535/2
PHYSICS
PAPER 2
$2^{1}/_{4}$ hours

WAKISSHA

Uganda Certificate of Education

PHYSICS

Paper 2

2hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

- Answer any five questions.
- Any additional question(s) answered will not be marked.
- Mathematical tables and silent non- programmable calculators may be used.

These values of Physical quantities may be useful to you,

Acceleration due to gravity, g	=	$10ms^{-2}$
Specific heat capacity of water	=	$4200Jkg^{-1}K^{-1}$
Specific heat capacity of copper	=	$400Jkg^{-1}K^{-1}$
Specific latent heat of fusion of ice	=	$3.36 X 10^{5}Jkg^{-1}$
Density of water	=	$1000kgm^{-3}$
Density of Mercury	=	$13,600kgm^{-3}$
Speed of sound in air	=	$340ms^{-1}$

Turn Over

1. (a) (i) What is meant by efficiency of a machine? (01 mark)

(ii) State two factors that determine the amount of frictional force between solid surfaces. (02 marks)

(b) Using a block and tackle system, a man exerts an effort of 500N to pull 12m of the hauling rope through his hands in one minute.
During this time, the load of 800N raises 0.6m.
Calculate;

(i) the efficiency of the system. (03 marks)

(ii) the power at which the man works. (02 marks)

(c) Describe an experiment to locate the center of gravity of an irregular shaped lamina. (04 marks)

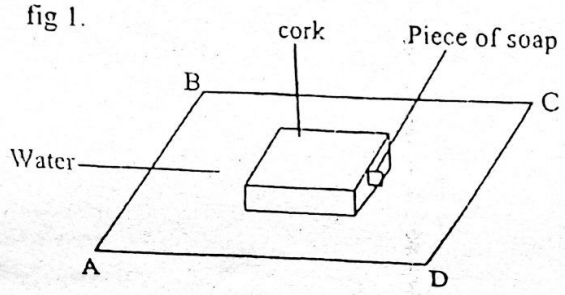
(d) Two capillary tubes of same radius are dipped into a beaker of water and the other in a beaker of Mercury.

(i) Draw the levels of the liquids in the two tubes. (02 marks)

(ii) Explain your observation in (d)(i) above. (02 marks)

2. (a) The diagram in figure 1 below shows the surface of water in a rectangular trough ABCD. A piece of cork to which a slice of soap is attached is lowered on the water surface as shown.

fig 1.



(i) State the forces acting on the cork (02 marks)

(ii) In what direction will the cork move (01 mark)

(iii) Explain what causes the motion (02 marks)

(b) Some water was put into an empty tin and boiled for several minutes. The tin was tightly curved and its heating stopped immediately.
Cold water was run over the tin.

(i) State what happened to the tin (01 mark)

(ii) Briefly explain the observation in b) i) above. (02 marks)

(c) Explain why the table-cloth on a table can easily be pulled out without disturbing the dish placed on it. (02 marks)

(d) A uniform rod AB of length 9m is pivoted at a point P, 4m from B,
A load W is attached at A to support the weight of a student of mass 50kg who is at B. the load is adjusted as the student starts walking towards P to keep the system in equilibrium.

A table below shows the load W when the student is at a distance P, from the pivot.

W(N)	380	280	180	80	30
x(m)	4.0	3.0	2.0	1.0	0.5

(i) Plot a graph of W against x. (03 marks)

(ii) Determine the weight of the rod. (03 marks)

(a) Cells are connected either in series or Parallel. Using usual symbols for cells, show such connections for two cells. (02 marks)

(b) (i) State one advantage of connecting cells in;

(i) series (01 mark)

(ii) parallel (01 mark)

(c) Explain why the voltage across the terminals of a cell fall when it is delivering current. (02 marks)

(d) An electric kettle is rated 2200W, 240V.

