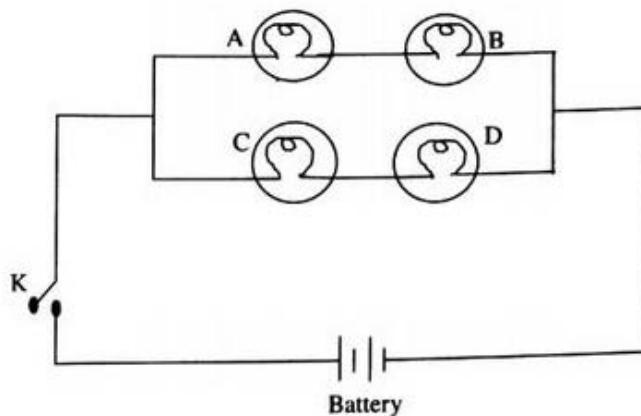
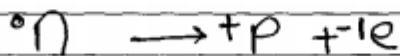


Figure 2

- (b) Rutherford proton-neutron model shows that there are no electrons in the nucleus of an atom. How is it possible for a radioactive element to emit beta particles (electrons) from its nucleus? (6 marks)

7. @ When key is closed and C blows off
bulb A and B will light up (while produce light) b/c
cause the path taken by current through bulb A and B is not
blocked.
Bulb D will not light up this is because the circuit through
bulb C and D is open by the blown bulb C.

(b) It is possible due to the fact that neutrons in the nucleus
tend to disintegrate producing a proton and electron during
radioactivity. As a result the electron(s) produced from the disinter-
grated neutron(s) will be the one which will be emitted as beta
particle during radioactivity of the radioactive element



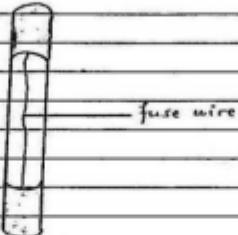
Hence the radioactive element will be able to emit
 ${}^{-1}\text{e}$ from the disintegrated neutron leaving a proton inside
the nucleus.

2018

7. (a) With the aid of a diagram, explain the function of a fuse in an electrical appliance. (5 marks)
- (b) A circuit in a house is protected by a 10 A fuse. The circuit is connected to the 240 V mains. The following appliances are connected to the circuit:

Appliance	Power rating
Bulb 1	100 W
Bulb 2	75 W
TV	300 W
Heater	1500 W

Determine whether the fuse will blow on or off if all appliances are turned on. (5 marks)

7. (a) The function of a fuse.
The function of the fuse in an electrical appliance is to disconnect the circuit by melting when high current is passed through it before entering the appliance.
The melting of the fuse protects the appliance from high current electricity which in turn could cause damage and even fire out break.

A fuse
(b) Given Bulb 1 = 100W p.d = 240V Bulb 2 = 75W TV = 300W Heater = 1500W Sum of power = 100W + 75W + 300W + 1500W = 1975W
then from Joules law equation. $P = IV$ Where $P = 1975W$ $V = 240V$

7.	(b) then,
	$I = \frac{P}{V}$
	$I = \frac{1975W}{240V}$
	$I = 8.23A.$
	\therefore The fuse will blow on because the appliance will use the low current of 8.23A than the limit of the fuse of 10A.

2017

10 marks

11. (a) How does the increase of length and cross-section area of a conductor affect its resistance?
- (b) (i) State the function of a circuit breaker in a wiring system.
(ii) Determine the ratio of resistance of wire A to that of wire B which are made up of the same material such that wire A has half the length and twice the diameter of wire B.
- (c) An electric kettle contains 720 W heating units:
(i) What current does it take from 240 V mains?
(ii) How long will the kettle take to raise the temperature of 2 kg of water at 30°C to its boiling point?

11-a i) Increase in length of a conductor increases the resistance of the conductor.
Due to increasing length.

$$R \propto l$$

ii) Increase in the cross-section area of the conductor, results into a decrease in the resistance of the conductor.

$$R \propto \frac{1}{A}$$

b) i) A circuit breaker is a type of switch which breaks / leaves contact with the circuit in case higher currents flow through it. It uses a bimetallic strip in its operation.

The main function is to prevent the excess current into the components which would lead to blowing up of appliances.

iv	$R = \frac{\rho l}{A}$
	$\frac{l_1}{A_1} = \frac{l_2}{A_2} = \frac{\rho l_1}{\rho l_2} = \frac{l_1}{l_2}$
	$\frac{4}{4} = \frac{l_1}{l_2}$
	$= \frac{l_1}{2\pi d^2} = \frac{4l_1}{\pi d^2}$
	$2 \times \frac{l_1}{2} = 4l_1 \times 2$
	$l_1 = 8l_2$
	$1:8$
	\therefore The ratio of resistance of A to that of B is 1:8

14c	i) $P = IV$
	$720W = \frac{I}{240V} \times 240V$
	$240V \quad 240V$
	$I = 3A$
	\therefore It takes 3A from the 240V mains
	ii) Heat lost = Heat gained
	$Pxt = MC\theta$
	$720Wt = 2kg \times 4200 J/kgK \times (100^\circ C - 30^\circ C)$
	$720Wt = 2kg \times 4200 J/kgK \times 70$
	$720W \quad 720W$
	$t = \frac{2 \times 4200 \times 70}{720W}$
	$t = \frac{4900}{6}$
	$= 816.67s$
	\therefore It will take 816.67s for the kettle to raise the temperature of 2kg of water at 30°C to its boiling point.

2016

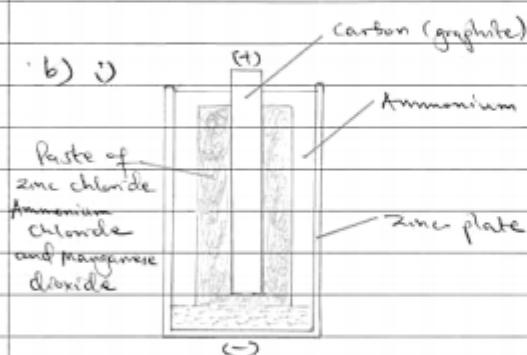
8. (a) (i) Distinguish between primary and secondary cells, giving one example of each.
(ii) Identify two defects of a simple cell.
- (b) (i) Explain why lead-acid accumulators are used in car batteries rather than dry cells?
(ii) A cell of unknown e.m.f, E and internal resistance 2Ω is connected to a 5Ω resistance. If the terminal p.d, V is 1.0 V , calculate the e.m.f, E of a cell.
- (c) (i) List two devices that are important when checking electrical faults in domestic appliances.
(ii) Briefly explain why a very high voltage is necessary when transmitting electrical energy from power station?

2015

7. (a) (i) What is meant by the internal resistance of a cell?
(ii) Distinguish between a cell and a battery.
- (b) (i) Draw a well labeled diagram of a dry cell (Leclanche).
(ii) Identify three disadvantages of a Leclanche cell over a lead-acid accumulators.
- (c) The current of 3.0A passes through a coil of resistance 5Ω connected to the terminals of a cell of constant e.m.f, E (Volt) and internal resistance, r (ohm). If a uniform wire of length, L (cm) is joined across the ends of a 5Ω coil to form a parallel arrangement of resistance 4Ω , the current is reduced to 0.25A . Determine the
(i) internal resistance of a cell.
(ii) e.m.f of a cell.

7. a) i. Internal resistance of a cell is the resistance or opposition offered by the cell to the current flowing in that cell.

7. a) ii. A cell is a set up which causes the flow of current while a battery is a collector of many cells. A cell is a set up which involve chemical reactions which lead to the flow of current but a battery is a collection of many cells causing the flow of current in a circuit.



A dry cell

ii. Disadvantages of a Leclanche cell over lead acid accumulators.

- Cannot be recharged unlike lead acid accumulators.
- Affected by local action and polarisation unlike the provides lead acid accumulators.
- Provides small voltage compared to the lead acid accumulators.

7. (c) Data given

When current (I) = 3 A, Resistance (R) = 5 Ω, Internal
Resistances (r) = ?, E.m.f = ?

When current (I) = 0.25 A, Resistance (R) = 4 Ω, Internal
resistance (r) = ? E.m.f = ?

i. From

$$\text{Electromotive force (E)} = \text{Current} \times (\text{External + internal}) \text{ resistance}$$

$$E = I (R + r)$$

$$E = 3A (5\Omega + r) \quad \text{--- (i)}$$

$$E = 0.25A (4\Omega + r) \quad \text{--- (ii)}$$

(Combining eqn (i) and (ii))

$$15V + 3Ar = 1V + 0.25Ar$$

$$3Ar - 0.25Ar = 1V - 15V$$

$$\frac{2.75Ar}{2.75A} = \frac{-14V}{2.75A}$$

$$r = -5.13 \Omega$$

7. (c) iii.

$$\text{from } E = I (R + r)$$

$$E = 3A (0.5\Omega - 5.13\Omega)$$

$$E = 3A \times -4.63\Omega$$

$$E = -0.39V$$

2013

6. (a) Briefly explain why
- Nylon clothes crackle when undressed?
 - Petrol road tankers usually have a length of metal chain hanging and touching the ground?
- (b) What would happen when
- an ebonite rod is rubbed with fur?
 - a glass rod is rubbed with fur?
- (c) (i) Define electric current.
(ii) Two cells each of e.m.f. 6 V and internal resistance of 5 Ω and 6 Ω respectively are connected in parallel to a resistor of 10 Ω. Find the current flowing in the 10 Ω resistor.

6 @

- (i) Nylon crackles when Unbrushed because nylon have static charge which attract to each other when Unbrushed.
- (ii) In order to avoid explosion by removing charges acquired by friction or moving on a rod to the earth's ground.

6 b

- (i) When桑子 rod rubbed with fur it becomes negatively charged.
- (ii) When glass rod rubbed with fur it becomes positively charged.

6 D ~~the~~ Electric current is the rate of flow of electric charge or is the ~~flowing~~ of electric charge per unit time.

6(iii)

Date

Total resistance = R_1 and R_2

$$\text{Total Internal resistance} = \frac{1}{R_{\text{eff}}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$= \frac{1}{5} + \frac{1}{6} = \frac{6+5}{30} = \frac{11}{30}$$

$$\frac{1}{R_{\text{eff}}} = \frac{11}{30} \text{ Then } R_{\text{eff}} = \frac{30}{11}$$

Resistance through R_1 is 10Ω Electromotive force is $6V$

Apply

 $E = I(R_{\text{ext}})$ Ohm's law of Galileo Galat

$$6V = I(10 + \frac{30}{11})$$

$$6V = I \left(\frac{110 + 30}{11} \right) \text{ ohms}$$

$$6V = I \left(\frac{140}{11} \right) \text{ ohms}$$

$$I = \frac{11}{140} \times 6V$$

$$I = 0.47 \text{ Ampere}$$

Current flowing through R_1 is 0.47 Ampere

2012

7. (a) (i) Differentiate between resistance and resistivity of a given conductor.
(ii) Is it possible for two cells in parallel arrangement to drive more current through a resistor than one cell? Give reason.
- (b) (i) What is '1 KILOWATT-HOUR' as applied to current electricity?
(ii) If you find a domestic electric bulb rated 60 W, 240 V what does this mean?
- (c) Find the cost of running five 60 W lamps and for 100 W lamps for 8 hours if electric energy costs Tshs. 27/= per unit.

7.q.i) Resistance of a conductor refers to the opposition it offers towards the flow of current in it, WHILE Resistivity of a conductor refers the ratio of the product of resistance and cross sectional area per unit length of the conductor

7.q.ii) It is not possible for two cells in parallel arrangement because their total electromotive force is taken across both their ends mainly as a result, each cell contributes equally to produce a

7.(a)) Common name or potential difference across their ends.

7.(b)) 1 kilowatt-hour refers to the rate of consumption of electrical energy of 1 kilowatt per hour.

7.(c)) This means the bulb consumes 60 watts when a potential difference of 240V is applied across it.

$$\text{Total for } 60\text{W lamp} = 5 \times 60 \\ = 300 \text{W}$$

$$\text{Total watts for } 400\text{W lamps} = 100\text{W} \times 4 \\ \approx 400 \text{W}$$

$$\text{Total watts} = 300 \text{W} + 400 \text{W} \\ = 700 \text{W} \\ \approx 0.7 \text{ kW}$$

$$\text{Total Kilowatt hours} = 0.7 \text{ kW} \times 8 \text{ hours} \\ \approx 5.6 \text{ kWhours}$$

But 1 kilowatt hour = 27/-
5.6 kilowatt hour = 5.

$$5 = 5.6 \times 27 \\ = 151.2 \text{/-}$$

$$\therefore \text{Total cost} = 151.2 \text{/-}$$

2011

- (b) If the resistances of the ammeters in Figure 2 are ignored, explain each of the following observations:
- (i) when switch S is closed, the current through A_1 is less than that through A_2 .
 - (ii) when switch S is opened, the current through A_2 falls.
 - (iii) when switch S is opened, the current through each ammeter is the same.

