PHYSICS I
PART I

1. State the reading indicated on the scale in Fig.1 shown below.

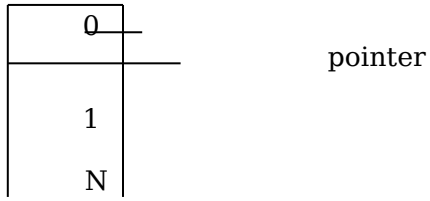


Fig. 1
(1mk)

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2. A bright object stands infront of a pin-hole camera. State two changes that occur on the image as the camera is moved closer to the object.
2mks
3. A measuring cylinder of height 30cm is filled to a height of 20 cm with water and the rest is occupied by kerosene. Determine the pressure acting on its base.
3mks
4. The diagram in fig. 2 shows the path taken by a gas molecule.

a. Explain why the molecule deviates at some points such as B.
1mk
b. State the law of motion that governs movement from A to B.
1mk
5. An object stands between two parallel plane mirrors facing each other. Show by calculation that the number of images formed is infinite.
1mk
6. A thermometric liquid should have low melting and high boiling point. State two other properties that make a liquid suitable as a thermometric substance.
1mk
7. The diagram in Fig. 3 represents a solid metal sphere suspended on a light string in a vacuum.

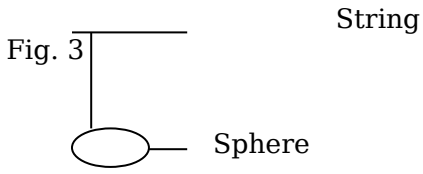


Fig. 3

a. Mark on the diagram the directions and names of the forces acting on the sphere
2mks
b. If the sphere is raised a little and then released the string breaks. Explain
1mk
8. Draw a diagram to show how a single pulley can be arranged to have a velocity ratio of 2.
2mks

9. A bob of mass 2.2kg is gently dropped onto a trolley of mass 0.5kg moving with a velocity of 2.0 ms^{-1} on a smooth horizontal runway. Determine the final velocity of the trolley and bob. 2mks

10. The diagram in fig. 4 represents a thin uniform triangular sheet of material. Mark accurately its centre of gravity, showing how you arrive at it. 1mk

Fig.4

11. A dull metallic mug and a pail of the same material are both filled with hot water of the same temperature. Their tops are then covered. Explain why water in the mug cools faster. 1mk

12. A pendulum bob is revolved in a circle of radius 0.6m. Calculate its displacement after it has covered ¼ of a cycle. 2mks

13. Fig. 5 represents two parallel current – carrying conductors P and Q placed close to each other. The direction of current in P is into the paper while in Q, current is out of the paper.

On the same diagram,

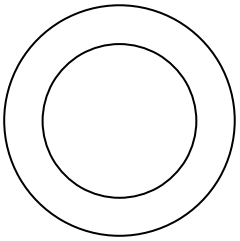
a. Sketch the magnetic field pattern 1mk

b. Indicate the force, F due to current on each conductor. 1mk

14. State three factors on which the turning effect of a force depends. 3mks

15. Fig. 6 shows a circular metallic plate with a fairly big circular hole at the centre. Explain why the hole may retain its diameter as the plate is heated. 1mk

Fig. 6



16. An object weighs 3.0N in air and 2.5N when completely immersed in water. Determine the density of object. 3mks

17. You are provided with two dry cells, an ammeter and two torch bulbs. Draw the circular diagram to show how you would connect them to give the maximum total current. The ammeter should be connected where it reads the maximum current.

18. Fig. 7 represents a network of capacitors. Determine the effective capacitance of the network. 3mks

19. State two advantages of parallel arrangement of electric bulbs in domestic wiring.
3mks

20. State three differences between friction in liquids and friction between solids.
3mks

21. Explain why gas tanks are usually painted with aluminium rather than oil paint.
1mk

22. The diagram in fig.8 shows part of a crowded scale magnified by a hand lens.

Fig. 8

Determine the magnification caused by the lens. 1mk

23. A fixed amount of gas was taken through a number of processes represented by AB, BC and CA in fig.9.



a. Which process was carried out according to Boyles law?
1mk

b. Suggest how process AB was carried out.
1mk

24. The final kinetic energy of an object is double its original value. By what ratio does its velocity increase?2mks

25. A drop of aniline is released to fall through a long column of water held in a vertical tube. Explain why the drop
finally acquires a steady velocity.
2mks

26. A student heated water to a temperature of 90°C and mixed it with 0.25kg of cold water at 22°C . After stirring,
the mixture attained a uniform temperature of 42°C. What was the mass of hot water?

The circuit in fig.10 represents a dry cell connected to a network of resistors. Use it to answer questions 27 and 28.

27. Determine the potential difference between A and B.
3mks

28. In which direction will current flow between A and B if the two points are connected through a conductor?
1mk

29. A body moves in a circle of circumference 5m with a speed of $1.25ms^{-1}$.
Sketch its distance – time graph, taking the centre of the circle as the reference point.
1mk
What is the frequency of its revolution?
2mks

The graphs in Fig.II represent the same wave.

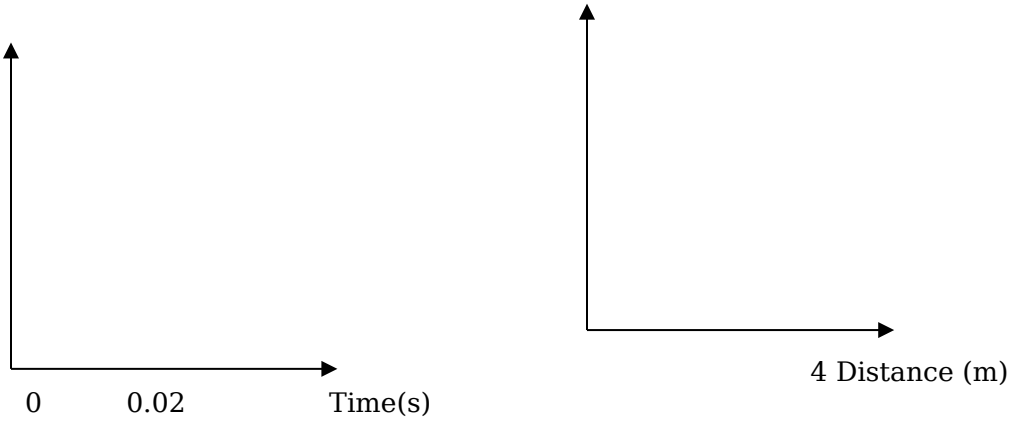


Fig.11

Use the graphs to determine

i. Wave length of the wave. 1mk
ii. Velocity of the wave. 2mks

31. A nail is provided with a sharp point and flat head. Explain the advantage of these features. 2mks

32. Rain drops of average mass 0.15g strike a horizontal plate at a rate of 60 drops per second. The drops arrive with an average velocity of $34ms^{-1}$. Calculate the average force exerted on the plate. 2mks

33. A charged plate X is connected to an electroscope and then placed parallel to a second plate Y of the same size.
Y is directly infront of X (fig. 12).
3mks

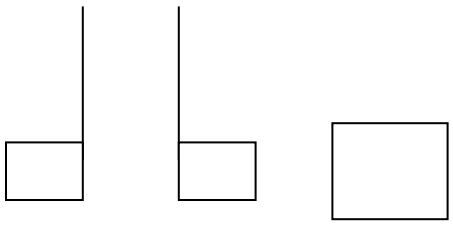


Fig. 12

Explain the effect on the leaf of the electroscope when Y is moved parallel to C.
1mk

34. Give two reasons why pressure decreases as altitude increases.
2mks.

PHYSICS I
PART II

a. The graph in Fig.1 shows how the length of an elastic band varies with the force applied on it.

(i) State the natural length of the band.
1mk

Determine
(i) The elastic constant of the band
2mks
(ii) The work done in stretching the band to 35 cm
3mks

b. The band described in Fig.1 is released suddenly from a length of 35cm to project a marble of mass 20g.
Calculate the velocity with which the marble takes off.
3mks

c. At a power generating station, water falls through a height of 115m. calculate the increase in temperature of
water. 3mks

2. a. In an experiment on momentum, a trolley, P of mass 800g was arranged as in fig. 2(a) with a ticker timer of
frequency 50HZ. Trolley P, initially moving with a velocity of 0.5ms^{-1} was made to collide with a stationary
trolley Q of mass 400g. A copy of the tape as it appeared after collision is presented in Fig.2 (b).

Determine

Velocity of trolley P after collision.
3mks
The change in momentum of trolley P.

3mks

b. Show that this collision was not inelastic.
2mks

c. An aeroplane flying horizontally with a velocity of $30ms^{-1}$ at a height of 40m releases a bag to drop at a target on the ground.

i. How long does the bag take to fall to the ground? 3mks

ii. Determine the horizontal distance from the target at which the bag should be released. 2mks

3.a. The diagram in fig. 3 represents a wheel and axle used as a machine whose efficiency is 80% to raise 400n of building materials. The wheel and axle have diameters of 75cm and 15cm respectively.