(i) State what is meant by the markings on the kettle? (01 mark)

(ii) What fuse should be fitted in the plug for the kettle to work normally? (02 marks)

(e) An electric heater is made of two elements of resistance 40Ω each which can be switched to parallel or series connection to a 240V supply.
Find out which connection gives maximum power. (03 marks)

(f) Describe how a lightning conductor safe guards a tall building from being struck by lightning. (04 marks)

4. (a) (i) Define temperature. (01 mark)

(ii) Explain why the bulb of a clinical thermometer is not quite full of mercury at room temperature. (02 marks)

(b) (i) Explain why a person feels colder after taking a bath of warm water. (02 marks)

(ii) State two practical instances that shows that evaporation causes cooling. (02 marks)

(c) When pieces of ice at 0^0C were put in 0.5kg of water at 20^0C, the final temperature was 15^0C. (04 marks)
Find the mass of the ice that was added.
[Specific latent heat of fusion of ice = 336,000 $Jkg^{-1}K^{-1}$]

(d) (i) Describe the principle on which a pressure cooker works. (03 marks)

(ii) Explain why it is difficult to cook quickly with an open vessel at mountain tops. (02 marks)

5. (a) (i) State one property of light that a pin-hole camera illustrates. (01 mark)

(ii) State two ways in which the image in a pin hole camera is different from the object. (01 mark)

(b) Explain, with the aid of a ray diagram, how a converging lens is used in a simple camera. (03 marks)

(c) Describe short sightedness and how it is corrected. (03 marks)

(d) (i) What is meant by total internal reflection? (01 mark)

(ii) Explain how a mirage occurs during hot sunny days. (03 marks)

(iii) State two practical applications of total internal reflection. (02 marks)

(e) A flag has four stripes of colours; yellow, red, cyan and blue.
Describe appearance of the flag when viewed in a room where there is only yellow light. (02 marks)

(a) Define the terms

(i) Wave length (01 mark)

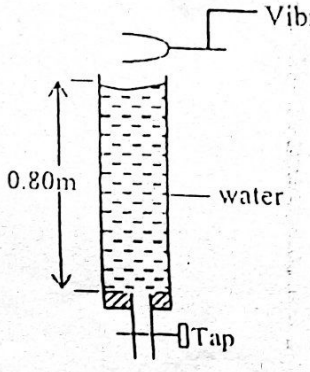
(ii) Beats in sound (01 mark)

(b) (i) Give two reasons why sound is louder at night than day time. (02 marks)

(ii) Briefly describe an experiment to demonstrate interference of water waves. (03 marks)

(c) A vibrating tuning fork producing a note of frequency 425H_Z is held above the mouth of the tube of length 0.80m, containing water as shown in figure 2 below.

fig. 2.



(i) The water is slowly run out of the tube. A loud sound is first heard when there is 0.60m of water left in the tube.
Explain why a loud sound is first heard for this length of the air column. (01 mark)

(ii) Sketch a diagram to show the mode of vibration of the air column. (01 mark)

(iii) State the name of this effect. (01 mark)

(iv) Calculate the value of speed of sound in air. (02 marks)

(d) How does wind affect the speed of sound in air? (02 marks)

(e) State two factors that affect the frequency of a vibrating string. (02 marks)

(a) State what is meant by the following as applied to magnetism.

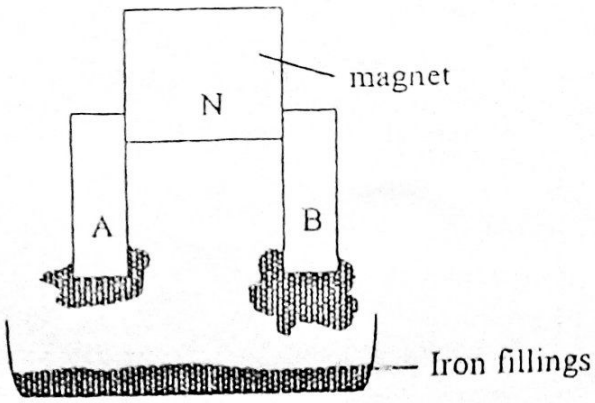
(i) Magnetic field? (01 mark)

(ii) Neutral point? (01 mark)

(b) What is magnetic induction? (01 mark)

(c) Figure 3 below shows two pieces of metal A and B attached on the pole of a magnet and placed near a dish containing iron fillings.

fig. 3.