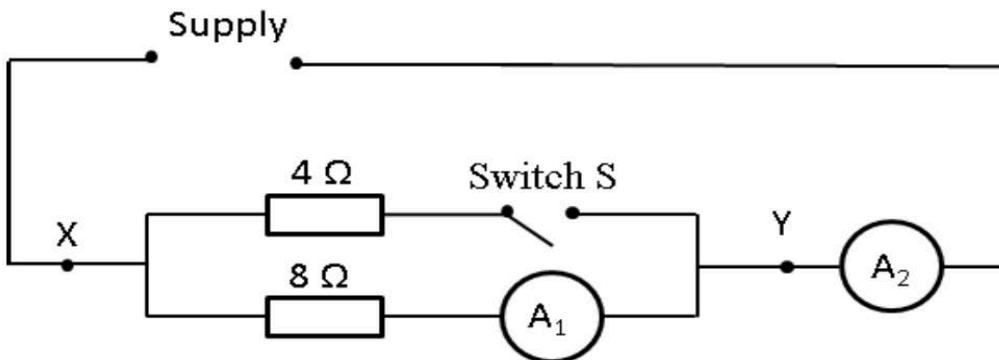


Figure 2

8. (a) Explain what will happen when three 1.5V – cells are connected:
- (i) in series
 - (ii) in parallel
11. (a) (i) What is meant by a fuse?
(ii) Briefly explain why fuse are made of very thin wires but heaters are made of thick wires.
- (b) (i) State how short circuit occurs in a house?
(ii) Mention two causes of electrical short-circuit.
- (c) (i) Fuse wires are labeled 3A, 5A, 10A, 12A, 18A and 20A. Select the best fuse for a 240V; 2.856kW electric kettle.
(ii) Describe with the aid of circuit diagram, how would you determine the resistance of a conductor using the ammeter-voltmeter method.

2010

6. (a) (i) State Ohm's Law. (1 mark)
(ii) Explain briefly, with the aid of a circuit diagram, how you would verify Ohm's law in the laboratory. (3 marks)

- (b) How would you know when is necessary to recharge an accumulator? (2 marks)
- (c) (i) State briefly the variation of the potential over a pear-shaped conductor and the variation of density of the charge. (2 marks)
(ii) An electron passes between two plates, one of which A, carries a positive charge and the other B a negative charge. What is the effect on the electron? (2 marks)

26. Waves

2020

9. (a) A piano wire and turning fork are devices which produces sound. Show clearly three ways in which a piano wire can be tuned to emit a note of the same frequency as a vibrating turning fork. **(6 marks)**
- (b) You are provided with a moving coil galvanometer of a coil resistance 20Ω and can carry a maximum current of 15 mA. How will you design this galvanometer to register 10 mA full scale deflection? **(6.5 marks)**

Q.	<p>(a) The following are ways in which a piano wire can be tuned to emit a note of the same frequency as a vibrating turning fork.</p> <p>① Increasing linear mass density of a wire (ρ), increasing linear mass density of a wire, will increase the frequency of a piano wire since $f \propto \rho$.</p> <p>② Increasing Tension in the wire (T) The increase the tension of the wire, the increase the frequency of a piano wire. since $f \propto \sqrt{T}$</p> <p>③ Decreasing length of a wire, increase in tension forces between the wire will lead to decrease in the length of the wire, therefore the decrease in length of the wire lead to increase in frequency of the piano wire. since $f \propto \frac{1}{L}$</p> <p>The small the length, the higher the frequency of a piano wire.</p>
----	--

9. (b)

Dalz Cirven

Resistance in the galvanometer (R_g) = 20Ω
 Maximum current (I) = $15mA$

$$1A = 1000mA$$

$$1 = 15mA$$

$$15mA \times 1A = 1000mA \times 1$$

$$\frac{1mA}{1000mA} = \frac{1mA}{1A}$$

$$y = \frac{15}{1000} A$$

$$y = 0.015A$$

$$\text{Maximum current } (I) = 15mA \\ = 0.015A$$

Current registered by the galvanometer
 $(I_g) = 10mA$

$$I_g = \frac{10mA}{1000mA}$$

$$I_g = 0.01A$$

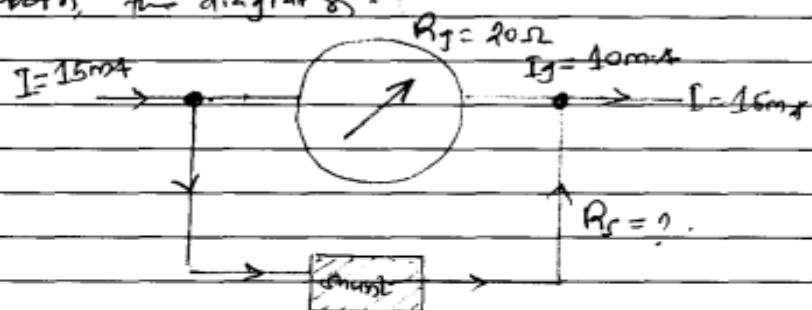
How the galvanometer would be designed
 to register $10mA$?

Ans:-

A galvanometer can be designed
 to give an ammeter reading by connecting
 it parallel with a device called shunt.
 A shunt is a low resistance resistor
 which connects parallel to a galvanometer
 to make it function as an ammeter.

Q. (b) so, resistance in the shunt (R_s) offered to the galvanometer to register 10mA will be (R_s) = ?.

From the diagram -



From the formula -

$$\frac{I_g R_g}{I - I_g} = \frac{I_g R_g}{I - I_g}$$

$$R_s = \frac{I_g R_g}{I - I_g}$$

$$R_s = \frac{0.01\text{A} \times 20\Omega}{0.015\text{A} - 0.01\text{A}}$$

$$R_s = \frac{0.02\text{A} \cdot 2\Omega}{0.005\text{A}}$$

$$R_s = 4\Omega$$

\therefore A galvanometer should be connected in parallel with a 4Ω resistor (shunt) to register 10mA full scale deflection.

2020

8. (a) Figure 3 shows the profile of a radio wave. Study it carefully and determine its wavelength. (4 marks)

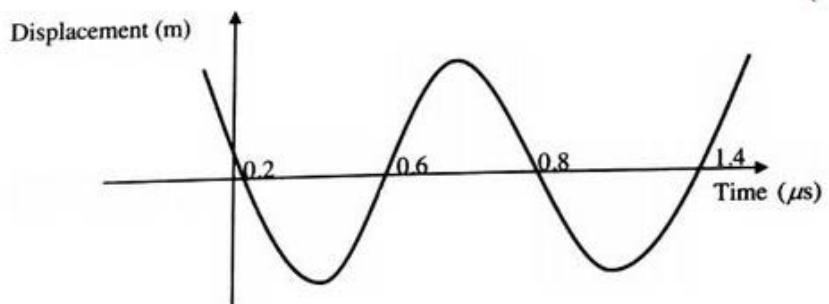


Figure 3

- (b) Explain how an earthquake occurs. (6 marks)

8 @	
$T = (0.8 - 0.2) \mu\text{s}$	
$= 0.6 \mu\text{s}$	
$1\text{s} = 10^6 \mu\text{s}$	
$? = 0.6 \mu\text{s}$	
$\frac{0.6}{10^6} \text{s}$	
$T = 6 \times 10^{-7} \text{ sec.}$	
$\text{frequency} = \frac{1}{T}$	
$F = \frac{1}{6 \times 10^{-7}} \text{ sec}^{-1}$	
$\text{Velocity of the wave} = 3 \times 10^8 \text{ m/sec}$	
from $V = f \lambda$	
$3 \times 10^8 = \frac{\lambda}{6 \times 10^{-7}}$	
$\lambda = 3 \times 10^8 \times 6 \times 10^{-7}$	
$\lambda = 180 \text{ m.}$	

(b) An earthquake is a shaking or trembling of the earth's crust. The earthquake occurs as follows;



- Due to the isostatic adjustment of the earth crustal rocks the earthquake may develop from a point where the isostatic force is happening or acting. This point where the earthquake begins is known as the focus after there it becomes spread at large areas as a form of disturbance.

Also movement of tectonic plates of the earth causes the earthquake to occur since it cause shaking of the earth's crustal rocks which results to an earthquake.

2018

6. (a) Define the following terms as used in sound waves:
 - (i) Audibility range.
 - (ii) Ultrasonic sound.
- (b) Why notes of the same pitch played on a violin and flute has different quality?
- (c) A string of length 75 cm has a mass of 8.2 g. If the tension in the string is 18 N, calculate the frequency of the first and third harmonics.

6 (a) (i) Audibility range is the interval of sound waves that can be perceived by human ear. (20Hz - 20kHz)

(ii) Ultrasonic sound is the sound with the frequency above 20 kHz which cannot be perceived by human ear.

(b) Notes of the same pitch played on a violin and flute has different quality because the number of overtones produced by a violin and flute differs.

(c) Data

$$\text{Length of the string (L)} = 75\text{cm} = 0.75\text{m}$$

$$\text{Mass of the string (M)} = 8.2\text{g} = 0.0082\text{kg}$$

$$\text{Tension of the string (T)} = 18\text{N}$$

soln

(i) Required to find the frequency of the first and third harmonics

$$\text{from } f_0 = \frac{V}{2L} \text{ but } V = \sqrt{\frac{T}{\mu}}$$

2017

10 marks

8. (a) (i) Define the term wavelength.
(ii) How does the size of the gap in the barrier affect the diffraction of waves?
- (b) (i) State two ways in which visible light differ from radio waves.
(ii) List two applications of gamma rays.
- (c) Figure 2 and 3 shows a wave travelling across water. Carefully study it then answer the questions that follow:

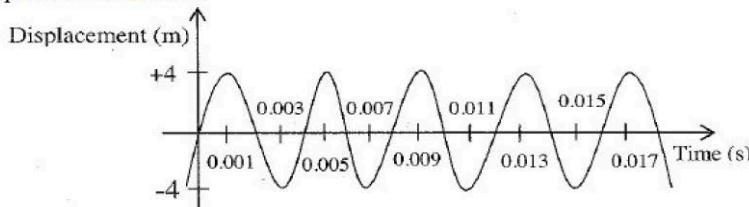


Figure 2

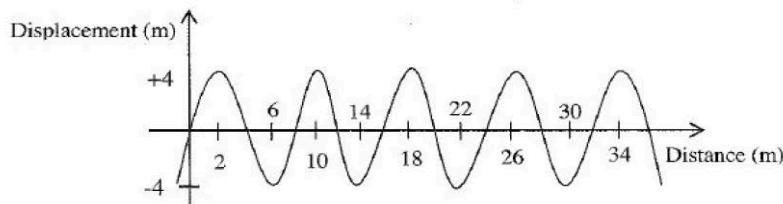


Figure 3

Determine the

- (i) Frequency of the wave.
(ii) Velocity of the wave.

8.	<p>(a) <i>y</i></p> <p>Wavelength is a distance between two successive or adjacent crests or troughs.</p> <p><i>i)</i> - when the size of the gap is larger the wave diffracted will have small amplitude and when the size of its gap is small the diffracted wave will have a greater amplitude.</p>
	<p>(b) <i>y</i> - Visible light has small wavelength than radio waves. <i>i)</i> - Also visible light has higher frequency than radio waves.</p>
8.	<p>(d) <i>y</i> - It's applicable in industries for detection of welded joints or metal casting.</p> <ul style="list-style-type: none"> - it's used or applicable in determining the arrangement of atoms in solids matter (crystallography).
	<p>(e) <i>y</i> <i>sols.</i></p> <p>The frequency is given by</p> $\text{frequency} = \frac{1}{\text{Period}}$ <p>but period from the given diagram = 0.004 s</p> $\text{freq.} = \frac{1}{0.004 \text{ s}} = 250 \text{ s}^{-1}$ <p>\therefore The frequency = 250 Hz.</p>
	<p><i>i)</i> Velocity of the wave.</p> <p>from $\text{Velocity} = \text{frequency} \times \text{wavelength}$,</p> $= 250 \text{ Hz} \times 8 \text{ m}$ $= 2000 \text{ m/s}$ <p>\therefore The Velocity of the wave = 2000 m/s.</p>

2015

- 10 (a) (i) List four main parts of a ripple tank.
(ii) What role does a stroboscope play in a ripple tank experiment?
- (b) (i) Explain why there are four strings of different thickness in a violin?
(ii) What does a violinist do to change the note emitted by a particular string?
- (c) (i) Briefly explain how a resonance tube works.
(ii) Calculate the frequency of vibration in a resonance tube of shortest length of 0.22 m when the next resonance length is 0.47 m.