Wheel
axle

Effort

Fig.3

i. Mark on the diagram the correct position and direction of the load to be lifted.
1mk

ii. State fully the principle on which this machine works.
1mk

iii. Calculate the effort needed to raise the load.
3mks

iv. The machine is operated manually and raise the load to a height of 5m in 20 seconds. Calculate the power developed by the operator.
3mks

b. i. State two factors that determine the efficiency of an inclined plane as a machine.
2mks

ii. Explain how these factors affect efficiency.
2mks

4. A student carried out an experiment to investigate how current varies with potential difference applied across a filament lamp. The following readings were obtained.

p.d.(V)	0	0.20	0.40	0.60	0.80	1.20	1.60	2.40
I (A)	0	0.11	0.20	0.28	0.34	0.43	0.50	0.58.

a. Draw a diagram for the circuit used to obtain the values.

2mks

b. Describe briefly how the experiment was carried out.

2mks

c. Plot a graph of V against I for the values presented in the table.

5mks

d. Determine the resistance of the lamp when a current of 0.4A flows through it.

3mks

e. Explain why a filament lamp does not obey ohm's law.

2mks

5. a. In an experiment to determine the maximum viscous drag of glycerine, a student used a steel ball of diameter

2.0mm together with a column of glycerine held in a tall glass tube blocked at the base. The ball was released

to fall along the middle of the column and then timed over a distance of 20cm near the base of the column.

The time taken was found to be 2.0 seconds.

i. Explain.

i. How the diameter of steel ball was accurately measured.

2mks.

ii. Why measurement was taken near the base of the column.

1mk

ii. Give two reasons why steel balls are more suitable tan lead balls for this experiment.

i. Sketch a velocity – time graph to show how velocity of the ball varied with time till it reached the base of the

column. 2mks

ii. Name the forces acting on the ball as it moves through glycerine.

2mks

iii. Write an equation showing the relationship between the forces when the ball was near the base. Define

the symbols used.

1mk

iv. Calculate the maximum viscous drag from stoke's law and the results of the experiment.

3mks

State one factor that affects viscosity.

1mk

SECTION II (15mks)

6. a. State two unique properties of waves.

2mks

b. i. What do you understand by a standing wave?

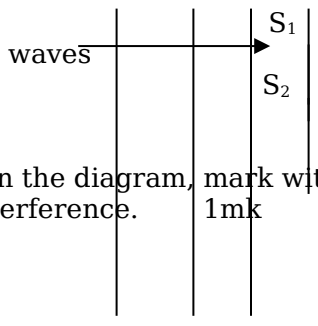
1mk

ii. A stretched string of mass 2g has a length of 0.6m and experiences a tension of 0.5N. Calculate the

frequency with which it vibrates when plucked.

3mks.

i. Complete the diagram below to show how the waves pass through the narrow slits S_1 and $S_{1..}$ 2mks



ii. On the diagram, mark with letter C any two points which experience constructive interference. 1mk

b. i. Describe briefly an experiment to show that in water waves, particles of the medium move only up and down
and not along the surface.
2mks

ii. Distinguish between longitudinal and transverse waves, giving one example of each.
4mks

a. A riding trolley of mass 400kg moves in a vertical plane in a circle of radius 3m formed by looped rails as shown in fig.4.

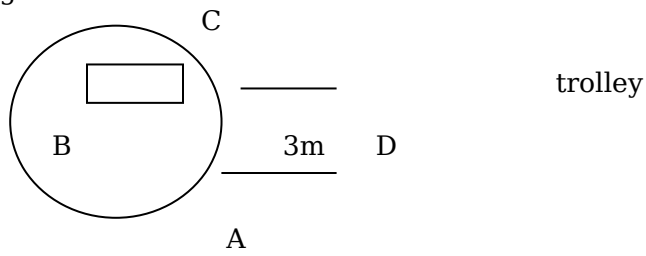


Fig. 4

i. Give the appropriate name of the force that keeps an object in circular motion.
1mk

ii. Determine the minimum velocity at which the trolley passes point C safely.
3mks

iii. State the minimum acceleration required for the trolley to maintain contact with the rails at C. 3mks

b. The trolley in fig.4 moves with a velocity of 8.0 ms^{-1} as it passes point A.
Determine.

i. The angular velocity at this point.
3mks

ii. The force exerted on the rails at this point.
3mks

a. Fig. 5 represents three manometer limbs A, B and C fitted on a water pipe Q with varying diameter.

Fig. 5

i. Indicate on the diagram the direction of flow of water. 1mk

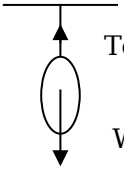
ii. Mark the level of water in C and explain the position of your mark 2mks

iii. Explain what is meant by streamline flow.

PHYSICS I
PART I
MARKING SCHEME

1. 0.40N
2. The image becomes brighter. 1mk
   The size increases. 1mk
3. $P=h_1P_1g+h_2g$ 1mk
   $= (02x10^3x10) + (0.1x8x10^2)$ 1mk
   $= 2800\ Nm^{-2}$ 1mk
4. a. It collides with other molecules 1mk
   b. A body at rest remains at rest and that which is in motion continues moving with the same velocity in the same directions unless acted upon by and external force. 1mk
5. $N = \frac{360}{0} - 1 = \alpha$ 1mk
6. High expansivity
   Regular expansivity (any two) 1mk
   Does not wet glass 1mk

7. (a)



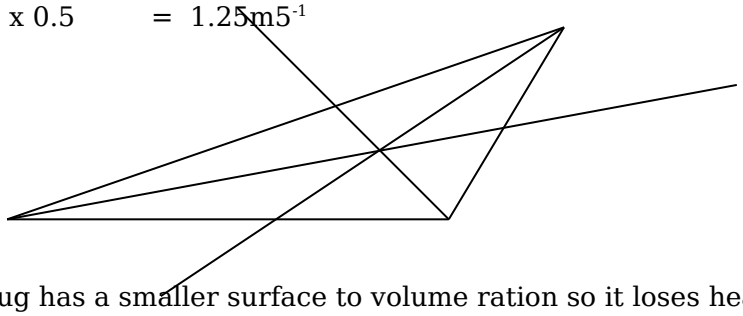
Tension (arrow + name) 2mks

Weight (or Gravity)

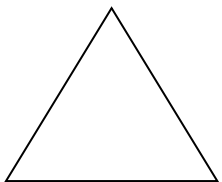
8.

9. $m_1v_1 = m_2v_2$
   $v_2 = \frac{m_1v_1}{m_2}$
   $= \frac{0.5 \times 20}{0.3 \times 0.5} = 1.25ms^{-1}$

10.



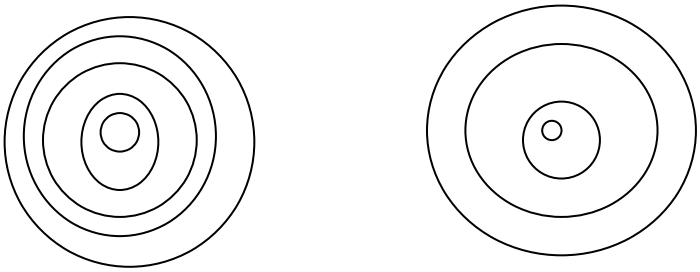
11. The mug has a smaller surface to volume ration so it loses heat faster. 1mk



12.

$$d = 0.6^2 + 0.6^2 = 0.846 \text{ m}$$
$$= 0.85\text{m}$$

13.

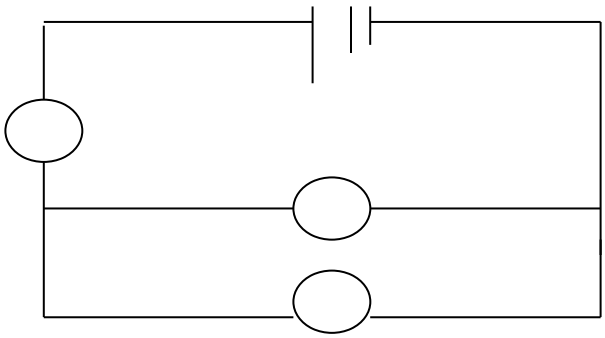


14. Angle between the force and the beam
Distance from the pivot
Magnitude of the force
3mks

15. The plate expands in width and length (circumference) at the same rate. 1mk

16. Weight of fluid displaced = 3.0 – 2.5
Mass of fluid displace = 0.5N.
= 50g
Vol of water (and of object) = $\frac{M}{\rho}$
= 50 = $50cm^3$
Density of object = $\frac{300}{50}$
= $6f\ cm^{-3}$ 3mks

17.