(i) Describe what is observed in A and B when the magnet is detached. (02 marks)

(ii) Describe the magnetic properties of metal A. (01 mark)

(d) (i) Describe how you would care for magnets to maintain their strength. (03 marks)

(ii) Explain how you would demagnetize a bar magnet by hitting. (03 marks)

(e) A galvanometer with a resistance of 100Ω gives a full scale deflection of 10mA. What adjustment is needed to make the metre suitable to measure current of up 10A? (03 marks)

(f) Given one advantage of using a magnetic relay to switch electrical machinery on and off. (01 mark)

8. (a) Define the following terms

(i) Isotopes (01 mark)

(ii) Atomic number (01 mark)

(b) Naturally occurring chlorine is a mixture of two Isotopes. One isotope has 17 protons and 18 neutrons. Find the total mass of each atom if the other atom has 2 more neutrons. (02 marks)

(c) (i) What are cathode rays? (01marks)

(ii) Describe briefly how cathode rays are produced in the Cathode ray tube. (03 marks)

(d) (i) Explain why people are advised against exposing themselves to x-rays unless it is absolutely unavoidable. (03 marks)

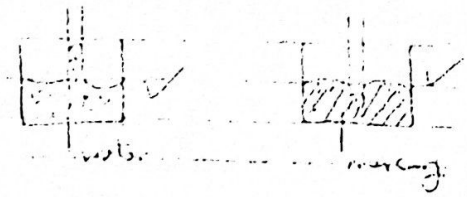
(ii) State two differences between Cathode rays and X-rays. (02 marks)

(e) Explain why alpha particle produce much dense track than that of beta particles. (02 marks)

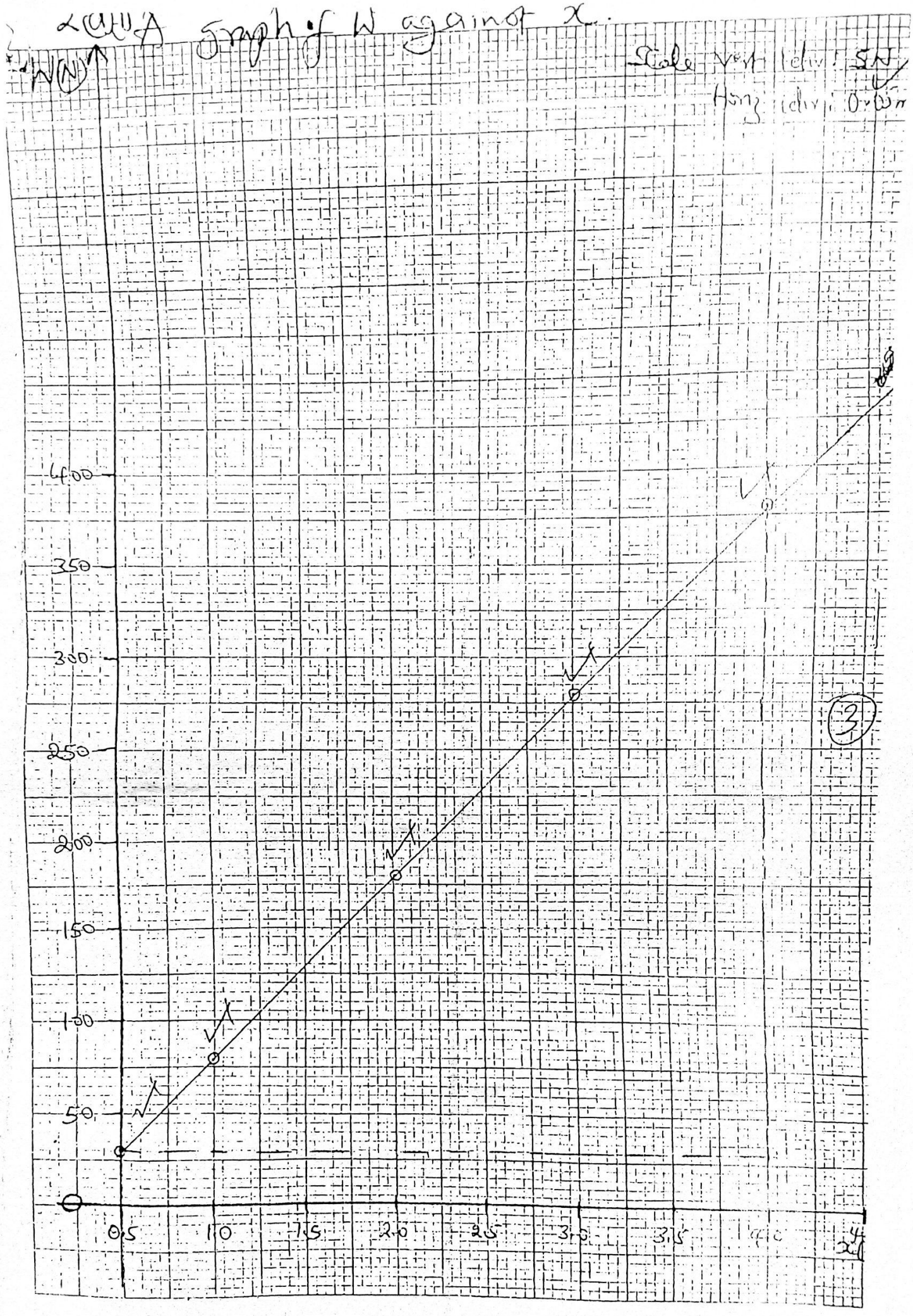
(f) State the energy changes that occur in an X- ray tube when in use. (01 mark)