10(a)	(ii)	<ul style="list-style-type: none"> ✓ Source of lamp ✓ Net reflector ✓ Water reservoir ✓ Wave producer.
	(iii)	It used to make the water waves to appear stationary when studying the waves.
	(iv)	This is because of producing note musical notes of different frequencies, thickness of string determines the frequency of a note it produces. This makes the violin to produce notes of different frequencies.
	(v)	The violinist have to change the following <ul style="list-style-type: none"> - the tension (tension or slackness) of the string if have to state slack / tightened the string in order to produce different musical note. - the lengths of the strings
	(vi)	Resonance tube work by changing the vibration of air in the tube by raising or lowering the height of the tube. This increase's the amplitude causes forced vibration which produces resonance.

10(b)	Soln.
	Data given.
	$l_1 = 0.88\text{m}$
	$l_2 = 0.47\text{m}$
	Then,
	$x \rightarrow \frac{1}{2}(l_2 - l_1)$ $\rightarrow \frac{1}{2}(0.47\text{m} - 0.88\text{m})$ $= \frac{1}{2} \times 0.85\text{m}$ $= 0.5\text{m}$ $x = 0.5\text{m}$

10(c)	Also,
	$V = 340\text{m/s}$
	$\frac{V}{x} = \frac{f}{\lambda}$
	$f \rightarrow \frac{V}{\lambda}$
	$= \frac{340\text{m/s}}{0.5\text{m}}$
	$= \frac{3400}{5}\text{Hz}$
	$= 680\text{Hz}$
	\therefore The frequency of the vibration is 680Hz .

5. (a) What is meant by the following terms?
- Resonance
 - Overtones.
- (b) Briefly give reasons for the following:
- the fundamental frequency may alter during the day.
 - notes of the same pitch played on a violin and a flute sound different.
- (c) The frequency obtained from a plucked string is 400 Hz when the tension is 2 N. Calculate:
- the frequency when the tension is increased to 8 N.
 - the tension needed to produce a note of frequency of 600 Hz.

5. a) Resonance is the phenomenon of producing vibration in a body at its natural frequency due to the impulse received from another vibration body with the same frequency.

(ii) Overtones are the harmonics which have higher frequency than the fundamental note frequency.

b) (i) Fundamental frequency may alter during the day due to the heat supplied by the sun causing expansion which leads to altering of fundamental frequency.

(ii) Notes vary due to objects producing them so they sound different on a violin and a flute because a violin

5 b (ii)

is a string instrument and a flute is a wind instrument hence different sources

5 c (i)

~~C~~ Solution

Data given

$$\text{initial frequency } (f_1) = 400 \text{ Hz}$$

$$\text{initial Tension } (T_1) = 2 \text{ N}$$

(vi)

when tension (T_2) = 8 N
from

$$f \propto \sqrt{T}$$
$$\frac{f}{\sqrt{T}} = \frac{K}{\sqrt{T}}$$
$$\frac{f}{\sqrt{T}} = K$$

2011

6. (a) (i) What is a sonometer?
(ii) Briefly explain when resonance is said to occur?
- (b) Two boys at 200m apart stand on one side of a high vertical cliff at the same perpendicular distance from it. When one fires a gun, the other hears the sound 0.6 seconds after the flash and the second sound 0.25 seconds after the first sound. Calculate the perpendicular distance of the two boys from the cliff.
- (c) Figure 1 illustrates part of the displacement-time graph of a wave traveling across water at a particular place with a velocity of 2m/s. Calculate:
(i) the amplitude.
(ii) the frequency
(iii) the wavelength

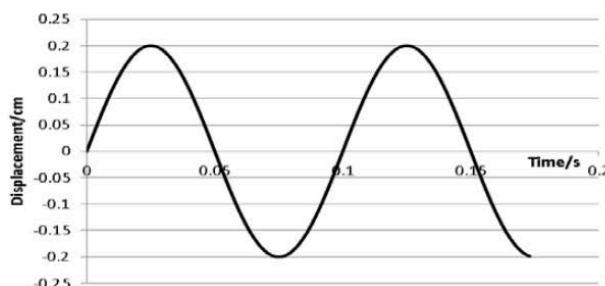


Figure 1

2010

- 10 (a) (i) Distinguish between longitudinal and transverse waves. **(1 mark)**
(ii) Explain how beats are formed. **(2 marks)**
- (b) A light wave is refracted into an optically less dense medium. What change will occur in:
(i) the frequency **(1 mark)**
(ii) the speed **(1 mark)**
(iii) the wavelength. **(1 mark)**
- (c) (i) What is an echo? **(1 mark)**
(ii) A sound is sent out from the ship and its reflection from the floor of the ocean returns one second later. Assuming that the velocity of sound in water is 1500 m/s, how deep is the ocean? **(3 marks)**

27. Electromagnetism

2019

11. (a) Electrical energy is distributed in all parts of Tanzania by the National grid system which transmits alternating current at a very high voltage. Explain why it is necessary to have a very high voltage? **(5.5 marks)**
- (b) A generator producing a varying current from 0 to 10 A was allowed to flow in a coil of magnetic field. After a time interval the current was observed to be 4 A. Describe how back e.m.f. Was induced in a self-induction. **(7 marks)**

11(a) It is necessary to do so, so as to ensure loss of power is minimum during transportation. According to the equation:

$P = I^2 R$, the voltage is inversely proportional to the current. so, high voltage will ensure current is low and hence prevent loss of power during transportation process

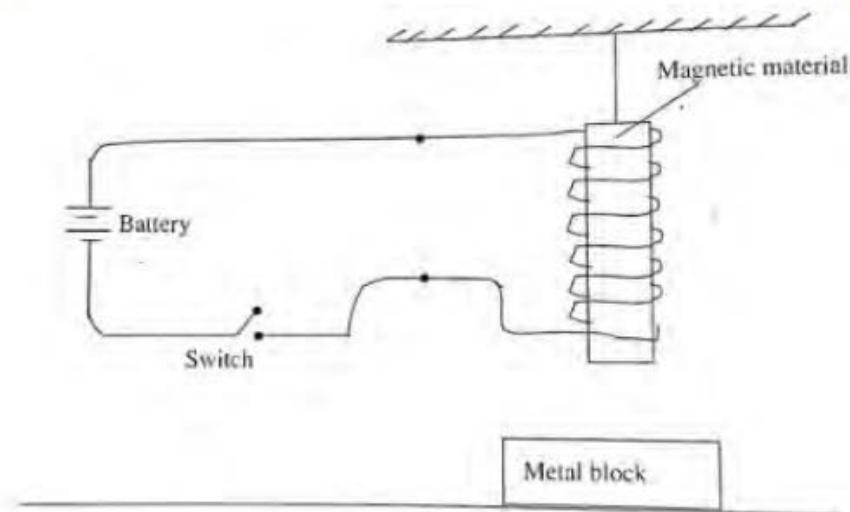
11(b) \rightarrow Self Induction is the production of induced emf as a result of changing magnetic flux in the same conduct.

\rightarrow Back emf is the induced current loop that opposes the flow of current in the generator

\rightarrow According to Lenz's law "The direction of induced emf is such that it opposes the change causing it" then the changing of the magnetic flux produces a current that opposes the production of induced emf. since it flows in both directions (ac generator)

- The rate of change of magnetic flux is directly proportional to emf production but produces a back emf that opposes it in its direction

9. (a) Carefully study Figure 2 which shows a design for an electrical operation model for lifting metal objects. Briefly explain three things you can do so that a heavier iron metal block can be lifted. **(6 marks)**

**Figure 2**

- (b) Why a musician must retune a stringed instrument if its temperature changes? **(2.5 marks)**
- (c) During a thunderstorm, the time between the flash of light and the thunder is 10 s. How far away is the thunderstorm? **(4 marks)**

9(a)	<p>① Number of turns of the coil around magnetic material should be increased. Since, Number of turns of coil \propto induced magnetism.</p> <p>② The magnetic material should be made Soft iron. This is because iron can be easily induced magnetism by an electric current.</p> <p>③ More powerful battery should be used in order to increase voltage and hence the current flowing. Higher current produces more induced magnetism.</p>
b)	<p>When temperature changes, it varies the length of the string, this causes frequency produced by string to change. Therefore, musician retunes to adjust length for the getting appropriate frequency of sound and hence obtaining desired tone quality.</p>

c) Given,

$$\Delta t = 10\text{s}$$

$$v_{\text{sound}} = 340\text{ m/s}$$

$$v_{\text{light}} = 3 \times 10^8 \text{ m/s}$$

Soln..

$$v = \frac{d}{t}$$

$$d = vt$$

$$t = \frac{d}{v}$$

$$\Delta t = \frac{d}{v_1} - \frac{d}{v_2}$$

4(c)

$$10\text{s} = \frac{d}{340} - \frac{d}{3.8 \times 10^8}$$

$$10 = \frac{d}{340} - \frac{d}{3.8 \times 10^8}$$

$$3.8 \times 10^8 = 111467d - d$$

$$d = 3400$$

$$\therefore \underline{3400\text{m}}$$

2018

10. (a) State the following rules:

- (i) Cork screw rule.
- (ii) Dynamo rule.

(b) (i) Give one structural difference between A.C. and D.C. generators.
(ii) Mention one application of induction coil.

(c) Figure 2 shows a transformer used to step down power. Assuming that there are no power losses, what will be the ammeter reading on the output part?

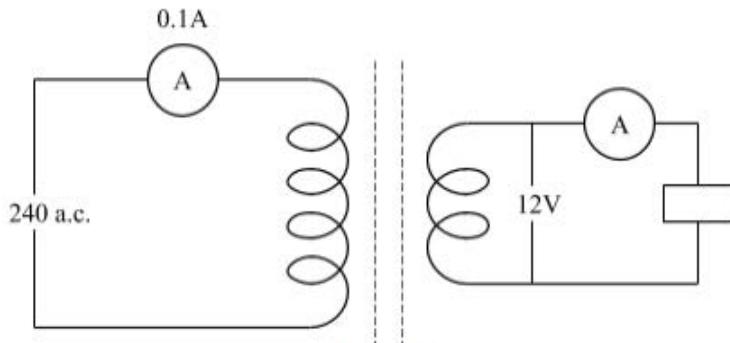
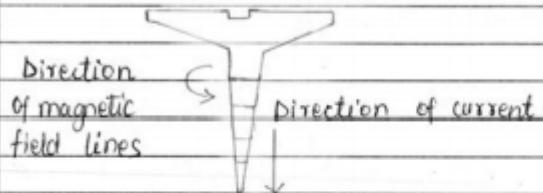
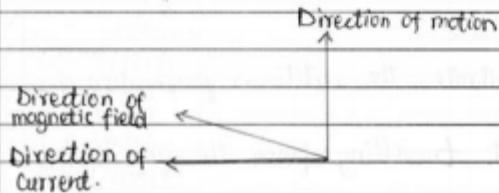


Figure 2

10(a) i) Cork screw rule states that "When a cork screw is screwed towards the direction of current then the direction of rotation represents the direction of magnetic field lines."



(i) Dynamo rule states that "When the first three fingers of the right hand are held mutually at right angles to each other such that the thumb represents the direction of motion, the middle finger representing the direction of magnetic field lines then the middle finger represents the direction of current."



(b)(ii) One structural difference between AC and DC generators is that AC generator uses slip rings whereas DC generators uses commutators.

ii) One application of the induction coil is that it is used in the car ignition system.

(c) Given data:

Voltage in primary coil, $V_P = 240V$

Voltage in secondary coil, $V_S = 12V$

Current in primary coil, $I_P = 0.1A$

Current in secondary coil, $I_S = ?$

Required to find ammeter reading in secondary coil, I_S .

From transformer equations

$$V_P = I_S$$

$$V_S \quad I_P$$

$$I_S = \frac{V_P I_P}{V_S}$$

$$I_S = \frac{240V \times 0.1A}{12V}$$

$$I_S = 2A$$

∴ The ammeter reading on the output part will be 2 Amperes.