18. $\frac{1}{C_e} = \frac{1}{5} + \frac{1}{2+3}$
$= 2/5$
$C_e = 2.5\mu F$
3mks

19. Can be used / run on low voltage
1mk
A fault in one bulb does not affect the others.
1mk

20. Friction in liquids only acts when there is relative motion while solid friction acts even under static
conditions. Friction in liquids increases with velocity, solid friction does not. Friction in liquids increases
with area of contact, solid friction does not.
3mks

21. To reflect heat that would raise temperature and pressure of the gas.
1mk

22. $\frac{0.6}{0.2} = 3$ 1mk

23. (a) CA
1mk
(b) Heating the gas without allowing it to expand (at constant volume) 1mk

24. $\frac{\frac{1}{2} mv_2^2}{\frac{1}{2} mv_1} = 2$

$\frac{v_2}{v_1} = \sqrt{2}$

$= 1.41.$

2mks

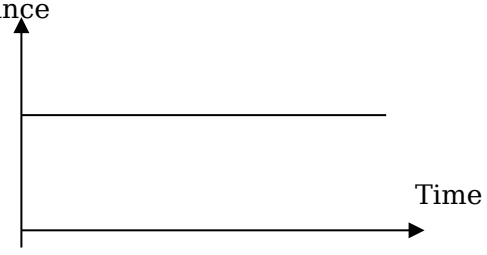
25. AS the drop accelerates down the column, the viscous drag on it increases. Finally the sum of upthrust and viscous force equals weight of the drop. So there is no net force. 2mks

26. Heat lost = Heat gained
Mx4200 (92-42) = 0.25x4200(42-22)
M = 0.10kg 3mks

27. $I_1x2+I_1x3 = 1.5$
$I_1x2+I_1x3 = 0.3A$
$V_{AB} = (0.3X3) – (0.3X2)$ 3mks
$= 0.3V$

28. From B to A 1mk

29. Distance



Period T = Circumference
Velocity.
= 5
1.25
= 4s
f = ¼
= $0.25H_2$ 2mks

30. (I) ¾ λ = 4m
= 5.33m 1mk

(ii) V = fλ (but f = 1/0.02x2 = 25)
= 25x5.33
= $133.25ms^{-1}$ 2mks

31. Sharp point insures small area hence high pressure for forward penetration. The flat head ensures low pressure to avoid reverse penetration.

32. F = $m(V_1-V_{2)}$
= $60x0.15x10^{-3}(34-0)$
=0.306
=0.31N

33. Leaf diverges more since potential between plates increases.

34. Sparse distribution of air molecules at high altitude.
Low temperature and hence low velocity of gas molecules at high altitude.

PHYSICS I
PART II
MARKING SCHEME

1. (a) (i) 10cm 1mk
ii) I k=ΔF
Δl
= 4.0-0
0.35-0.1
= $16Nm^{-1}$
II W = ½ ke^2
= ½ x16x0.25
= 2J 2mks

(b) ½ mv^2 = 2
V = √2x2
0.02
= $14.14ms^{-1}$ 3mks

(c) mc θ = mgh
= gh
c
= 10x115
4200
= 0.27^0C. 3mks

2. (a)(i) V = D/t
= 5.5×10^{-2}

1/50 x 11
= 0.25ms^{-1}

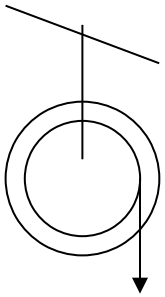
(ii) P =MΔV
= 0.8x(0.5-0.25)
=0.2kgms^{-1} 3mks

b. Initial momentum
0.8x0.5
0.4
0.4>0.3
Final momentum
(0.8+0.4) 0.25 the collision was not inelastic
2mks

(c) (I) S = ut+½ at^2. U=O
t = $\sqrt{\frac{2S}{a}}$
= $\sqrt{\frac{2x45}{10}}$
= 3s 3mks

(ii) D = Vxt
= 30x3
= 90m 2mks

3(a) (i)



(ii) Providing a system is in (rotational) equilibrium, the sum of clockwise moments equals the sum of anticlockwise moments.
1mk

(iii) $\frac{L}{E \quad X}$ 100 = 80
V.R

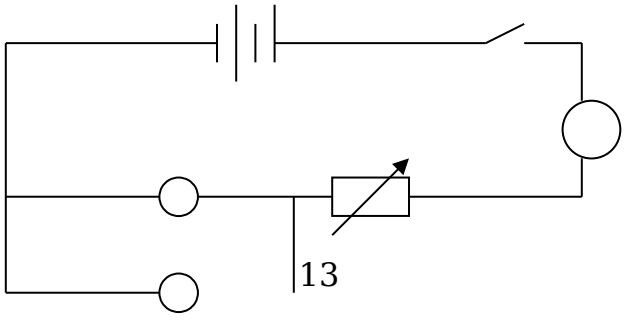
Or $\frac{400}{E}$ x 100 = 80
$\frac{75}{15}$
E = 100N

3mks

(b)(i) - Angle of inclination
- Smoothness
2mks

ii. The larger the angle the higher the efficiency since less friction is experienced.
The smoother the plane the higher the efficiency sine less friction is experience

4(a)



b. Close the switch, vary resistance using the rheostat and record the corresponding values of the ammeter and voltmeter.
2mks

c. Graph

d. $R = \frac{\Delta v}{\Delta I}$

$= 1.50 - 0.5$

$0.5-0.25$

$= 4.6\Omega$

e. As current increases, temperature of the filament increases due to heating effect. This causes resistance of the filament to increase.

5(a)(i) Taking at least 3 readings at different points on the ball then working out the average value. Velocity was constant over this region.
2mks

Velocity was constant over this region

Density of steel allows terminal velocity to be achieved within a small distance lead balls would require a taller column).
1mk

(b)



(ii) Upthrust, Viscous Force, Weight

(iii) W=U+F (W = Weight
U = Upthrust
F =Viscous force

Or Weight = Upthrust +Viscous Force

(iv) $F = 6\Pi nVr$

$= 6x3.14x1.8x10^{-4}x\frac{20x10^{-2}}{2.0x10^{-3}}$ 3mks

= Temperature 1mk

SECTION B.

6(a) Undergo diffraction
Undergo interference 2mks

(b) (i) A wave whose amplitude does not depend on distance/position
{OR where all particles oscillate with the same amplitude}
1mk

(ii) $= f = 1/2l \sqrt{T/m}$

$= 1/1 \sqrt{\frac{14.4}{2x10^{-3}}}$

0.5

= 60Hz 3mks

(c) Construct 2mks

Marking points 1mk

(d) i. Place a cork, to float on a wide trough of water Generate water waves using a vibrator to disturb the floating cork.
It is observed to move only up and down.
2mks

(ii) Longitudinal waves: Oscillations are parallel to the direction of travel e.g. sound.
In transverse waves, oscillations are perpendicular to the direction of travel e.g. water waves. 4mks

7(a) (i) Centripetal force 1mk

(ii) $\frac{mv^2}{r} = mg$

$v = \sqrt{rg}$

$= \sqrt{3x10}$

$= 5.48ms^{-1}$ 3mks

(iii) $10ms^2$ 1mk

(b) (I) $w = \frac{V}{r}$

$= \frac{8.4}{3}$

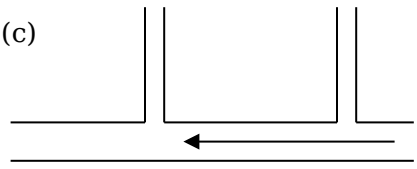
$= 2.8 \text{ rad } s^{-1}$ 3mks

(ii) $F = mv^2 + mg$

$= \frac{400 \times 8.4^2}{3} + 400 \times 10$

$= 1.34 \times 10^4 N$ 3mks

(c)



C is on a wider section where velocity is lower and pressure is therefor higher than at B.

(iii) A flow in which the paths taken by fluid particles do not cross one another.
1mk

PHYSICS II

PART I

Use the following constants where necessary

$g = 10m/s^2$

Density of water = 1000 kgm^{-2}

Density of mercury = 1.36 x 10^4 kgm^{-3}

Speed of sound in air = 330ms^{-1}

L(f) ice = 3.4x10^5 Jkg^{-1}

L(v) steam = 2.3 x 10^6 Jkg^{-1}

1 . What are the S1 units of viscosity ?
(1 mark)

2. Distinguish between ductile and brittle materials
(2 mks)

3. A car moving at 36 kmh^{-1} accelerates at 2m /s^2 calculate the distance travelled from where the acceleration began to where the velocity reaches 54 kmh^{-1} and the time taken to cover this distance
(3mks)

4. State two laws of solid friction.
(2mks)

5. Give two reasons why the acceleration due to gravity varies from place to place
(2mks)

Use the diagram below to answer questions 6 and 7

Some lead crystals were heated in a crucible and the temperature versus time curve Plotted as below:

6. What are the names represented by AB and CD?
(2mks)
AB
CD

7. What happens to the lead crystals atoms at AB?
(2mks)

8. 0.02kg of ice and 0.01kg of water at 0° are in a container. Steam at 100° is passed in until all the ice is just

melted. How much water is now in the container?
(3mks)

9. State two applications of capillarity.
(2mks)

10. The buoy B shown below has a mass of 12 kg and a volume of 50 litres. It is held in position in sea water of
density 1040 kgm^{-3} by a light cable fixed to the bottom so that 4/5 of its volume is below the surface.
Determine the tension in the cable .
(3mks)

Use the diagram below to answer question 11 and 12. In the circuit shown a current of 2A flows through the 5Ω resistor

11. Calculate the P.D between x and y
(1 mk)

12. Determine the current, I.
(2 mks)

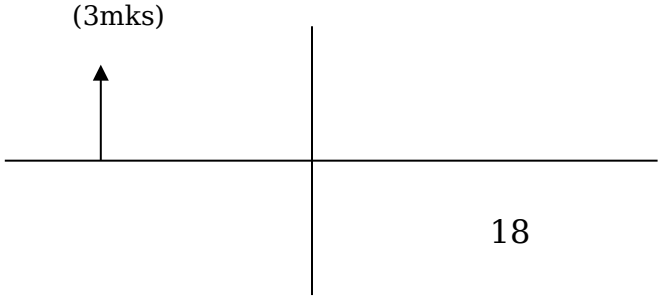
13. Air is blown into a rotating disc that has 170 holes round it. Determine the frequency of the sound produced
if the disc makes two revolutions per second
(1mk)

14. Give one important use of each of the following e.m. waves .
(2mks)
(i) Microwaves
(ii) Infrared

15. The metal sphere A shown below is mounted on an insulating stand. How would you test whether the sphere is
positively or negatively charged ?