END

WAKISSHA
MARKING GUIDE
Uganda Certificate of Education
PHYSICS 535/2

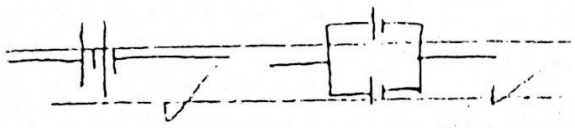
No.	Scoring Point	Notes	Mark
1. a)	i) Ratio of power output to power in put.	Ratio of useful work done to work put into machine to operate	01
	ii) - amount of force pressing the surfaces. - molecular nature of surfaces - Roughness of surfaces	Any first 2	02
b)	i) $V.R = \frac{effort\ distance}{load\ distance} = \frac{12}{0.6} = 20$ ii) $M.A = \frac{L}{E} = \frac{8000}{500} = 16$ iii) $\eta = \frac{M.A}{V.R} \times 100\% = \frac{16}{20} \times 100\% = 80\%$ iv) Power $= \frac{f \times d}{t} = \frac{500 \times 12}{60} = 100W$		03
c)	- Balance the metal sheet on a horizontal knife edge. - A line is drawn on the metal sheet along the straight edge. - Repeat the procedure for two other positions of balancing. - The point of intersection gives the Centre of gravity.	- Make three holes along the edge of the sheet - Suspend the metal sheet freely from a nail through one of the holes. - suspend a plumbline from the same nail - Make two points on the sheet along string. - Draw a line through points. - Repeat procedure for other two holes lines. - where the lines intersect is the Centre of gravity.	02 04
d)	i) 		02
	ii) Capillary tube in water, rises when dipped because adhesion greater than cohesion while in mercury falls due to cohesion being greater than adhesion.		02
			16

2.(a)	i) Repulsive force ✓ Attractive force ✓		01
	ii) Cork moves down wards ✓		02
	iii) Soap reduces the surface tension of water ✓ hence making cork to sink. ✓		1
(b)	(i) The tin collapses in wards ✓		02
	(ii) Pouring water over the Can Causes steam inside to condense reducing air pressure inside ✓ Therefore, tin collapses in wards due to excess atmospheric pressure being greater than inside pressure in the Can. ✓		
(c)	If the table- cloth is suddenly pulled, no force is applied to dish on it and hence it remains on the table quite undisturbed due to inertia ✓		02
(d)	(i) See graph	Correct scale ½ Each correctly plotted point ½	03
	(ii) Slope S = $\frac{380-30}{4-0.5} = 100\text{Nm}^{-1}$ ✓ Weight of rod = 100 x 9 = 900N ✓		03
			16



A graph of W against x.

3.(a)



(b) (i) provides large emf

(ii) lower internal resistance of the cell

(c) Some energy is lost across the internal resistance of the cell hence P.d across the cell is less than the emf of the cell.