2017

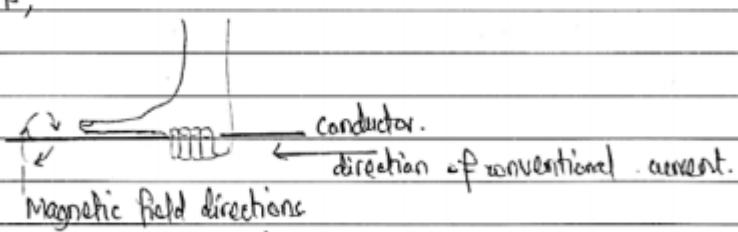
10 marks

9. (a) (i) What is meant by mutual induction.
(ii) Illustrate how the right hand grip rule is used to determine electric current and magnetic field directions.
- (b) (i) Draw the diagram of direct current (d.c) generator showing its important parts.
(ii) Briefly explain how simple a.c dynamo can be converted to simple d.c dynamo.

Q9. (a) i) Mutual induction is the process of inducing e.m.f. to a conductor due to magnetic field flux change caused by another conductor nearby.
- Mutual induction is used in induction coils.

Q9. (a) ii) Right Hand grip rule states,
"Imagine a conductor is gripped by the right hand with the thumb pointing in the direction of the conventional current then the fingers curling around the conductor show the direction of magnetic fields."

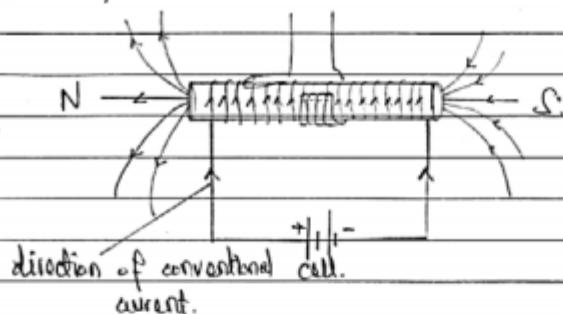
That is,



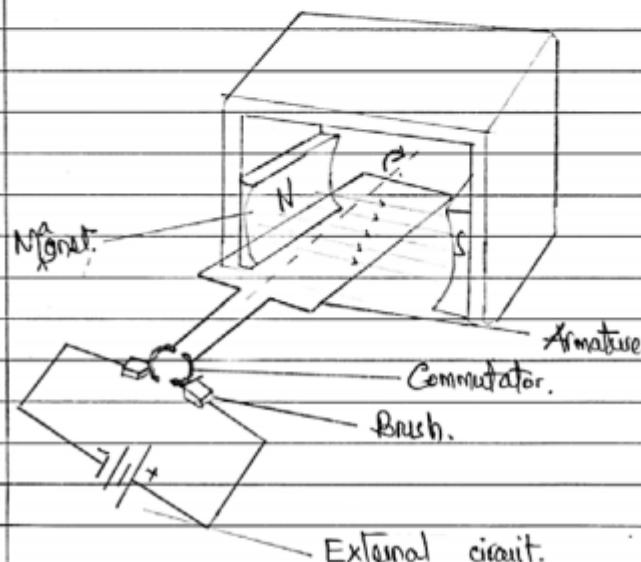
For a solenoid,

"Imagine a solenoid is gripped by the right hand with the fingers indicating the flow of conventional current, then the thumb will point in the direction of the North pole of the resulting magnetic field."

09. a) That is,



09. b) i) DIAGRAM SHOWING A D.C. GENERATOR.



09. b) ii) An a.c. dynamo can be converted into a simple d.c. dynamo by replacing the slip rings in the a.c. dynamo with a commutator.

2016

11. (a) (i) State the purpose of dynamo.
(ii) How can an a.c dynamo be converted to a d.c dynamo.
- (b) (i) Briefly explain why an e.m.f is induced in the coil as it rotates.
(ii) At what position of the coil in 11 (b) (i) is the induced e.m.f zero?
- (c) Explain the function of each of the following features of a simple electric motor:
(i) Split-ring commutator.
(ii) Brushes.

2015

11. (a) (i) State the functions of the hair springs in a moving coil galvanometer.
(ii) Explain why moving coil galvanometer is unsuitable for measuring alternating currents.
- (b) (i) Draw the magnetic field lines pattern in a horizontal plane due to a current carrying straight conductor when a d.c flows through it.
(ii) What would happen on the pattern if a.c were used instead of d.c?
- (c) (i) What should be done in order to increase the speed of rotation in a d.c electric motor?
(ii) An electric motor is connected by cable to a generator and produce a current of $10A$ at $240V$. Calculate the resistance of the cable.

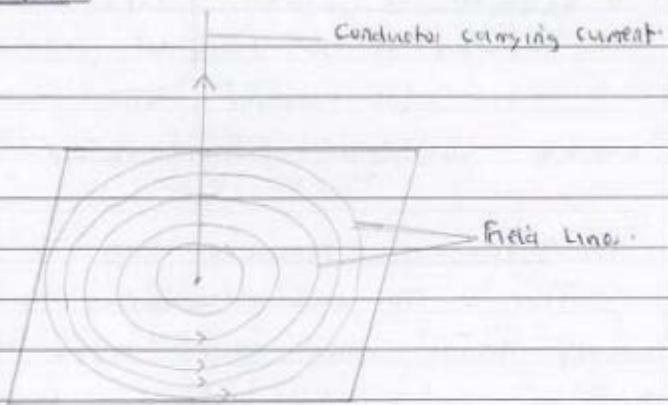
ii. Q11. The functions of hair spring in moving coil galvanometer include;

- It conduct an electric current into coil between magnets to produce force which would cause pointer deflection.
- It is attached to the pointer of galvanometer. Hair spring is attached to galvanometer's pointer and return pointer to zero after deflection.

iii. Moving coil galvanometers are unsuitable for measuring alternating currents. (a.i.c). because;

This is mainly because alternating current (a.i.c) produces a varying magnetic field such that its direction changes, as the result pointer would deflected to and from at the same frequency as a.c varies and hence the net effect of deflection would be zero thus point would remain at the same position without being deflected.

II. b. i) Magnetic field in a straight conductor when d.c is passed.



ii) If a.c was used instead of d.c the effect on the pattern would be as explained below:

The pattern of the magnetic field would be continuously changing in direction as the a.c current alternates in the conductor hence the magnetic pattern would be distorted.

II. c) To increase the speed of rotation in a d.c electric motor the following should be done:

- Using of strong magnets: strong magnets produce strong magnetic flux hence increase speed of rotation.
- By increasing the number of turns of coil: The number of turns should be increased to increase area exposed to magnetic field thus increased torque produced and speed of rotation.
- By increasing the applied d.c current: The current applied from outside should be increased to increase the speed of rotation of motor.

ii) Data given:

$$\text{Current produced } (I) = 10 \text{ A}$$

$$\text{Potential difference } (V) = 240 \text{ V}$$

Resistance of cables (R) = Required.

From

Ohm's law

$$V = IR$$

$$\frac{240}{10} = \frac{10}{R}$$

$$R = 24 \Omega$$

$$\therefore \text{Required value} = 24 \Omega$$

2013

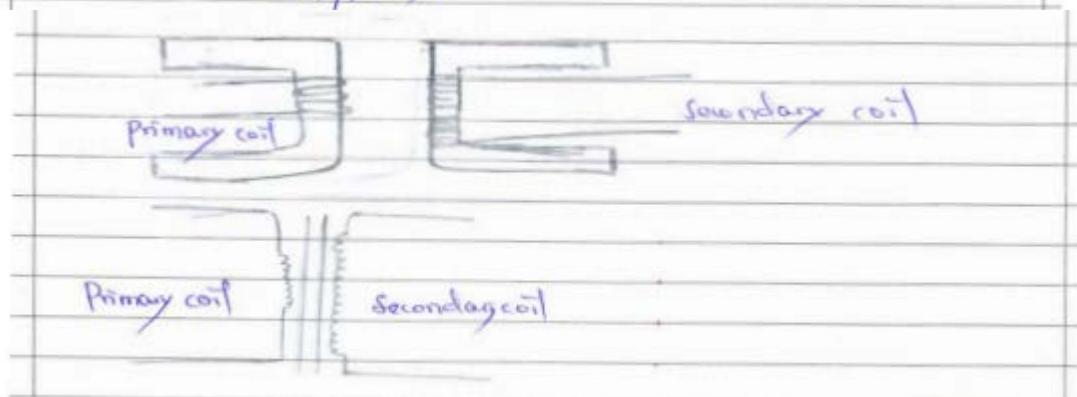
10. (a) (i) State the laws of electromagnetic induction.
(ii) Mention two advantages of a.c. generators over d.c. generators.
- (b) (i) Briefly explain why the core of a transformer is made of thin layers of metal insulated from one another.
(ii) Describe the structure of a step-up transformer and state how it works.
- (c) A transformer with 4800 turns in the primary coil is designed to work from 240 V a.c. mains to give a supply of 8 V in order to ring a bell.
(i) What would happen if the transformer were connected to a 240 V d.c. mains?
(ii) Briefly explain why the primary current increases when a bell is being rung?

(b) ii/ The core of transformer is made of thin layers of metal insulated from one another in order to reduce eddy currents which cause loss of energy in transformer.

(b) ii/ The structure of step up transformer is

- The step up transformer is made of two coils which are primary and secondary coil wound on a soft iron core.
- The number of turns on a primary coil is smaller than the number of turns in a secondary coil so as to step up voltage from the primary coil to secondary coil.
- This transformer obeys the mutual induction as a result a.c from primary coil is stepped up and induced in the secondary coil.

Example
diagram



10 (c) i) Data

Number of turns in primary (N_p) = 4500

Number of turns in secondary coil (N_s) = ?

Voltage at primary coil $E(V_p)$ = 240V

Voltage at secondary coil (V_s) = 8V

Required.

Question

What do you think would happen if transformer were connected to 240V d.c mains

Answer

Trans

Answer

The transformer works only in a.c because a.c can be induced from primary coil to secondary coil as mutual induction.

So

When the transformer would be connected to 240V d.c then

There would be no 'induction of current' in the secondary coil as a result the transformer would not function. Because transformer works on a.c only and not d.c.

10 (c) ii) Primary current increases when the bell is rung because

When the bell is rung then the voltage in secondary coil is induced by being stepped down as a result the current increases in primary coil because the voltage is stepped down to secondary coil where the bell rung after using such voltage stepped down.

2010

- (2 marks)
7. (a) (i) What is meant by the terms solenoid and electromagnetic induction? (1 mark)
(ii) List down two applications of electromagnetics. (1 mark)
- (b) Describe the structure and mode of action of a simple d.c. motor. (3 marks)
- (c) (i) Draw a diagram of an electric bell showing the polarity of the electromagnet, the direction of the current, the core, the yoke, spring and the armature. (3 marks)
(ii) Explain what will happen to the mode of action of the electric bell if the core and yoke are made of steel instead of soft iron. (2 marks)
11. (a) (i) Define electromagnetic field. (1 mark)
(ii) Show electromagnetic field lines pattern due to a solenoid. (1 mark)
- (b) With the aid of a well labeled diagram, explain how an electric bell operates. (4 marks)
- (c) How can you make a galvanometer read
(i) higher current values? (2 marks)
(ii) higher voltage values? (2 marks)

28. Radioactivity

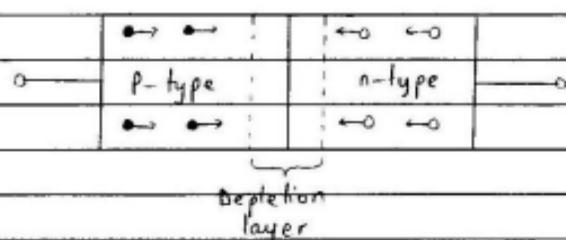
2019

10. (a) A sample of carbon isotope $^{14}_6C$ has a half-life of 5700 years. What fraction of $^{14}_6C$ will remain after 11400 years? (6 marks)
- (b) Describe the construction and mode of action of the PN junction semiconductor. (6.5 marks)

10.	Given a $^{14}_6C$
	$T_{\frac{1}{2}} = 5700 \text{ years}$
	$t = 11400 \text{ years}$
	$\frac{N}{N_0} = ?$
	from the radioactivity equation,
	$\frac{N}{N_0} = \left(\frac{1}{2}\right)^{\frac{t}{T_{\frac{1}{2}}}}$
	$\frac{N}{N_0} = \left(\frac{1}{2}\right)^{\frac{11400 \text{ years}}{5700 \text{ years}}}$
	$\frac{N}{N_0} = \left(\frac{1}{2}\right)^2$
	$\frac{N}{N_0} = \frac{1}{4}$
	∴ The fraction of $^{14}_6C$ that will remain after 11400 years is $\frac{1}{4}$

(b) Construction of PN junction semiconductor.

The PN junction semiconductor is made by combining two p-type and n-type semiconductor materials to make a single continuous crystal. When the p-type block and n-type block are combined together, they form a single-continuous crystal with the junction between them with the depletion layer which is the region around the p-n junction which is fairly free of majority charge carriers.