16. Two brass spheres one large and the other small are given an equal amount of charge
    (a) Which sphere has a larger potential than the other ?
    (1mark)
    (b) Which sphere has a larger capacitance than the other?
17. Under a driving force of 4000N a car of mass 1250kg has an acceleration of 2.5m/s ^{2}
    Find the frictional force acting on the car.
    (2 mks)
18. A moving coil milliameter gives an f. s. d for a current of 20m A and has a resistance of 10 Ω Show how you would adapt it to a voltmeter to read 5V and determine the total resistance of the voltmeter
    (3mks)
17. A uniform meter rule of mass 120g is supported on both ends. If a mass of 200g is suspended at the 75cm mark, Determine the reaction at 0 cm mark
    (3mks)
20. State the condition of a body moving in a fluid to attain terminal velocity
    (1 mks)
21. How is Polarisation corrected in a dry cell ?
(1 mk)
22. A wire of diameter 0.42mm has a resistivity of 2.5 x10^{-8}, how many metres should be cut to make a resistor of 10 ohms?
    (3mks)
23. Define specific heat capacity of a substance and derive its units.
    (2mks)
24. The sketch below shows the profile of a wave. Determine the wavelength and the frequency of the source .
    (2mks)

25. Why is it advisable to put on diving suits in deep sea diving?
(1mk)
26. A thunder cloud has a horizontal lower surface area of 40km^2 and is 1km above the Earth . Treating this arrangement as a capacitor, Calculate the electrical energy stored when its potential is 2 x 10^5 V. Take Permitivity of free space = 8.85 x 10^{-12} Fm^{-1}.
(3mks)
27. Draw rays to show the position of the image in the arrangement shown below
    (3mks)



28. Determine the r.m.s. of gas molecules in a container if their speeds are $2ms^{-1}$,$3ms^{-}$, $4.5ms^{-1}$ and 3.5^{-1}ms-1 respectively.
(2mks)

29. The diagram below shows a type of a wave. Name the parts x and y and explain how the wave is produced.
(2mks)

30. A Piston of cross-section area $0.4m^2$ encloses a gas in a tube at a pressure of 10^5 pa If the piston compresses the gas by 2.5cm in 2 seconds, determine the power of the Piston.
(2mks)

31. The diagram below shows a copper wire hanging with a large weight over a block of ice. Explain what would happen after sometime and why this happens.
(2 mks)

32. State one advantage and one disadvantage of using a convex mirror as a driving mirror.
Advantage:
Disadvantage:

33. A man is 2m tall and his eye level is 1.85m above the ground. What is the minimum vertical length of a mirror he would use to be able to see the whole of himself ?
(3mks)

34. Write a relation between a magnification M and image distance V from the curved mirror formula

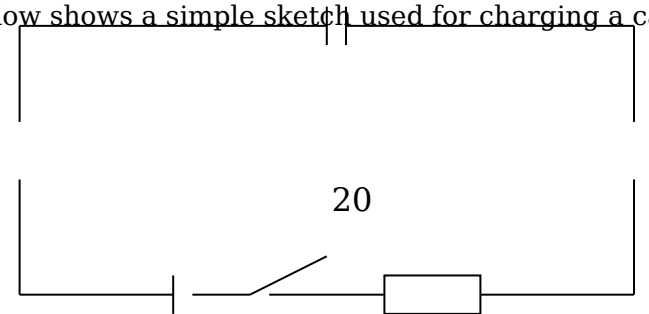
F $\quad \frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

PHYSICS II
PART II

Instructions

i) g = 10ms^{-2}
ii density of water = 1 x 10^{3} kgm^{-3}
iii) Speed of sound in air = 330ms^{-1}

1.(a) State the law of flotation .
(1mark)
(b) An ordinary hydrometer of mass 30g floats with 3.2cm of its stem out of the water .The cross section area of
the stem is 0.80cm^{2}.Find the total volume of the hydrometer and the length of the stem above the surface when
it floats in a liquid of relative density 1.65.
(7 mks)
(c) Sketch the stem of a hydrometer and mark on it a suitable scale from 0.7 to 1.00
(2mks)
(d) If the stem were narrower but with the same volume as at present, what effect would this have? (2mks)
2. (a) Define the terms displacement and retardation.
(2mks)
(b) A car decelerates uniformly from a velocity of 20ms $^{-1}$ to rest in 4 seconds. If it takes another 4 seconds to
reverse with uniform to its original point,
(i) Draw a velocity and speed time graph for the motion.
(4mks)
ii) Determine the displacement covered.
(2mks)
(iii) Find the average velocity of the car.
(2 mks)
(iv) Find the distance moved by the car.
(2mks)
(v) Determine the average speed of the car
(2mks)
3 (a) Define the specific latent heat of fusion of a substance and state its units
(2mks)
(b) A copper calorimeter of mass 0.4kg contains 0.5kg of water at 10^{0}c. An electrical heater heats the water and
calorimeter to 90^{0}c in 3 minutes. Take the specific heat capacity of copper and water to be 400 Jkg^{-1}K^{-1} and
4200 Jkg $^{-1}$K^{-1} respectively and calculate:-
(i) Heat absorbed by water . (2mks)
(ii) Heat absorbed by calorimeter.
(2mks)
(iii) Calculate the power of the heating coil to 2 significant figures if the coil is 85% efficient .(3mks)
(c) An exhaust pump consists of a cylinder of volume 80cm^{3} which is attached to a container of volume 400 cm^{3} at
a pressure of 720mm Hg . After one stroke of the exhaust pump, what is the pressure in the container? (3mks)
4. (a) State two factors that determine the capacitance of a capacitor .
(2mks)
(b) The set up below shows a simple sketch used for charging a capacitor

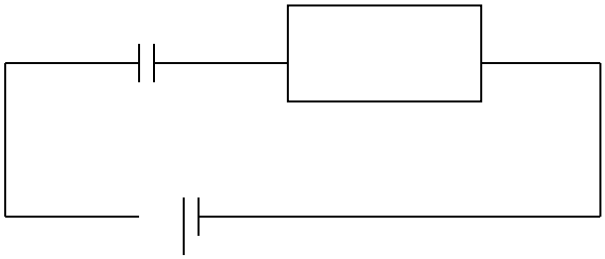


(i) Show with an arrow the direction of the charging current
(1mk)

(ii) What is the purpose of R?
(1mk)

(iii) State what happens when the switch S is closed. (2mks)

(c) (i) Find the Pds V_1 and V_2 in the capacitor arrangement below and the charges Q_1, Q_2 and Q_3. (8mks)



(ii) What is the relationship between Q_1,Q_2 and Q_3
(1mk)

5.(a) Draw diagrams to illustrate what happens when plane waves are incident on a slit

(i) When the width of the slit is larger than the wavelength
(2mks)

(ii) When the width of the slit is smaller than the wavelength
(2mks)

(b) Describe an experiment and illustrate with a diagram to show that sound cannot travel in a vacuum (5 mks)

(c) A ship sends out an ultra- sound which is received after 6 seconds . If the wavelength of the Ultra sound is 0.05m and the frequency of the transmitter is 100KHZ, find the depth of the ocean .
(3mks)

SECTION II

6. (a) You are provided with the following apparatus. Two d.c cells, a stop clock accurate to 1 x 10^{-2} seconds, a hinged metal plate, a switch , an electro magnet , a steel ball bearing, enough connecting wires.

(i) Draw a suitable circuit to show how the acceleration due to gravity can be measured fairly accurately with the above apparatus.
(4mks)

(ii) Explain how the set-up you have drawn is used to estimate, g, giving an equation where necessary . (5mks)

(iii) State a possible source of error in your experiment.
(1 mk)

(b) A 50cm plastic rule has a mass of 20g placed at the 4 cm mark, a knife edge at the 20 cm mark. If the rule is balanced, determine its mass in grams. Draw the set up to show the arrangement
(5mks)

7. Define the terms' stress and strain. What is :

(a). The S.1 Unit of stress?
(3mks)

(b). A mass of 2.5kg is attached to the end of a long vertical wire 2.1 m long and produces an extension of 0.5mm. If the diameter of the wire is 0.7mm, calculate :-

(i) Tension stress
(4mks)

(ii) Tensile strain
(2mks)

(iii) Young modulus of the wire
(2mks)

c.) How do the following affect surface tension of water :

(i) Impurities
(1mk)

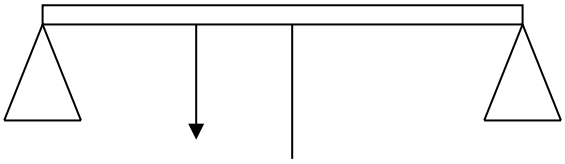
(ii) Temperature
(2mks)