(d) (i) The kettle consumes 2200J of energy in one second when connected to a 240V supply

(ii) $P = I\,V$

$2200 = I \times 240$

$I = 9.17A$

Required fuse is 10A

(e) For series, total resistance

$R = 2 \times 40 = 80\,\Omega$

Power $P = \frac{V^2}{R} = \frac{240^2}{80} = 720W$

For parallel, Total resistance

$R = \frac{R}{2} = \frac{40}{2} = 20\,\Omega$

Power $P = \frac{240^2}{20} = 2880W$

Hence parallel connection gives more power.

(f)
- When a negatively charged cloud passes near the conductor,
- It induces positive charge on the spikes of the conductor by repelling the electrons to earth
- The high charge density at spikes ionizes the air
- The +ve ions are repelled to form Positive space charge
- Negative ions are attracted to spikes and discharged.
- Should lightning occur, it's directed through positive space charge to the conducter which will conduct it harm lessly to earth.

01

01

02

01

02

03

04

16

4.(a) i) Is a number which expresses the degree of hotness or coldness on a chosen scale ✓

ii) Room temp. is below the range of clinical thermometer (35°C – 43°C) and therefore, this will lead to shrinking of mercury back to the bulb. ✓

(b) i) Molecules with higher K.e move to the surface of liquid and escape into the atmosphere.
This reduces the average K.e of molecules left in the liquid leading to reduced temp hence feeling colder.
Water Oozes through pores of porous pot

ii)
- In refrigeration.
- Wet and dry bulb hydrometer.
- Methylated spirit sprayed on the hand.
- Exposing wet clothes on a rainy day to wind.

Dogs pant
Any first 2

(c) Heat lost by water = Heat gained by Ice to melt + Heat gained by melted ice to raise temp

$M_w C_w(20-15) = m_i L_f + m_i C_w(15-0)$

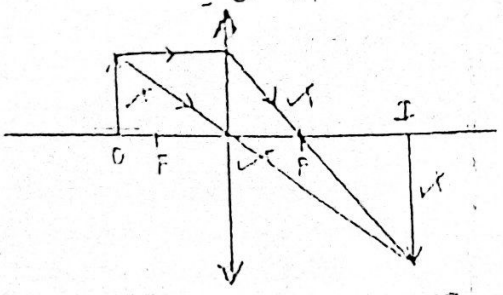
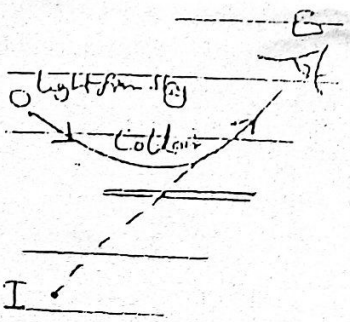
$0.5 \times 4200(20-15) = 336000xm_i + 4200x15xm_i$

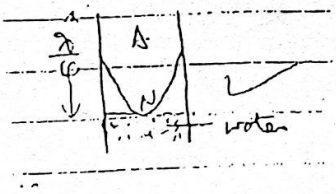
$m_i = 0.0263Kg$

(d) i) - The lid ring of a cooker makes it airtight.
- when a cooker is in use, a steam pressure inside builds up and increases B.pt
- A loaded pin valve is used to release some steam in order to maintain the required pressure and to avoid explosion
- pressure inside is regulated by using weights, placed on the pin value
- the more the weights, the greater is the pressure inside thus boils faster.

ii) At higher altitude, air is less dense thus exerting less pressure reducing the boiling point.

01
02
02
04
03
02
16

5 (a)	(i) Rectilinear propagation of light ✓		01
	(ii) - Inverted or upside down ✓ - Turn left to right ✓		
(b)	 When an object is placed between Centre of curvature and principal focus, it forms a real magnified and inverted image on the screen.	ACC Object placed at the Centre of curvature	03
(c)	- The eye cannot see far objects clearly ✓ - The eye ball is too long and rays from a far object are focused in front of the retina. ✓ - It is corrected by placing a concave lens in front of the eye ✓ - Rays from a distant object are <u>diverged</u> slightly before entering the eye so that on being <u>refracted</u> by the lens, the image is formed on the retina.	Some points can be scored on a ray diagram	03
(d)	i) Is when all incident light in a more dense medium is reflected back in to the same medium. ✓		01
	ii) - On a hot day, air near the ground is hotter than air above sine the refractive index of air increases gradually for ground up wards. - Light from the sky is gradually refracted away from the normal as it passes through the layers of warm but less dense air near the hot road. - To an observer at E will see a pool of water as the refracted rays travel upwards		03
	(iii) -Totally erecting prisms. ✓ - Transmission of radio waves. ✓ - Prism periscopes. - Prism binoculars - Sending messages through optical fibres	Any first 2	02