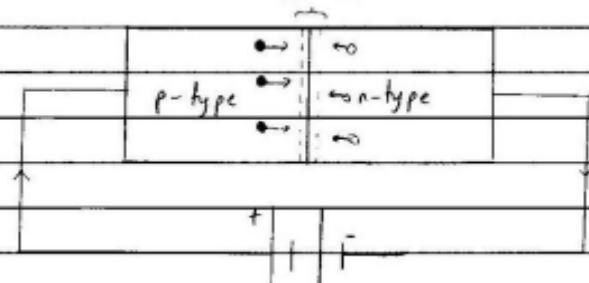
Mode of action of a PN junction semiconductor

The PN junction semiconductor works when the p-type block and the n-type block are connected to the current through terminals hence giving two types of PN junction semiconductor connections:-

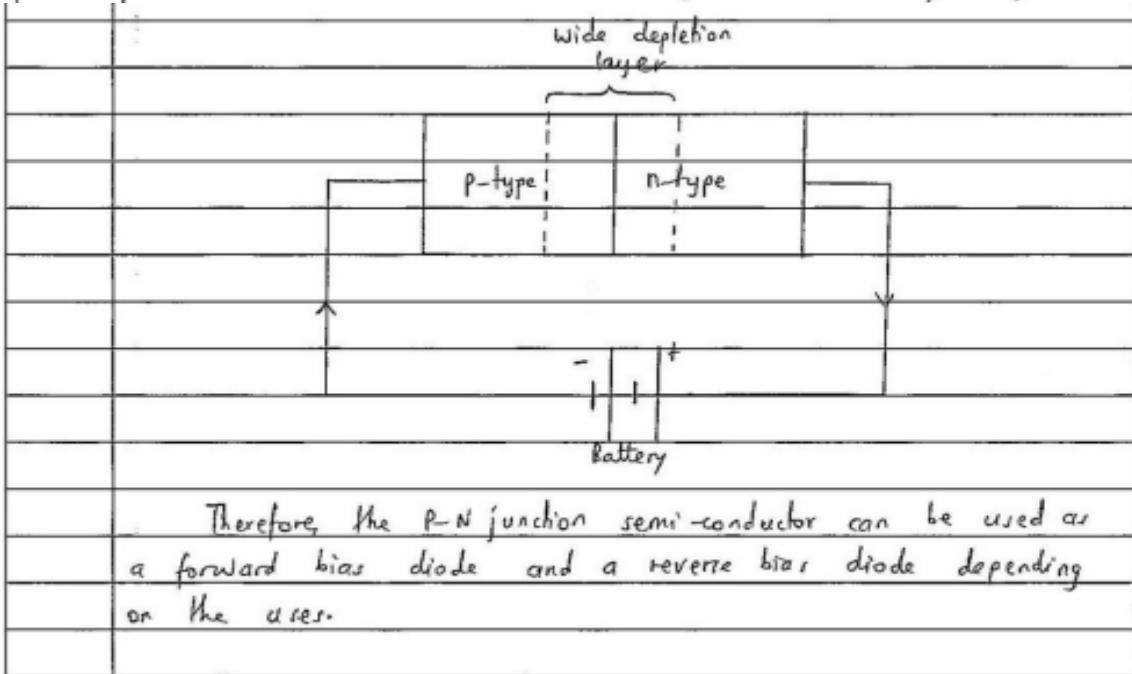
Forward bias of a PN junction semiconductor

Forward bias of a PN junction semiconductor is achieved when the p-type block is connected to the positive terminal and n-type block connected to the negative terminal of current. When this happens, the holes and positive charges repel each other hence pushing the holes towards the junction and the electrons and negative electric charges repel each other pushing the electrons towards the junction and hence decreasing the depletion layer and creating a potential difference across the p-n junction which allows the charge carriers to flow through the PN junction in one direction and hence behaving as a diode.

Reversed



	<p>Reverse bias of a PN junction semiconductor</p> <p>Reverse bias of a PN junction semiconductor is achieved when the p-type block is connected to the negative terminal and n-type block connected to the positive terminal of current. When this happens, the holes and negative charges attract each other and the electrons and the positive charges attract each other thereby pulled away from the p-n junction and the depletion layer is widened. Reverse bias impedes the flow of charge carriers across the p-n junction since the non-conducting depletion layer is large and wide where breakdown voltage needed is very high.</p>
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2018

7. (a) What is meant by radioactive decay?
- (b) A certain sample with half-life of 8 days contains 16 g of iodine 131.
 - (i) Write an expression to show the decay process of the sample.
 - (ii) Use an expression in (b) (i) to sketch the graph then estimate the mass of sample which will remain undecayed after 20 days.
- (c) Describe the use of Geiger-Muller (G-M) tube in detecting nuclear radiations.

7. (a) Radioactive decay is the disintegration or decomposition of large unstable (radioactive) material to produce stable substances by emission of particles such as alpha and beta particles and electromagnetic radiations such as gamma rays as the forms of energy released.

7. (b)(i) Data:

$$\text{Half-life } (t_{1/2}) = 8 \text{ days}$$

$$\text{Original mass } (N_0) = 16 \text{ g}$$

$$\text{Remained mass } (N_t) = ?$$

$$\text{Time taken } (t) = ?$$

$$\text{Number of half-lives } (n) = ?$$

\therefore Expression is as follows

$$\frac{\text{Mass remained } (N_t)}{\text{Original mass } (N_0)} = \left(\frac{1}{2}\right)^n$$

where:

n is number of half-lives

$$\therefore n = \frac{t}{t_{1/2}}$$

$$\therefore \text{The expression is: } \frac{\text{mass remained } (N_t)}{\text{original mass } (N_0)} = \left(\frac{1}{2}\right)^{t/t_{1/2}}$$

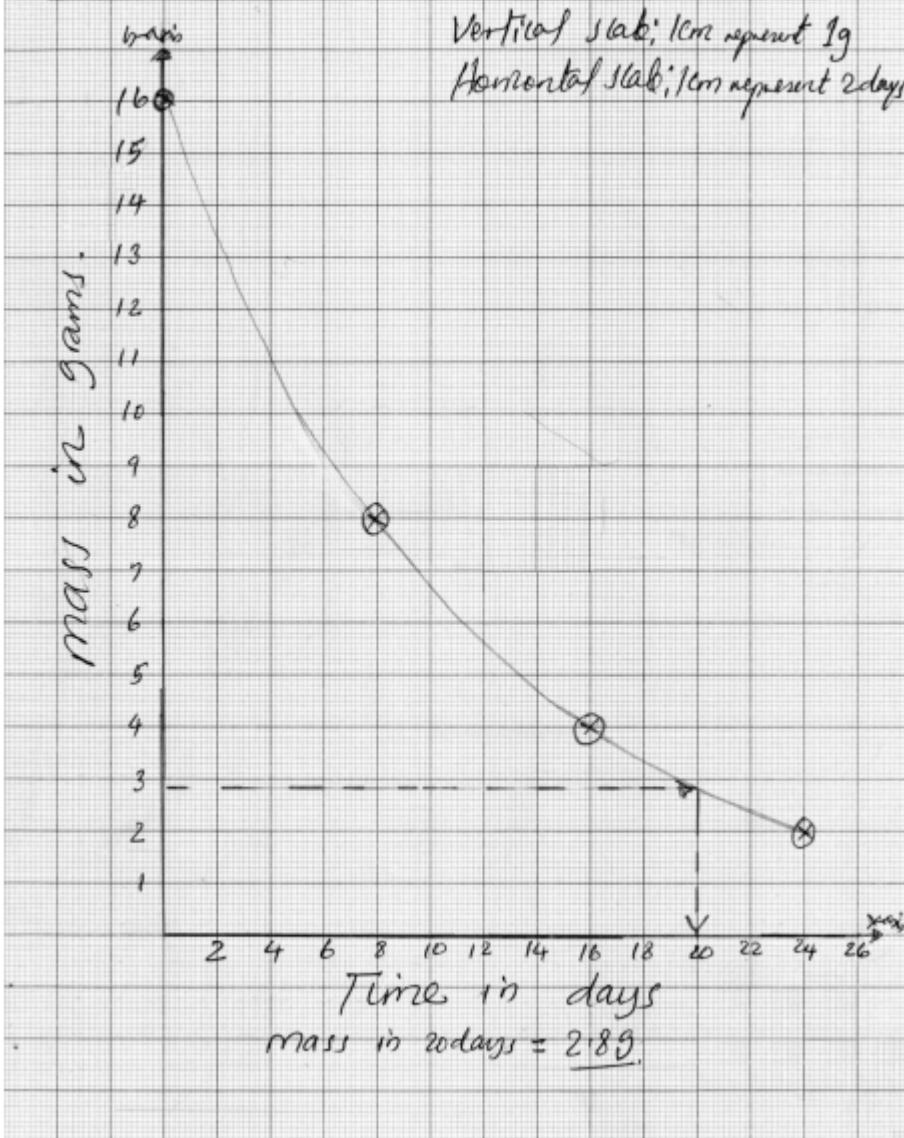
b (ii) from:

$$\frac{N_t}{N_0} = \left(\frac{1}{2}\right)^n$$

Hence, the 'Table':

mass(g)	time (days)
16	0
8	8
4	16
2	24

7(b)(ii) THE GRAPH OF MASS(g) AGAINST TIME(days):

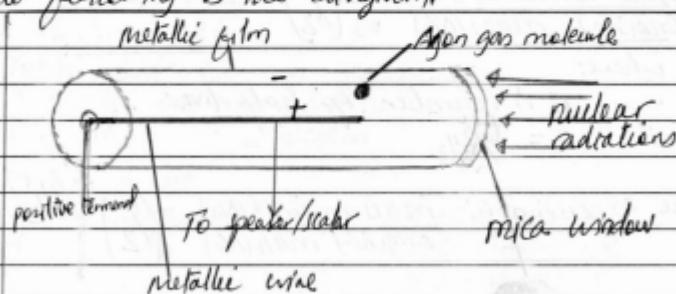


7. (b) (ii) Hence the graph.

From the graph:

After 20 days the mass remained undecayed was equal to 2.8 grams.

(C) - Geiger-Muller (GM) tube is the tube which has metal film with high negative voltage (-), and this metallic wire which runs through the middle of the tube and it's connected to positive terminal (+). The tube has also the mica window and it's filled with noble (rare) gases like Argon. It's detects the nuclear radiations. But the following is the diagram.



When the radiations pass through the mica window into the tube the gas molecules are ionized and negative charges (ions) move to the positive wire. As the electrons reaches the wire sound is produced by a speaker or counts are detected by the scintillators.

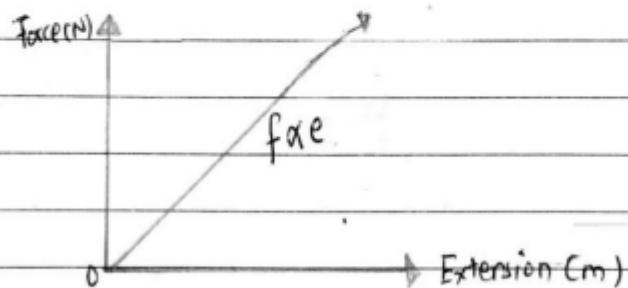
2017

7. (a) (i) What is the essential of kinetic theory of matter?
(ii) Sketch a graph showing how force applied in a stretched string varies with its extension.

- (b) (i) State Hooke's law.
(ii) List two applications of gamma rays.

7. a) i) Kinetic theory of matter states that " particles in a matter are in a state of random, ^{continuous} motion".
- This theory is essential in explaining the thermal expansion of solid, liquid and gases.
 - Also this theory shows how gases molecules cause pressure on the container walls.

7. a) ii) A GRAPH OF FORCE APPLIED AGAINST EXTENSION.



7. b) i) Hooke's law states that "The extension of the spring is directly proportional to the force applied, provided that the elastic limit is not exceeded".

7. b) ii) Initial force applied $\stackrel{(f_1)}{=} 2N + 0.4N = 2.4N$

Initial extension, $(e_1) = 24\text{mm}$

Final force $(f_2) = ?$

Final extension $(e_2) = 16\text{mm}$.