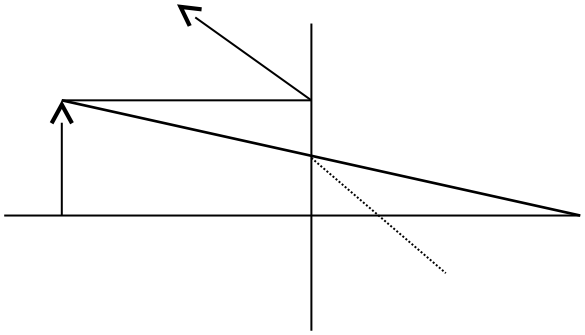
(iii) Give one problem caused by capillarity
(1mk)

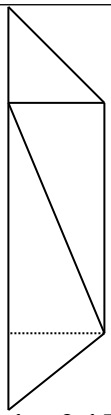
PHYSICS II
PART I
MARKING SCHEME

1. Newton second per square meter or Nsm^{-2}	1	
Total	1	
2. Ductile materials undergo plastic deformation until they break -Brittle materials break just after elastic limit is reached	1 1	
Total	2	
3. $36kmh^{-1} = 10ms^{-1}$ $54\ kmh^{-1} = 15ms^{-1}$ $15 = 10 + 2t$ $t = 2.5$ seconds $s = 10 \times 2.5 + \frac{1 \times 2 \times 6.25}{2}$ $= 31.25m$	1 1 1	$S = 15^2 - 10^2 = \frac{225 - 100}{2 X2} = \frac{}{4}$ 31.25M Substitution Answer
Total	3	
4. (i) Frictional force between two surfaces oppose their relative motion (ii) Frictional force is independent of the area of contact between the surfaces if the normal reaction is constant	1 1	Give mark for third law Correctly stated Max 2
Total	2	
5. (i) due to the spin of the earth (ii) due to the shape of the earth	1 1	

Total	2	
6. AB – melting point CD – boiling point	1 1	Names should not be interchanged
Total	2	
7. – atoms gain enough heat energy to overcome intermolecular forces and separate – Temperature remains constant	1 1	
Total	2	
8. Heat to melt 0.02kg ice = 0.02 x 340000 = 6800 J 6800 = 420000m +2300000m m = 2.5 x 10^{-3} Total mass = 1.2 x 10^{-1} + 2.5 x 10^{-3} = 0.1225kg -	 1 1 1	 Heat to melt ice Working of mass condensed m. Answer
Total	3	
9. (i) Rise of sap up plants (ii) rising of kerosene up the wicks (iii) top layers of soil draw water from wet sub-soil	1 1	 Any two Check for other alternatives
Total	2	
10. volume of water displaced = $^4/_5$ x 50= 40 litres = 4 x 10^{-2} m^3 up thrust = 4 x 10^{-2} x 1040 x 10 = 416N T = 416 – 120 = 296N	 1 1 1	 Volume Upthrust Tension
Total	3	
11. p.d = 5 x 2 = 10v	1	
Total	1	
12. current in (6+4) Ω = 10 = 1A Current I = 2 + 1 = 3A		Current Answer
Total	2	
13. f = 170 x 2 = 340Hz	1	
Total	1	
14. (i) Microwaves – rapid cooking in ovens (iii) Photography - where ordinary light is ineffective	1 1	
Total	2	
15. –It should be brought near to the caps of two electroscopes One positively and the other negatively charged - The electroscopes that diverges farther have the same charge as sphere	 1 1	
Total	2	

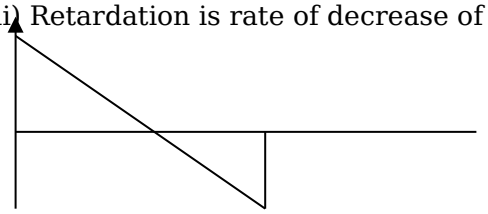
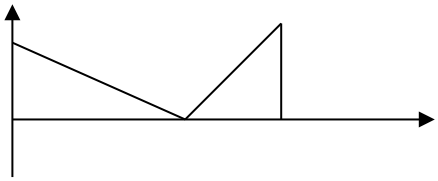
16. (I) The small one (ii) The large sphere	1 1	
Total	2	
17. D- F = ma 4000 – F = 1250 x 2.5 F = 875N	 1 1	 Substitution Answer
Total	2	
18.I = 0.02A R = 10Ω MA V=0.02 X10 V_2 = 4.8V = 0.2V R(m) = 4.8 = 240 Ω 0.02 Total resistance = 240+10 = 250Ω	 1 1 1 	 Voltage of millimeter and multiplier Resistance of multiplier Total resistance
Total	3	
19.  $R_1 + R_2$ = 3.2N 1.2 x 0.5 + 2 x 0.75 = 1R_2 0.6 + 1.5 = R_2 2.1 = R_2 R_1 = 1.1N	 1 1 1	 Moments R^2 worked R^1 worked
Total	3	
20. When the resultant force by the fluid on the body is zero	1	Give mark if U + F = mg
Total	1	
21. Hydrogen gas produced is oxidised to water by manganese (iv) oxide	1 1	
Total	2	
22. A = 22 x (2.1 x 10^{-4})^2 = 1.386 x 10^{-7} 7 L=RA = 10 x 1.386 x 10^{-7} 2.5 X 10^{-8} = 138.6 2.5 = 55.44M	1 1 1	Calculating area Correct substitution Correct answer
Total	3	
23. Heat required to raise the temperature of unit mass by 1 kelvin C = Q = J kg $^{-1}$ K^{-1} MCΔØ	1 1	Definition Derived C
	2	

24. 5 $\lambda = 10M$ 4 $\lambda = \frac{40}{5} = 8M$ $f = \frac{1}{T} = \frac{1}{0.4} = 2.5$ HZ	1 1	Correct λ Correct frequency
Total	2	
25. To enclose air at atmospheric pressure which helps to protect divers from excessive high pressure below the sea	1	
Total	1	
26. $C = EA = \frac{8.85 \times 10^{-12} \times 40 \times 10^{6}}{d}$ $= \frac{}{1 \times 10^{3}} = 3.54 \times 10^{-7}$F $E = \frac{1}{2} CV^2 = \frac{1}{2} \times 3.54 \times 10^{-7} \times 4 \times 10^{10}$ $= 7.08 \times 10^{3}$J	1 1 1	Calculation of capacitance Substitution in formula Answer
Total	3	
27. 	1 1 1	Marking of F^1 and C^1 behind Mirror Virtual image correctly drawn Rays direction
Total	3	
28. c r.m.s $= \sqrt{\frac{2^2 + 3^2 + 4.5^2 + 3.5^2}{4}}$ $= \sqrt{\frac{45.5}{4}}$ $= 3.4\ ms^{-1}$ (Id.p)	1 1	Correct substitution Answer
Total	2	
29. X – node Y – antinode Produced by two transverse waves moving in opposite direction – one being a reflection of the other	1 1	For both names, no marks for one name
Total	2	
30. Volume of gas compressed $= 2.5\ 10^{-2} \times 4 \times 10^{-1} = 10 \times 10^{-3} m^3$ power $= \frac{\text{pressure x volume}}{\text{time}}$ $= \frac{10^5 \times 10 \times 10^{-3}}{}$	1	Substitution

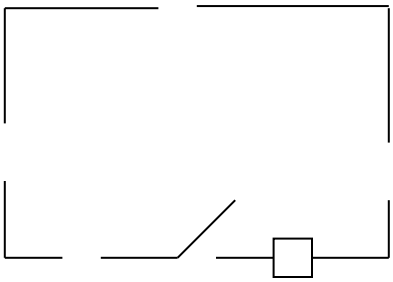
2 = 500w	1	Answer
Total	2	
31.– The wire works its way through the block and falls down without cutting the ice - Pressure on wire lowers M.P of ice Melted water turns back to ice when wire has passed	2	
32.(i) Has wide field of view (ii) Distance behind vehicle following cannot be estimated correctly	1 1	
Total	2	
33.  AL = 1/2 HE = 1/2 x 0.15 = 0.075M LB = 1/2 FE = 1/2 x 1.85 = 0.925M Mirror Length=AB=AL+LB = 0.925+0.075M = 1.00 meter	1 1 1	Distance AL Distance LB Answer (no marks for guess work)
Total	3	
34. $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ (multiply through by v) $1 + \frac{v}{u} = \frac{v}{f}$ $1 + m = \frac{v}{f}$ $m = \frac{v}{f} - 1$	1 1	For multiplication by v Answer
Total	2	

PHYSICS II
PART II
MARKING SCHEME

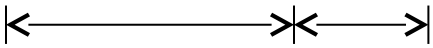
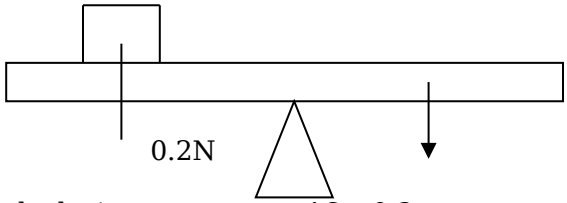
Q1. (a) A floating body displaces its own weight of the fluid in which it floats	1	
(b) Volume of displaced $= \frac{30g}{g}$ cm^{-3}=30cm^3	1	For vol.of water
Volume of bove water = 0.8 x 3.2	1	For vol. of stem