(e)	- The yellow strip appears yellow ✓ - The red strip appears red ✓ - The cyan strip appears green ✓ - The blue strip appears black ✓		02
6(a)	(i) Distance between two successive particles that are in phase. ✓		01
	(ii) Are regular rise and fall in loudness of sound when two notes of nearly equal frequency are sounded together. ✓		01
(b)	(i) - less interference ✓ - air is more dense ✓	Less ionization of air	02
	(ii) - The tray of a ripple tank is filled with water. ✓ - The tray is illuminated with light ✓ - two circular dippers connected to vibrator are made to dip in the water - Waves from the dippers cross each other's path and interference patterns are observed on the screen inform of bright lines for constructive interference and dark lines for destructive interference.		03
(c)	(i) Natural frequency of air column in the tube is equal to that of the tuning fork, the air column is set in to Vibration with a large amplitude and aloud sound is heard.		01
	(ii) 		01
	(iii) Resonance ✓		01
	(iv) $\frac{\lambda}{4} = l$ $= 0.80 - 0.60$	ACC $V = 4f(l_2 - l_1)$ $= 4 \times 425(0.80 - 0.60)$ $V = 340 ms^{-1}$	02

	$\frac{\lambda}{4} = 0.2$ $\lambda = 0.8m$ $V = f\lambda$ $= 425 \times 0.8$		
(d)	$V = 340ms^{-1}$		02
	- Wind in the same direction as sound increases the speed of sound - Wind in the opposite direction to that of sound reduces the speed of sound.		02
(e)	- Length of the string - Mass per unit length - Tension in the string	any first 2	16
7 (a)	(i) The space around a magnet where a magnetic force is exerted.		01
	(ii) A point in a magnetic field where the resultant magnetic force is Zero.		01
(b)	Is when a piece of iron gets magnetized because of being near a magnet.		01
(c)	(i) A- many iron fillings still remain on A B- It loses almost all iron fillings		02
	(ii) Difficult to magnetize and hard to demagnetize		01
(d)	(i) - magnets should not be heated as this demagnetizes them - magnets should not be hit or dropped as doing this will weaken the magnet. - opposite poles of a magnet should be connected by pieces of soft iron called keepers when in storage so as to maintain the strength.		03
	(ii) A magnet is hit several times while lying in the East-west direction of the earth's field When the magnet is hit vibration energy of atoms increases. This disorganizes the regular arrangement of the domains hence demagnetizing the bar magnet.		03

(e)	P.d across galvanometer = P.d across shunt $10x10^{-3}x100 = (10-0.01)R_s$ $R_s = 0.1001\ \Omega$ A resistance of $0.1\ \Omega$ must be connected in parallel with resistance of galvanometer in order to produce a current of 10A.		03 01
(f)	Current lever sensor		16
8.(a)	(i) are atom of the same element with the same atomic number and different mass numbers. (ii) Is the number of protons present in the nucleus of an atom.		01 01
(b)	Mass number for first Isotope = 17+18= 35 Mass number for 2nd Isotope = 17+20= 37		02
(c)	(i) are a steam of fast moving elections (ii) Current through cathode from low voltage source heats cathode and electrons are emitted thermionically. The eht between cathode and anode accelerate, the emitted electrons to higher speeds towards the fluorescent screen.		03
(d)	(i) Our bodies absorb energy from radiations (X-rays) These X-rays radiations produce ions which destroy living cells causing cells to stop functioning, cancer, blood cancer and at time death.	Any first 2	02
	(ii)		

Cathode rays	X-rays
- fast moving elections	- are electromagnetic waves
- less penetrative	- more penetrative
- Travels slower	- travels faster
- long wave length	- short wave length

(e)	α - particles make thicker tracks as they cause intense ionication than B- particles.		02
(f)	Chemical energy → Heat → K.e		01
			16

END