From Hooke's law:

$$F \propto e \quad \text{So, } \frac{F_1}{e_1} = \frac{F_2}{e_2}$$

$$F = ke$$

$$\frac{F}{e} = k \text{ (constant)} \quad F_2 = \frac{F_1 \times e_2}{e_1}$$

$$F_2 = \frac{2.4N \times 16\text{mm}}{24\text{mm}}$$

$$F_2 = 1.6\text{mm N}$$

but the load = $F_2 - \text{weight of the scale}$
per mm

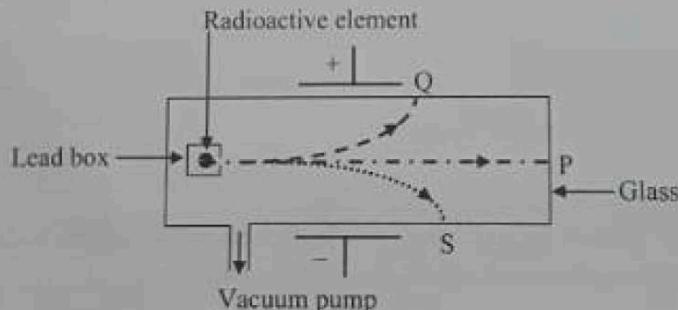
$$= 1.6N - 0.4N$$

$$\text{The load} = 1.2N$$

∴ The load to be used is 1.2N

2016

10. (a) (i) What is meant by radioactive element?
(ii) Name three instruments which are used to detect radiation from radioactive source.
(b) Figure 2 shows the deflection of radiations from a radioactive element by an electric field.

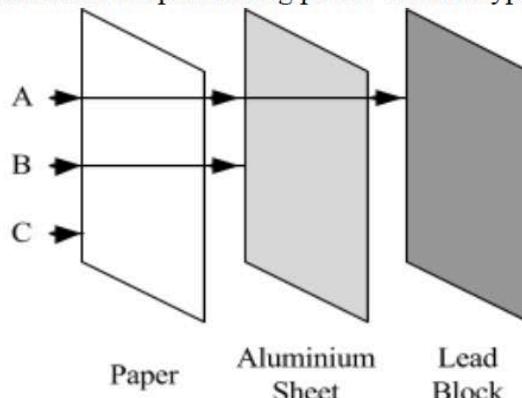
**Figure 2**

- (i) Identify the radiations Q, P and S, giving reasons for your answers.
(ii) Briefly explain why the radioactive source is kept inside a lead box leaving only a small hole?
(c) (i) What are radioisotopes?
(ii) State two important applications of radioisotopes.

2015

8. (a) (i) Define nuclear fission.
(ii) Mention two products of nuclear fission.

- (b) Figure 1 shows a comparison of the penetrating power of three types of radiations.

**Figure 1**

- (i) Identify the name of radiations represented by the letters A, B and C.
(ii) Write two properties of each type of radiation named in 8 (b) (i).
(iii) What effect does the radiation B has on the nucleus of an atom?
(c) Complete the following equations and for each name the type of decay.
(i) $^{226}_{88}Ra \rightarrow \underline{\hspace{2cm}} + ^{222}_{86}Rn$.
(ii) $^{222}_{86}Rn \rightarrow 2 ^0_{-1}e + \underline{\hspace{2cm}}$.

8. a) i) Nuclear fission refers to the splitting of a heavier radioactive element into smaller elements to release energy.

ii) The products are smaller elements and Energy.

b) i) A - Gamma radiation.

B - Beta particles

C - Alpha particles.

ii) Properties of Gamma radiation

- Has high penetration power more than the betas and alpha particles.
- Has got no charge.

Properties of Beta particles.

- Has negative charge.

8 b) ii) properties of beta particles.

• It is deflected at the positive terminal of in an electric circuit.

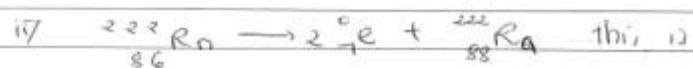
Properties of Alpha particles.

- Has positive charge.
- Has got less penetrating energy than beta and alpha particles.

iii) When the Beta particles are released in the atom the number of proton decreases by 1 and the number of neutron increases by 1 in the nucleus.



alpha decay.



Beta decay.

2014

8. (a) (i) What is meant by radioactive decay?
(ii) Give two effects of beta (β) particle on the nucleus of an atom.
- (b) (i) Define the term isotope of an element.
- (c) (i) How would you test whether a car battery needs recharging? (Give three points).
(ii) Two resistors each of $5\ \Omega$ are connected in parallel across the same battery of e.m.f. 5 V and negligible internal resistance. If the battery is fully charged and then discharged within 20 hours, calculate the storage capacity of the battery.

i) Radioactive decay is the disintegration of a radioactive material by emitting some rays.

ii) It makes the atom to have properties similar to the next atom or next element.
- It causes stable atom.

b) i) Isotope are the atoms of an element with the same atomic number but different mass number.

ii) Data given

The carbon symbol = ${}_{6}^{12}\text{C}$
The charge (Q) = ?

From

$$\begin{aligned} Q &= \text{electronic charge} \times \text{Atomic Number} \\ &= 1.602 \times 10^{-19} \text{ C} \times 6 \\ &= 9.612 \times 10^{-19} \text{ C}. \end{aligned}$$

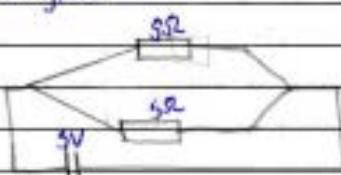
The charge in coulombs on the nucleus is $9.612 \times 10^{-19} \text{ C}$

c) i) By measuring the density of sulphuric acid if it is low then the battery needs to be re-charged.

- By observing the electromotive force given out if it is low then the battery needs to be recharged.

- By measuring the workload put of the battery if it is not at high or low level.

ii) Data given



8 Time \Rightarrow ii) Time (t) = 20 hrs. = $(60 \times 60) \times 20$ seconds.

From the circuit

$$E = I(R_{\text{fr}})$$

$$E = IR_F$$

$$I = E$$

$$R_I$$

$$E = \frac{5V}{5.5\Omega}$$

$$I = 4A \quad R_I = R_1 R_2$$

$$R_1 + R_2$$

$$R_I = 5 + 5$$

$$= 2.5\Omega$$

$$I = \frac{5V}{2.5\Omega}$$

$$= 2A$$

from Quantity of charge (Q) = It .

$$Q = 2A \times 36000 \text{ seconds}$$

$$= 144000 \text{ coulombs.}$$

\therefore The storage capacity was 144000 coulombs

2013

5. (a) The half-life of a certain radioactive substance is 64 days. Explain the meaning of this statement.
- (b) A certain radioactive material has a half-life of 2 minutes. If the initial count rate is 256 per minute;
 - (i) how long does it take to reach a count rate of 32 per minute?
 - (ii) what fraction of the original number of atoms is left undecayed?
- (c) (i) What is meant by nuclear fission?
(ii) A uranium nucleus, U-238, with atomic number 92, emits two α -particles and two β -particles and finally forms a thorium (Th) nucleus. Write the nuclear equation for this process.

5 (a) The meaning of this statement is that
A radioactive material takes 64 days
to decay to its half from original.

(b). Data given

$$\text{Half-life} = 2 \text{ minutes}$$

$$\text{Initial count rate} = 256 \text{ per minute.}$$

i) How long does it take to reach a count
rate of 32 per minute?

Solution -

$$256 \xrightarrow{2 \text{ min}} 128 \xrightarrow{2 \text{ min}} 64 \xrightarrow{2 \text{ min}} 32.$$

$$\text{Then } 2 \times 2 \times 2 = 8 \text{ min } 2 \times 3 = 6 \text{ min.}$$

\therefore It takes 6 minutes to reach a count
rate of 32 per minute.

ii) What fraction of the original number
of atoms is left undecayed.

Solution

Formula:

$$N_n = N_0 \left(\frac{1}{2}\right)^t$$

$$\frac{N_n}{N_0} = \left(\frac{1}{2}\right)^t$$

$$\text{where } N_0 = 256$$

$$N_n = 32.$$

Then,

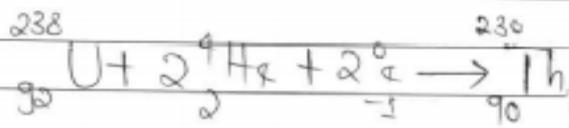
5 (b) ii) $32 = \frac{\text{Fractional of the original}}{256} \text{ number left undecayed.}$

$$\therefore \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}.$$

The fraction of the original number of
atoms left undecayed = $\frac{1}{8}$.

c) (i) Nuclear fission - Is the disintegration
of a heavy nucleus to lighter nuclei of
an atom.

(ii) Solution.



9. (a) Define the following terms:
- binding energy.
 - thermonuclear fusion.
- (b) (i) What is meant by background count? Give two sources of radiations always present in a neighbourhood of a detector.
- (ii) How does the rate of escape of electrons from a metal relate to its temperature?
- (iii) A sample containing 400 g of iodine-131 has a half-life of 8 days. How much of the sample will remain undecayed after 40 days?

9. (a) (i) Binding energy is that energy which exists between particles of a nucleus which prevent it from disintegration.

(ii) Thermonuclear fusion is that reaction of small elements to combine to form large element in the presence of heat accompanied with the emission of neutrons, followed by large amount of heat.

9. (b) (i) Background count is that count rate which is taken before the sample was placed in the detecting instruments.

9. (i) Two sources of radiations includes alpha and beta particles.

9. (b) (ii) The rate of escape of electrons from a metal surface depends on the temperature since when temperature is greater the metal will absorb enough energy and attain its work function and hence escape from the metal.

9. (b) (iii) Original mass = 400 g
Half life ($t_{1/2}$) = 8 days
Number of days = 40 days

$\frac{1}{2}^{\text{th}}$
from

$$N = N_0 \left(\frac{1}{2}\right)^n$$

but $n = \frac{t}{t_{1/2}} = \frac{40 \text{ days}}{8 \text{ days}} = 5$

$$N = 400 \times \left(\frac{1}{2}\right)^5$$

$$\frac{50}{400} \times 1 = \frac{1}{8}$$

$$\frac{50}{400} = \frac{1}{8} = 12.5$$

$\therefore 12.5\%$ of a sample will remain undecayed.

29. Thermionic Emission

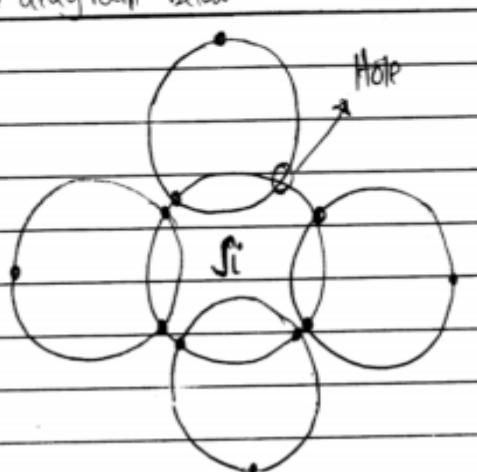
2010

8. (a) (i) What particle are emitted in thermionic emission? Explain why they are emitted. (2 marks)
(ii) What do you understand by the term transistor? (1 mark)
- (b) (i) How a common emitter arrangement of a transistor is stabilized for temperature changes? (2 marks)
(ii) Show the circuit symbol for pnp-transistor and npn-transistor. (2 marks)\
- (c) Draw a simple common emitter amplifier circuit using npn-transistor as a current amplifier. (3 marks)

30. Electronics

2020

11. (a) Describe the mechanism of doping intrinsic semiconductor to obtain p-type semiconductor. (6 marks)
- (b) Why most of the transistors in use are n-p-n transistors? (2.5 marks)
- (c) Form One students were shouting in their classroom. Briefly explain how other students in the next room can hear them shouting. (4 marks)

11 (A) Doping intrinsic semiconductor: refers to the process of adding impurities in a semiconductor in order to modify its conductivity.	
In the process of doping intrinsic semiconductor to get p-type semiconductor, the impurities which are added are from the the TRIVALENT GROUP.	
Consider the diagram below:	
	
.1 P-type doping: muthanium	

II A) From the diagram above when the semiconductor of SILICON is being doped by trivalent group it adds the formation of HOLE due to the one atom needed to complete the doping hence the process
 > Hence the semiconductor lack one atom on which lead to the formation to be known as Acceptor Impurity,
 > And through that the HOLE is POSITIVE CHARGE.
 > The semiconductor used during the doping mechanism to form P-type is called SILICON

II (B) Most of the transistors use N-P-N transistors because during the N-P-N transistors consist electrons as a majority charge and hence due to that the electron have higher speed and smaller mass than the holes which are contained in the P-N-P transistors.