$= 2.56\ cm^3$ Total volume of hydrometer $= 30 + 2.56$ $= 32.56cm^3$ Vol. of liquid displaced $= \frac{30}{1.5} = 20cm^3$ Vol. Of the stem above the liquid $= 32.56 - 20$ $= 12.56\ cm^3$ Length of the stem above liquid $= \frac{12.56}{0.8} = 15.7cm$ (d) (i)graduations would be further a part (ii) hydrometer would be more sensitive	1 1 1 1 1 1 1	For total volume Vol. of stem above liquid Substitution Answer Divisions gap Highest volume bottom If values intercharged Wrong
Total	1 2	
Q2 (a) (i) Displacement is distance covered in a particular direction (ii) Retardation is rate of decrease of velocity   (ii)Displacement $= \frac{1}{2} \times 20 \times 4 - \frac{1}{2} \times 10 \times 4$ $= \frac{OM}{}$ (iii) Average velocity $= \frac{0}{8}$	1 1 1 1 1 1 1	 Area above x – axis Area below x-axis 1^{st} area above axis 2^{nd} area above axis substitution answer all

= 0ms^{-1} (iv) Distance = 2 (½ x 20 x 4) = 80m (v) Average speed = 80 = 10ms^{-1} 8	1 1 1 1 1 1	substitution this working answer must be shown- substitution penalise 4 mks if working is not shown answer substitution answer
Total	1 4	
Q3. (a) It is the amount of heat needed to convert unit mass of a solid to liquid at constant temprature L(f) = Jkg^{-1}	1 1	Definition Units
Total	2	
(b) Heat absorbed by water = 0.5 x 4200 (90-10) = 168000J (ii) Heat absorbed by calorimeter = 0.4 x 400 (90-10) = 12800J (iii) Total heat = 168000 + 12800 = 180,800J time = 180 seconds 85p = 180,800 100 180 P = 180,800 180 x 0.85 = 1181.7w 1200w (2sf) (c) P_1 = 720 V_1 = 400 v_2 = 480 from Boyle`s law 720 x 400 = P_2 x 480 P_2 = 720 x 400 480 = 600 mm Hg	1 1 1 1 1 1 1 1 1 1	*Substitution* Answer Substitution Answer Substitution Answer Rounding to 2sf Using Boyle`s law Substitution Answer
Total	1 2	
Q4. (a) (i) Distance between plates (ii)Area between plates (iii)Dielectric used (b)	1	Any two Arrows show direction Of charging current

(i)  (ii)To protect the ammeters in the circuit (iii)A current flows until the P.d across the capacitors is equal to the P.d of the charging cells (c)C_{T1} (Parallel = 1 + 2 = 3μF $C_T = \frac{2 \times 3}{2 + 3} = \frac{6}{5} = 1.2\mu F$ $Q = CV = 1.2 \times 10^{-6} \times 240$ $= 288 \times 10^{-6} C$ $V_1 = \frac{288 \times 10^{-6}}{2 \times 10^{-6}} = 144V$ $V_2 = 240 - 144 = 96V$ $Q_1 = 288\mu C$ $Q_2 = 2 \times 10^{-6} \times 96$ $= 192\mu C.$ $Q_3 = 1X\ 10^{-6} \times 96 = 96\mu C$ $Q_1 = Q_2 + Q_3$	1 1 1	Give one mark for half statement
Total	15	
Q5.	1 1 1 1	Diffraction not acute Diffraction must be shown Wavelength must be maintained Circular wavefront for diffraction waves A maintained

- An electric bell is suspended inside a bell jar; and the jar connected to a vacuum pump. - The bell is switched on and air is slowly pumped out - When all the air has been removed no sound is heard from the bell except faint vibrations along the suspension. c) V = f x = 100000 x 0.05 = 5000 ms-1 d = 5000 x 6 x $\frac{1}{2}$ = 15000m	1 1 1 1	Bell shown inside bell far Connection to battery and vacuum pump 1 mark for each point Finding v Expression for d Answer
Q6 (ii) –When switch is in position x the ball is held. when it is moved to y the ball drops and dock is switched on - The ball falls through h hits the hinged plate , circuit is broken and dock stops - - Time t to fall is noted from s = h = ut + $\frac{1}{2}$ gt2 u = 0 $h = \frac{1}{2} gt^2 \Rightarrow g = \frac{2h}{t^2}$ (iv)Air resistance as the ball falls may reduce volume of g.	1 1 1 1 1 1	Electromagnet well positioned Position of cells Hinged plate Clock Noting time

(b)   Anti clockwise moments = 16 x 0.2 Clockwise moments = 5w 5w = 16 x 0.2 w = $\frac{3.2}{5}$ = 0.64 N m = $\frac{0.64kg}{10}$ = 0.064kg = 64g	1 1 1	Moments Answer for N Mass in grammes
Total	15	
Q7. Stress is tensile force per unit area. Units are NM^{-2} Strain is extension per original length when a material is pulled b) Stress = $\frac{F}{A}$ A = $\frac{22}{7}$ x (3.5×10^{-4}) = 3.85 X $10^{-7}M^2$ Stress = $\frac{25}{3.5x10^{-7}}$ = 6.4g x 10^7 NM^{-2} Strain = $\frac{5 \times 10^{-4}m}{2.1}$ = 2.35 x 10^{-4} (iv) Young modulus E = $\frac{Stress}{Strain}$ = $\frac{6.49 \times 10^7}{2.38v10^{-4}}$ = 2.7 x 10^{11} NM^{-2} C) Impurities – weakens cohesive force between water molecules . (ii) Increased temp. increase KE of molecules - Inter molecular distance increases and cohesion force is lowered which in turn lowers surface tension.	1 1 1 1 1 1 1 1 1 1 1 1 1 1	Definition Expression for area Answer Expression for stress of answer Expression Answer Expression answer

(iii) House bricks are porous and draw water up the walls making a house damp	1	
Total	15	

PHYSICS III
PART I

Take the following constants where necessary;-
Acceleration due to gravity g= 10ms^{2}
Density of water = 1000kgm^{-3}
Density of mercury = 1.36 x 10^{4}kgm^{-3}

1. State the reading of the vernier calipers shown below:

Reading = _____
(1mk)

2. A ball is kicked vertically upwards with a velocity of 16ms^{-1}. Find the time taken for the ball to fall back to the ground.
(3mks)
3. Give two reasons why the weight of a body varies from place to place.
(2mks)
(i)
(ii)

4. A mass X hungs from a spring balance. The density of X is 6000kgm^{-3}. The spring balance reads 1.2N in air. What will be the reading of the spring balance when the mass is completely immersed in water? (3mks)

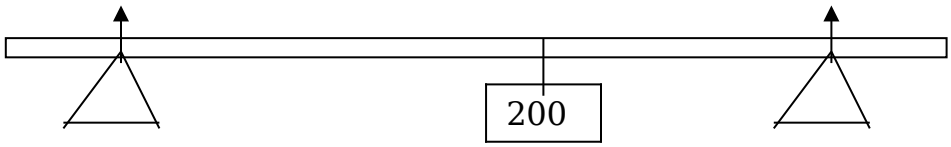
5. State Archimedes' Principle. (1mk)
6. Complete the diagrams below to show the levels and meniscus of the liquids in the glass tubes. Explain the difference in the shapes and levels.
(2mks)

7. When a needle is placed gently on clean water it normally floats. What would happen when a drop of liquid soap is added to one end where the needle is floating and why?
(2mks)

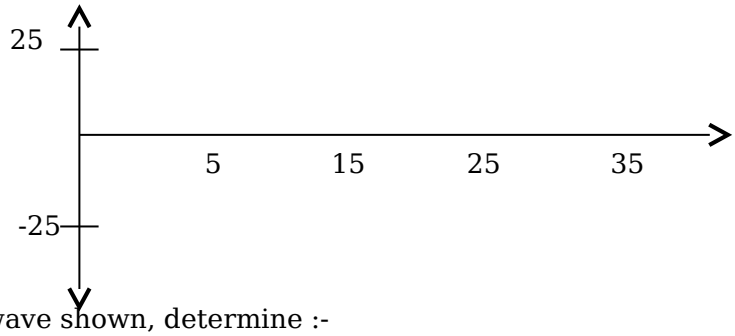
8. A milliammeter with a coil resistance of 10Ω has a full - scale deflection of 15mA. How would you convert it to an ammeter with a f.s.d of 2A?
(2mks)
9. What is the mass on earth of a bag of beans whose weight is 180N on the moon if the gravitation of the moon is 1/ 6^{th} that of earth.
(3mks)
10. Explain the two features of a clinical thermometer stated below:
(i) Constriction: (1mk)
(ii) Thin walled bulb: (1mk)
11. State the principle of the conservation of momentum.
(1mk)
12. Draw the field on the two conductors carrying a current shown below and show the direction of the forces acting on the two conductors.
(2mks)



13.A parallel beam is 6m long. It rests on two supports placed 0.5m from each end. A weight of 200N is hung 4m
from end A. find F_1 and F_2 if the beam weighs 100N. (3mks)



13. A car decelerates uniformly from a velocity of 20ms^{-1} to rest in 4 seconds. If it takes 4 seconds to reverse back with a uniform acceleration to its original starting point:-
(i) Draw a velocity time graph for the motion.
(2mks)
(ii) Determine the displacement covered.
(1mk)
14. A Force of 8.0N stretches a spring by 3.2cm. How much work is done in stretching this spring by 7.2cm?
(2mks)
15. A block and tackle system is used to lift a mass of 120kg. The machine has a velocity ratio of 4 and is 75% efficient. Calculate the effort used.
(3mks)
16. The diagram below shows part of a wave motion. The numbers on the diagram show scales in cm. The speed of the wave is 16ms^{-1} .