II (C) The students in other classroom can hear them shouting due to the DIFFRACTION of sound waves.
 Diffraction is the phenomenon observed when the sound wave meets an obstacle on which if the obstacle does not have gap the sound waves vibrate / reverberate around an obstacle.
 Hence the student could hear the sound because the sound waves rotate around the walls of their classes and hence seems to be originated into their point in the class

2020

10. (a) Distinguish the concepts of conductors, semiconductors and insulators in terms of their energy bands. **(6 marks)**

(b) Figure 4 shows an electric circuit. Carefully study it and calculate the value of current x and r. **(4 marks)**

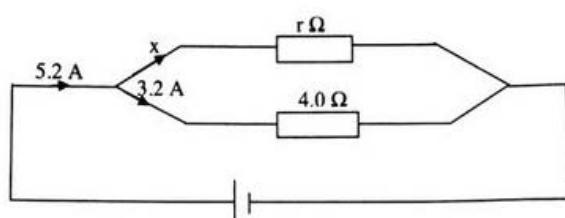


Figure 4

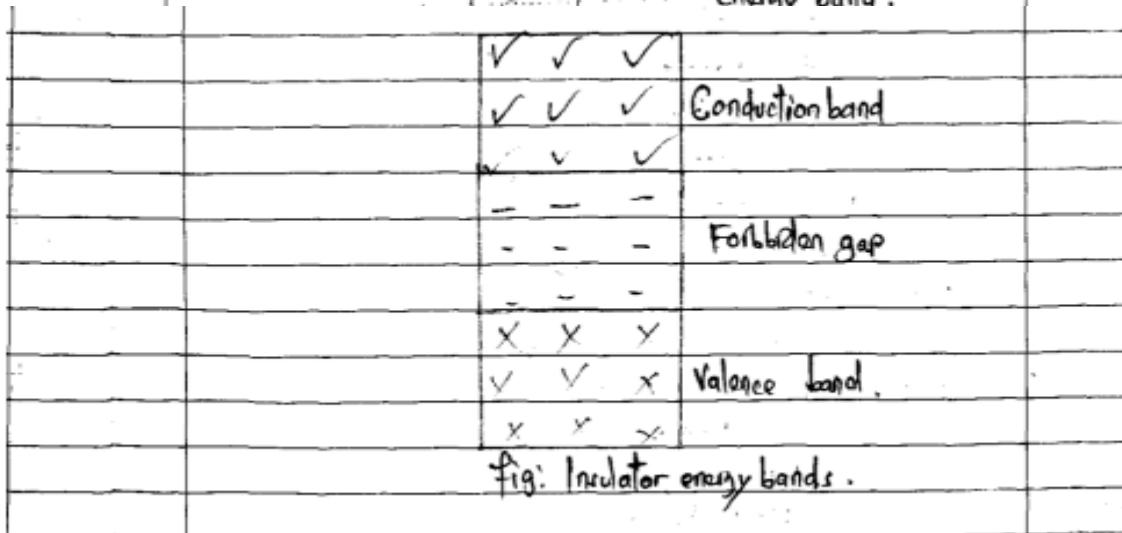
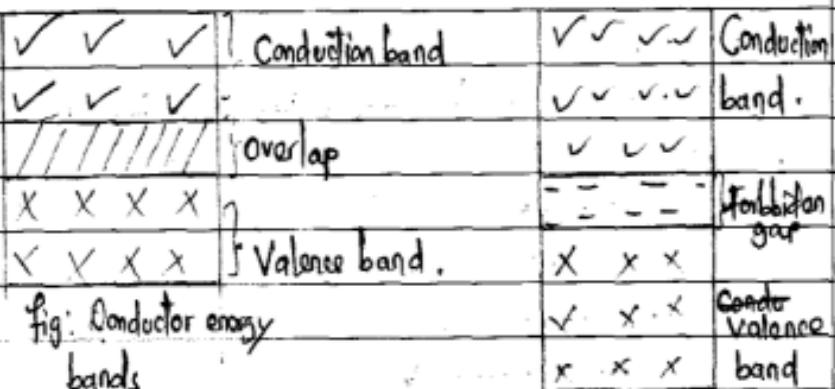
(c) From part (b), determine the effective resistance. **(2.5 marks)**

10. @

CONDUCTORS SEMICONDUCTORS INSULATORS

→ Conductors have - Semiconductors have - Insulators have a very large no forbidden gap moderate sized forbid and wide forbidden and sometimes an gap compared to gap compared to the Valence and the that of insulators Semi-conductors Conduction band of the conductor do overlap

DIAGRAMS



10 (b) From:

$$I_{\text{total}} = I_{R_1} + I_{R_2}$$

$$I_T = 5.2 \text{ A}$$

$$I_{R_1} = X$$

$$I_{R_2} = 3.2 \text{ A}$$

$$5.2 \text{ A} = 3.2 \text{ A} + X$$

$$5.2 \text{ A} - 3.2 \text{ A} = X$$

$$X = 2 \text{ A}$$

Let $r_{S2} = R_1$

$4.0 \Omega = R_2$

R_1 and R_2 share the same Voltage since they are in parallel

From $V = IR$.

$$I = 3.2 \text{ A}$$

$$R = 4.0 \Omega$$

$$V = (3.2 \times 4.0) V$$

$$= 12.8 \text{ V}$$

\therefore Voltage across resistor is 12.8V.

$$I_T = 12.8 \text{ V}$$

$$R_{AT} = 12.8 \text{ V}$$

$$r = \frac{12.8 \text{ V}}{2 \text{ A}}$$

$$r = 6.4 \Omega$$

$$\therefore X = 2 \text{ A} \text{ and}$$

$$r = 6.4 \Omega$$

(c) From $R_T = \frac{R_1 R_2}{R_1 + R_2}$

$$R_1 = 6.4 \Omega$$

$$R_2 = 4.0 \Omega$$

10 (c) $R_T = \frac{(6.4 \times 4)}{6.4 + 4} \Omega$

$$= \left(\frac{25.6}{10.4} \right) \Omega$$

$$= 2.46 \Omega$$

\therefore The effective resistance is 2.46Ω

2017

10 marks

- 10 (a) (i) Define the term semiconductors.
(ii) How do intrinsic semiconductors differ from extrinsic semiconductors?
- (b) (i) List four properties of cathode rays.
(ii) Describe how x-ray tube is used to produce x-rays.
- (c) (i) Mention three uses of induction coil.
(ii) Briefly explain the working principle of a bicycle dynamo.

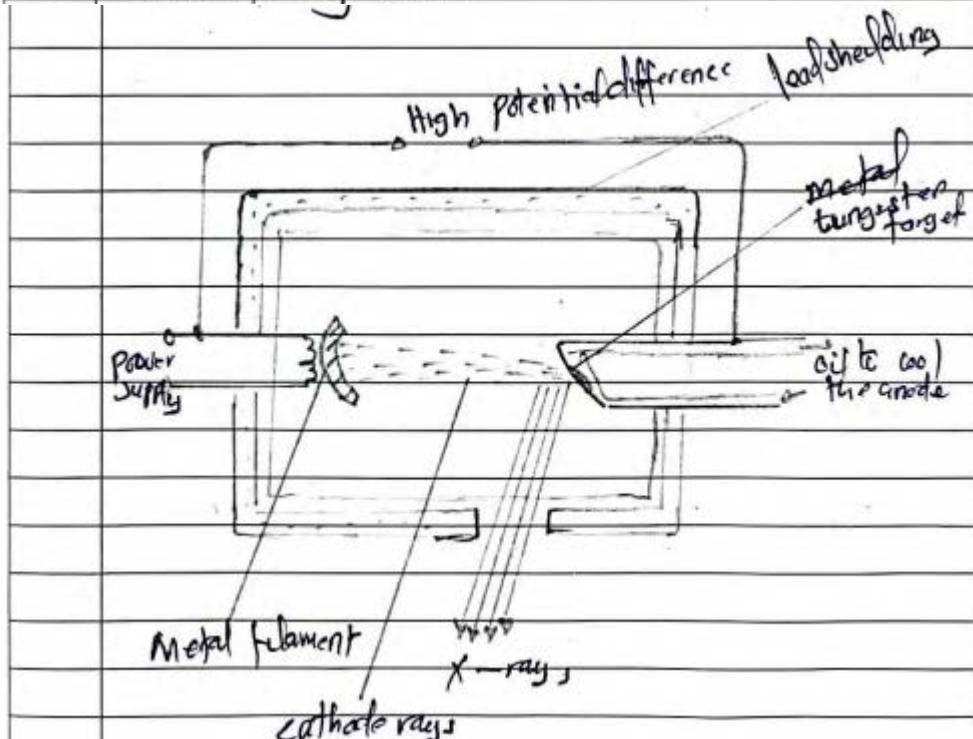
10 (q)(i) Semiconductor is an electrical device which its electric conductivity lies between insulators and conductors.	
(ii) consider the following table, shows its differences.	
Intrinsic semiconductor	Extrinsic Semiconductor
(i) If conductivity depends on temperature only	(ii) If conductivity depends on temperature and impurities
(ii) The number of holes and electrons are equal	The number of holes and electrons are not equal.

10(a)	Intrinsic Semiconductor	Extrinsic Semiconductor
	(iii) If it is pure enough semiconductor	(ii) If it is impure semicon- ductor
	(iv) Its conductivity is not high because the number of hole and electron equal are equal	(iv) Its conductivity is very high because the number of hole and electron are differ.

10(b)

- (i) It travels in straight line
- (ii) It has negative charge
- (iii) It can cause fluorescence (glow) when strikes the target
- (iv) It has energy and momentum

(ii) Consider the following diagram of the Cathode ray tube



10(b) (m) The production of X-rays is done by the metal filament to emitting cathode rays which goes to strike the tungsten target. When metal filament is heated by the heat from the power supply with high current the metal filament electrons will undergo the kinetic energy, this cause the metal filament to discharge electrons which goes to strike the tungsten target and X-rays will be produced. There is the high amount of cathode rays emitting from the metal filament but few of them are converted to X-rays while others are lost due to loss of heat energy.

10(c) (i) Induction coil used in internal combustion in the engines

(ii) used in wireless telegraphy.

(iii) Induction coil used to trigger flash used in cameras and strobe lights.

(ii) The working principle of dynamo is to produce or induced current by changing the magnetic flux. When the coil rotates in the bicycle dynamo there is cutting off of the magnetic flux linking in the permanent magnets, this cause the current to be induced in the dynamo by changing or cutting off magnetic flux.

2014

- 10 (a) (i) What is meant by saturation current?
(ii) Give one peculiar property of a diode as a rectifier.
- (b) Briefly explain the function of each of the following apparatus:
(i) Geiger-Muller (G-M) tube.
(ii) Diffusion cloud chamber.
- (c) Figure 2 shows a section of a cathode-ray oscilloscope.

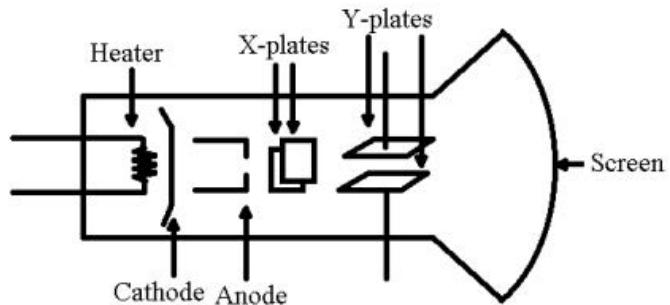


Figure 2

What changes should be done in order to produce the following on the screen:

- (i) a brighter trace
(ii) a vertical line
(iii) a wave pattern
(iv) a horizontal line.

10. (a) (i) Saturation current is the amount of current required to emit the electron from the cathode.
10. (a) (ii) Diode is used as a rectifier because it allows current to flow in one direction only.
10. (b) (i) Geiger-Muller (G-M) tube is used to detect radiations present near a radioactive material. G-M tube detects especially alpha and beta particles.
10. (b) (ii) Diffusion cloud chamber is also used to detect radiations present near a radioactive material.
10. (c) (i) To produce brighter trace increase anode voltage
(ii) To produce a vertical line switch off time-base and connect alternating voltage to Y-plates
(iii) To produce a wave pattern switch on time base and connect alternating voltage to Y-plates.
(iv) To produce a horizontal line use time base only.

2012

10. (a) (i) What is a transistor?
(ii) Mention two applications of transistors.
- (b) (i) List down two types of diodes.
(ii) Briefly explain the mode of action of a forward bias in a p-n junction.
- (c) Figure 2 shows a common-emitter amplifier circuit.

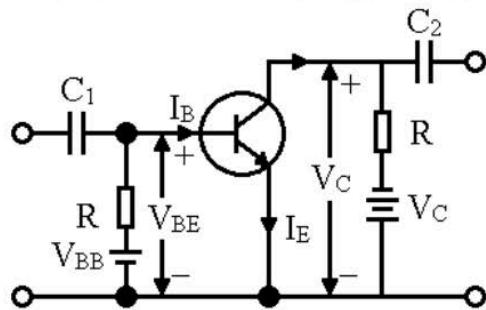


Figure 2

- (i) Why is the circuit named so?
(ii) Explain the function of capacitors C_1 and C_2 .

10.(a) A transistor: Is a device consisting of sandwiched semiconductor

(i) and is used to amplify alternating current or voltage or switching.

(ii) Application of a transistor

1. Amplification of A.C current or voltage.

2. Switching.

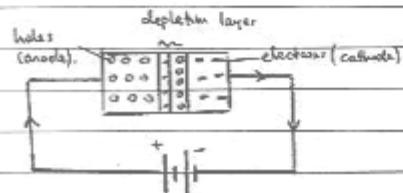
10(b). (i) types of diodes.

1. Semiconductor diode.

2. L.E.D (light emitting diode).

10(b) Forward bias in a p-n junction occurs when the anode (side

(i), with holes) is connected to the positive terminal and the cathode (side with electrons) is connected to the negative terminal such that the like charges repel and diminish the depletion layer. This option reduces the resistance of the p-n diode and so the diode conducts electricity.



10(c) The circuit is common emitter amplifier circuit because the

(i) emitter of the transistor is shared by the source and the output. It is an amplifier because the input current is amplified as it passes through the transistor: $\beta \times I_B$.

(ii) C_1 - absorbs any d.c component from the external circuit which may distort the output as they get amplified.

C_2 - absorbs any d.c component that managed to pass through C_1 and prevents them from reaching the output.

2010

8. (a) (i) What particle are emitted in thermionic emission? Explain why they are emitted. **(2 marks)**
(ii) What do you understand by the term transistor? **(1 mark)**
- (b) (i) How a common emitter arrangement of a transistor is stabilized for temeprature changes? **(2 marks)**
(ii) Show the circuit symbol for pnp-transistor and npn-transistor. **(2 marks)**\
- (c) Draw a simple common emitter amplifier circuit using npn-transistor as a current amplifier. **(3 marks)**

31. Elementary Astronomy

2018

9. (a) (i) Define the term astronomy.
(ii) Enumerate three importance of astronomy to mankind.
- (b) (i) Specify the difference that exists between galaxy and a planet.
(ii) Outline three defining characters of a planet.
- (c) Briefly explain the importance of stratosphere to living things on the earth's surface.

Q9. (a). (i) <u>Astronomy</u>	<p>This is the study of the motion, behaviour and properties of the heavenly bodies in the universe.</p> <p>(ii) - Development of calendars. - It is used by the land and sea navigators. - The knowledge of astronomy helps people to predict seasons and plan for their developmental activities.</p>
(b). (i)	<p>A galaxy is the giant collection of billions of stars while a planet is the large heavenly body that revolve around the sun through the orbit.</p>
(ii).	<p>- It must be revolving the sun & in its orbit. - It should be large. - It should have the spherical shape.</p>
(c).	<p>Stratosphere is the second layer of the atmosphere from the earth's surface. This layer contains the Ozone-layer which prevents most of the sun's ultra-violet radiations from reaching the earth's surface. This reduces the risks of getting cancer since the rays are harmful. Also it prevents global warming.</p>

2016

10 marks

9. (a) (i) What is Zodiacal light?
(ii) Mention three uses of earth satellite.
- (b) (i) Give two examples of a Jovial planet and two examples of a terrestrial planet.
(ii) How are the bodies in the solar system kept in normal positions?
- (c) (i) Which planet is often called " Morning star"?
(ii) Briefly explain how astronomy gave rise to the 12 months of the year.

2015

9. (a) What is meant by the following terms?
(i) Asteroids.
(ii) Astronomy.
- (b) Distinguish between:
(i) Constellations and a galaxy.
(ii) Meteor and meteorites.
- (c) (i) Mention two types of tides.
(ii) With the aid of diagram, describe how ocean tides are formed.

Q. a) i) Asteroids these are small bodies or planet which revolves around the Sun. Mostly found between the planet Mars and Jupiter. That is why that place are called the Asteroid belts.

ii) Astronomy is the study of universe and heavenly bodies found in Solar System. This branch of science also involve the origin, composition, properties, characteristics and motion of all bodies found in the universe example planet Stars as well as Comets and Asteroids.

b) i) Constellation is the group of stars that form a definite shape or pattern when viewed from the earth example Scorpion and Lion while galaxy is the large group of stars that are found in the atmosphere example the sun.

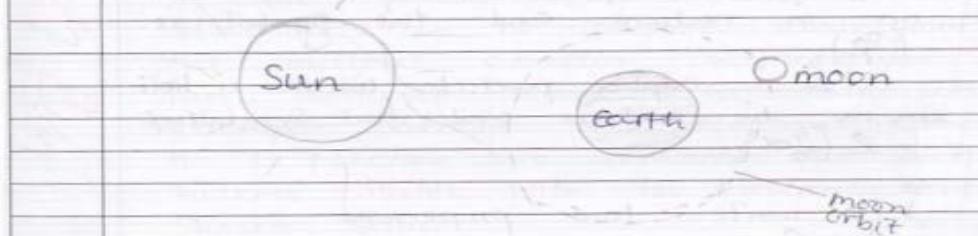
ii) Meteor an asteroid with head and bright tail which seen in the sky at night and falling down example which falling in Mbazi in Mbeya region while Meteorites are asteroids which enter the earth's atmosphere and manage to reach the ground before being burnt completely

Q. C) The types of tides are

- Spring tides which formed during fully moon or new moon.
- Neap tides which formed during quarter moon.

ii) Ocean tides are period of rise or fall in the level of water

Ocean tides are caused by gravitational interaction between the moon, sun and the earth, which cause the water to bulge, hence led to the ocean tides



2010

5. (a) (i) Define the terms astronomy and asteroids. **(2 marks)**
(ii) Is scorpion a galaxy or a constellation? Give reason for your answer. **(1 mark)**
- (b) Distinguish between:
(i) a planet and a star **(1 mark)**
(ii) a comet and a meteor **(1 mark)**
- (c) Which planet in the solar system is
(i) closest to the Sun? **(1 mark)**
(ii) furthest from the Sun? **(1 mark)**
(iii) closest to the earth? **(1 mark)**
(iv) surrounded by rings? **(1 mark)**
(v) the second largest planet? **(1 mark)**

32. Geophysics

2019

8. (a) Why the inner core of the earth is solid while the outer core is liquid? Briefly explain. **(5 marks)**
- (b) The frequency obtained from a plucked string when the tension is 2 N is 400 Hz. Calculate the frequency when the tension is increased by 6 N. **(5 marks)**

8@	<p>The inner core of the earth is solid because it is subjected to very high pressure. This makes the material making it become very closely compacted forming a core.</p> <p>The outer core is liquid because it's not subjected to very high pressure as the core. The temperature within the earth causes the rocks to melt and cause the outer core become liquid.</p> <p>The materials making inner core are harder than those of outer core.</p>
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8(b)	<p><u>Data</u></p> $T_1 = 2 \text{ N}$ $f = 400 \text{ Hz}$ $T_2 = 2 \text{ N} + 6 \text{ N}$ $= 8 \text{ N}$ $f_2 = ?$ <p>From:</p> $f \propto \sqrt{T}$ $f = K\sqrt{T}$ $K = \frac{f}{\sqrt{T}}$ $\therefore \frac{f_1}{\sqrt{T_1}} = \frac{f_2}{\sqrt{T_2}}$ $\frac{400 \text{ Hz}}{\sqrt{2 \text{ N}}} = \frac{f_2}{\sqrt{8 \text{ N}}}$ $f_2 = \left(\frac{400 \times \sqrt{8}}{\sqrt{2}} \right) \text{ Hz}$ $\therefore \text{frequency produced} = 800 \text{ Hz}$
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2013

9. (a) What is meant by the following terms as used in geophysics:
- (i) Tsunami.
 - (ii) Magma.
- (b) (i) List down the various layers of the atmosphere starting from the Earth's surface.
(ii) Which layer in part (b) (i) above is nearest to the Earth? Explain two importances of it.
- (c) (i) What is a constellation?
(ii) Briefly explain the causes of ocean tides.

Q.

a) i) Tsunami:

Tsunami are massive oceanic waves (water waves) that are a result of earthquakes taking place in the ocean. Tsunami are common in few East countries such as China, Japan, and Indonesia.

i) Magma

Magma is the molten rock within the earth's interior. Magma results from volcanic activities inside the earth.

b) i) 1st. TROPOSPHERE

2nd. STRATOSPHERE

3rd. MESOSPHERE

4th. THERMOSPHERE

5th. EXOSPHERE

ii) TROPOSPHERE is a layer nearest to the earth. The following are two importance of troposphere

1. Troposphere provides a layer where all weather phenomena such as rainfall, winds and storms occurs or appear.
2. It contains useful gases such as oxygen which support life on earth, Carbon dioxide for plants photosynthesis and Nitrogen to provide inertial environment.

for chemical reactions.

9 c) i) Constellation is the group of stars that form a particular pattern when viewed from the earth's surface. Examples of constellations are Orion, Little Dipper, Constellations at Amazon's constellation.

ii) Ocean tides are caused by attraction forces (gravitational attractors) between the earth, moon and sun. Gravitational forces between the earth and moon cause water to be attracted towards the moon on one side and away from the moon on opposite side of the earth thus causing ocean tides. Also attraction between the earth and the sun cause ocean tides.

Another cause for ocean tides is the earth's rotation. The rotation of the earth makes different places in the earth to experience two high tides and two low tides per day as it makes different sides of the earth to face the moon.

2012

8. (a) What is meant by the following terms:
- global warming.
 - greenhouse effect.
 - earthquake.
- (b) Mention three effects of global warming.
- (c) (i) What is the major cause of global warming?
(ii) Briefly explain three measures that can be taken to control global warming.

8(a)(i)	Global warming is rise of earth average temperature due to what is known as green house effect.
(ii)	Green house effect is the process where by the emission of radiation by atmosphere warms the earth's surface.
(iii)	Earthquake is the suddenly shaking of the earth crust.
(b)	Effects of global warming 1. Rise in sea level 2. Acidification of oceans and seas 3. Disappearance of some plant and animal species.
(c)(i)	The major cause of global warming is the accumulation of green house gases in the atmosphere such as Carbon dioxide (CO_2), methane, Carbon Chlorofluorocarbons (CFC) etc.
(ii)	Measures that can be taken to control global warming. 1. Reducing or avoiding use of fossil fuels like coal 2. Planting trees through afforestation and reafforestation programs 3. Using alternative source of energy like Solar energy, wind energy etc.

2011

7. (a) (i) What are sustainable energy sources?
(ii) State four applications of energy generated from water.
- (b) (i) Define geothermal energy.
(ii) Briefly explain how geothermal energy can be harnessed.
- (c) (i) What is a windmill?
(ii) Mention three disadvantages of energy caused by wind.
(iii) Does wind itself possess energy? Explain.
9. (a) Define the term earthquake.
- (b) Briefly explain the meaning of the following terms as used on earthquake:
(i) Hypocentre
(ii) Epicentre
- (c) (i) What is global warming?
(ii) Name four gases that contribute to global warming and give one source of each.

2014

9. (a) What is meant by the following terms?
(i) Volcanoes
(ii) Non-renewable sources of energy.
- (b) (i) Mention two merits and two demerits of volcanoes.
(ii) Briefly explain two hazards associated with earthquakes.
- (c) (i) List down two disadvantages of non-sustainable energy sources.
(ii) State two applications of energy generated from water.

Q) a) Volcanoes - Activities which results to the ejection of molten materials from the earth's interior

b) Non-renewable energy resources are sources of energy which when used cannot be replaced. They include, coal, petroleum and natural gas.

b) i) Merits of volcanoes

→ They aid in formation of fertile soils and mineral deposits by introducing them from the interior.

→ They form features such as mountains and lakes which are tourist attractions.

i) Demerits

→ They can bring about death of living things such as plants and animals.

→ They bring destruction of properties.

c) i) Hazards associated with earthquake.

→ Death of people and animals. This can be caused by falling of buildings, tsunami and other things which can kill people.

→ Destruction of properties such as railway lines, buildings and other things which can lead to displacement of people and animals.

c) ii) Disadvantage of non-renewable resources

→ They cannot be replaced when we overuse.

→ They contribute to global warming when decomposed to produce energy and some are harmful like nuclear energy.

ii) Energy generated from water.

→ Produces electricity for domestic uses such as cooking, lighting purpose.

→ Produces electricity for industrial uses such as lumbering, mining.