From the wave shown, determine :-
(a) The wavelength. (1mk)
(b) The frequency. (2mks)
17. The fundamental frequency of a stretched string is 200Hz. If its tension is doubled with length kept constant, find its new frequency.
(2mks)

18. An object of mass 2kg rests on a horizontal surface whose coefficient of friction is 0.25. what is the minimum force required to start it moving?
(2mks)

20. Determine the effective capacitance of the arrangement shown below.
(2mks)

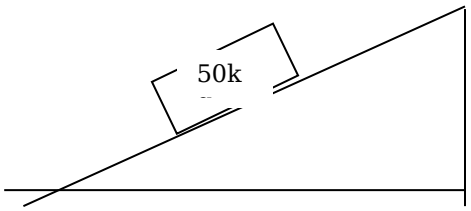
21. A trolley of mass 2kg moving at $6m^{-1}$ collides head on with a second trolley of mass 3kg moving at $2.5ms^{-1}$. If the two stick together after collision, find their common velocity V.
(2mks)

22. State two factors that affect the strength of an electromagnet.
(2mks)

23. The ball shown below was released from the surface of a viscous liquid.

Sketch alongside the velocity - time graph of the ball and label it.
(2mks)

24. A man pushes a crate of mass 50kg along an inclined plane which is at 30^0 to the horizontal. He overcomes a frictional force of 50N. Find the mechanical advantage of the incline. (3mks)



25. An electric hedge-cutter is rated 1KW and takes a current of 5A. Determine the resistance of the coil.
(2mks)

26. State two advantages of a Lead acid accumulator over Leclanche dry cell.
(2mks)

27. What is the difference between the motion of smoke particles in Brownian motion and motion of dust particles due to convectional currents?
(2mks)

28. A metal bar XY is stroked with a magnet as shown below:

(i) Show the alignment of the dipoles.
(1mk)

(ii) Name a suitable metal for XY.
(1mk)

29. Give two reasons why the earth pin of a 3 - Pin plug is longer than the other two Pins.
(2mks)
30. Hydrogen occupying a volume of 2.1m^3 at a pressure of 1 x 10^5 Pa is compressed until the volume is 7.5 x $10^{-1}m^3$. If the temperature does not change, what is the new pressure? (3mks)
31. State two factors that affect the pitch of a vibrating string.
(2mks)
32. A cylindrical metal of mass 600g is heated by a 1KW heater for half - a minute. Its temperature rises from 25^{0}C to 65^{0}C. Find the specific heat capacity of the metal.
(2mks)

PHYSICS III
PART II

Use the following constants where necessary.
(i) g = 10ms^{-1}
(ii) density of water = 1000kgm^{-3}
(iii) Speed of sound in air = 330ms^{-1}

SECTION I:

1. Peter set up the arrangement below to determine the heat energy, E, required to change 1kg of water into steam at constant temperature and pressure at one atmosphere.

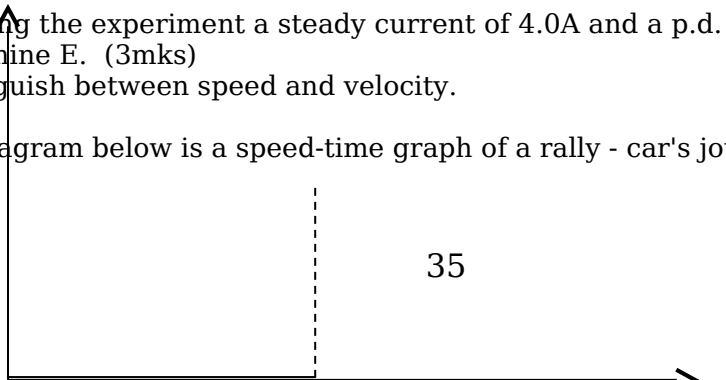
He took mass readings M, indicated on the balance at certain time intervals t. He obtained the following data:

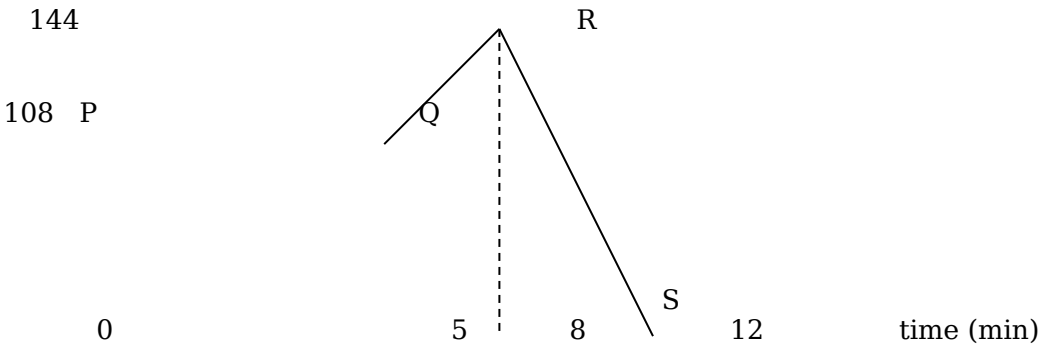
M(g)	100	98	96	94	92	88
t (s)	0	60	180	240	360	540

(a) Plot a graph of M (vertical axis) against time.
(4mks)
(b) Determine the slope of your graph.
(2mks)
S = _____

(c) What does the slope represent?
(1mk)
(d) If during the experiment a steady current of 4.0A and a p.d. of 12V were recorded, determine E. (3mks)

2. (a) Distinguish between speed and velocity.
(2mks)
(b) The diagram below is a speed-time graph of a rally - car's journey.





Describe the motion of the car in the three parts shown.
(3mks)

(c) Calculate the acceleration represented by parts:

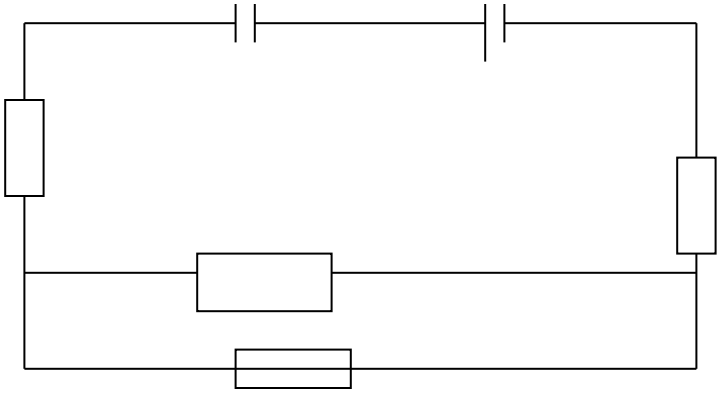
(i) QR
(2mks)

(ii) RS (2mks)

(d) Determine the average speed for the whole journey.
(4mks)

3. (a) State the difference between insulators and conductors of electricity.
(2mks)

(b) In the circuit shown below the battery has an internal resistance of 2Ω. The current through the 6Ω resistor is 1.5A.



Determine:

(i) The effective resistance in the circuit.
(3mks)

(ii) The p.d. across the 3Ω resistor.
(1mk)

(iii) The current through the 4Ω resistor.
(2mks)

(iv) The 'Lost volts'. (2mks)

(v) The e.m.f. of the source. (2mks)

(c) A milliammeter gives a full-scale deflection of 20mA. Its coil resistance is 15Ω. Show how it can be converted to a voltmeter to give a f.s.d. of 15V and determine the total resistance of the voltmeter. (4mks)

4. (a) In a given machine, state two factors that would determine the size of mechanical advantage and explain their effects.
(2mks)

(b) A pulley system has two pulleys on the lower block and two on the upper block.

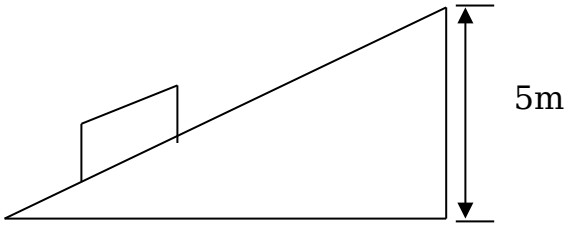
(i) Draw a diagram to show the system.
(2mks)

(ii) How can the effort required to raise a given load by such a system be determined?
(2mks)

(iii) In the pulley system you have drawn, the effort arm moves down by 80cm. How high does the load rise?
(2mks)

(iv) Suppose an effort of 160N is used to raise a load of 480N using the above pulley. What is its efficiency?
(3mks)

(c) A man pushes a 75kg load through an inclined plane and raises the load through a vertical height of 5m. The incline is at 30^0 to the horizontal. If the incline is 80% efficient, calculate the effort needed.(4mks)



5. (a) State the law of floatation.
(1mk)

(b) An object is weighed in air and then in water, in a beaker placed on top of a pan balance. The weight of the object in air is 2.0N and its weight in water when completely immersed is 1.5N.

(i) If the object is held with a spring balance and lowered slowly into the water, what would be observed about the readings on the spring balance and the pan balance? 2mks)

(ii) Explain your answer in part (i).
(2mks)

(iii) What is the density of the object?
(3mks)

(c) The cross-section area of an unloaded ship is $2000m^2$. By what depth will it sink in fresh water when a cargo of 4×10^6 kg is loaded into it?
(3mks)

SECTION II

6. (a) State two examples of progressive waves.
(2mks)

(b) The table below shows results from an experiment to show variation of frequency with length of a stretched string. Five different tuning forks were used.

Frequency f (Hz)	256	288	341	384	512
Length L (m)	0.94	0.84	0.72	0.64	0.48
$\frac{1}{L}$ (m^{-1})					

(i) Complete the table.
(2mks)

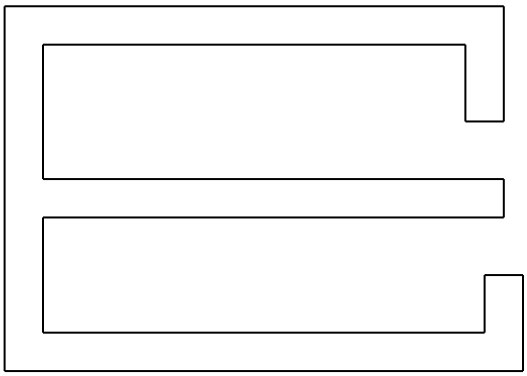
(ii) Plot a graph of frequency f against $\frac{1}{L}$
(5mks)

(iii) Determine the slope of the graph and give its units.
(3mks)

S =

(i) Determine the approximate frequency that will resonate with the string of length 0.5m. (5mks)

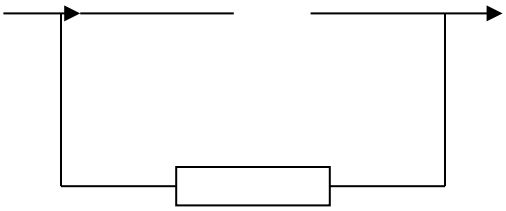
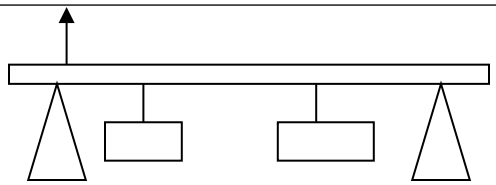
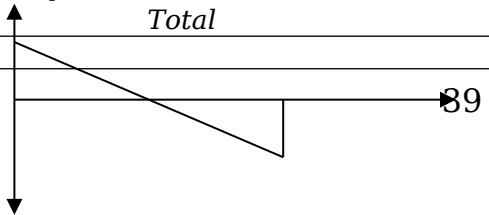
7. (a) The diagram below shows a moving coil loud-speaker. Indicate on the diagram the nature and position of the magnetic poles.
(3mks)



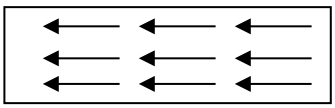
(b) (i) Explain what would happen if a p.d. of 12V, 50Hz is connected across its terminals.
(ii) Explain also what would happen if the p.d. were to change to 24V at 100Hz.
(6mks)
(c) (i) Draw a diagram of an apparatus that shows that water can be made to boil at 80^0C. (3mks)
(ii) Explain how the process is achieved. (3mks)

PHYSICS III
PART I
MARKING SCHEME

NO.	SOLUTION	MARKS	AWARDING
1.	Reading = 0.75cm *Total*	1 1	1 mk
2.	From V = u - gt 0 = 16 - 10t t = 1.6 seconds total time = 1.6 x 2 = 3.2 seconds *total*	 1 1 1 3	Mark substitution. Time upwards. Total time.
3.	Due to spin of the earth because the distance of mass from centre of earth. *Total*	1 1 2	
4.	Volume of water displaced = $\frac{120g}{6g}$ cm^3 $= 20cm^3$ Mass of water displaced = 20g Upthrust = wt. Of water displaced = 0.2n Reading of balance = 1.2 - 0.2 = 1N *Total*	 1 1 1 3	
5.	An object wholly or partially immersed in a fluid experiences an upthrust equal to the weight of the fluid displaced. *Total*	1 1	
6.	Diagrams	1	

	Forces of adhesion greater in water. Forces of cohesion greater in mercury. *Total*	1 1	
7.	The needle moves to opposite side. Force of cohesion is lowered. *Total*	1 1 2	
8.	 p.d of shunt = 0.015 x 10 = 0.15V R(s) = $\frac{0.15}{1.985}$ = 7.56 x 10 -2 Ω *total*	 1 1	
9.	Weight on earth = 180 x $\frac{6}{1}$ = 1080N mass on earth = $\frac{1080}{10}$ = 108kg *total*	 1 1 1 3	Multiplication by 6 Division by 10
10.	Constriction – allows the doctor to read temperature when thermometer has been removed from body. Thin walled bulb - allows mercury to get heated quickly. *Total*	 1 1 2	
11.	If no external forces act on a system of interacting objects the total momentum of the system remains constant. *Total*	 1 1	
12.	 *Total*	1 1 2	Field pattern shown. Forces shown (repulsion)
13.	 100 x 2.5 + 200 x 3.5 = 5 F_2 950 = 5F_2 F_2 = 190N F_1 = 300 - 190 = 110N *Total*	 1 1 1 3	Correct moments 1 mk for 190N 1 mk for 110N
14.			

		1	Shape above x-axis
		1	Shape below x-axis
	Displacement = ½ x (20 x 4) + ½ (-20 x 4) = 40 - 40 = 0 metres *total*	1 3	
15.	Force needed = $\frac{8}{3.2}$ x 7.2 = 18N Work = ½ x 18 x $\frac{7.2}{100}$ = 0.648J *Total*	1 1 2	Force OR K = 250Nm^{-1} Answer: w= ½kx^2 = ½ x250x0.072x0.0 = 0.648J
16.	$\frac{M.A.}{V.R.}$ X 100 = $\frac{75}{100}$ $\frac{75}{100} = \frac{1200}{4E} \Leftrightarrow 4E = \frac{1200 \times 100}{300}$ = 400N *Total*	1 1 1 3	Expression Substitution Answer
17.	Wavelength = $\frac{25 - 5}{100}$ = 0.2M f = $\frac{v}{\lambda} = \frac{16ms^{-1}}{0.2}$ = 80Hz *total*	1 1 1 3	Answer in metres. Substitution Answer
18.	$\frac{f_1}{\sqrt{T_1}} = \frac{f_2}{\sqrt{T_2}}$ $f_2 = \frac{f_1\sqrt{2T_1}}{\sqrt{T_1}}$ = 200 x 1.414 ≅ 283 Hz *total*	1 1 2	Expression for f_2 Answer
19.	F = μR F = 0.25 x 20 = 5N *total*	1 1 2	Substitution Answer
20.	$\frac{1}{C_T} = \frac{1}{5} + \frac{1}{6} + \frac{1}{12} + \frac{1}{2}$ $= \frac{12 + 10 + 5 + 30}{60} = \frac{57}{60}$ $C_T = \frac{60}{57}$ = 1.053μF *total*	1 1 2	Expression for CT Answer
21.	(2x6) - (2.5x3) = 5V 4.5 = 5V V = $\frac{4.5}{5}$ = 0.9ms^{-1} *total*	1 1 2	Substitution Answer
22.	(i) strength of current in the coil (ii) number of turns in the coil *total*	1 1 2	
23.	V Ms^{-1}		

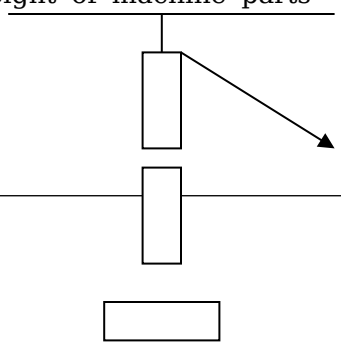
	Vo Vo = terminal velocity time (s) *total*	1 1 2	Sketch Labelling for terminal velocity
24.	Force parallel to the plane = 500 sin 30 = 500 x 0.5 = 250N total force = 50 + 250 = 300N M.A = $\frac{500}{300} = \frac{5}{3} = 1\ ^2/_3$ *total*	 1 1 1 3	 Force parallel to plane Total force Answer
25.	$P = I^2 R$ 1000 = 25R $R = \frac{1000}{25} = 40\Omega$ *total*	 1 1 2	 Substitution Answer
26.	- Lead acid accumulator has a higher current and lower internal resistance. - It can be recharged after use. *Total*	 1 1 2	
27.	- Motion of smoke particles is <u>random</u>. - Motion of dust particles follow a <u>particular path</u> depending on the movement of convectional currents. *Total*	1 1 2	
28.	 Steel *Total*	1 1 2	Correct arrows direction.
29.	- Protects the user from electric shock should there be a fault with the socket. - Opens the socket for the other two pins. *Total*	 1 1 2	
30.	$P_1 V_1 = P_2 V_2$ $P_2 = \frac{P_1 V_1}{V_2} = \frac{1 \times 10^5 \times 2.1}{0.75}$ $= 2.8 \times 10^5$ Pa *total*	 1 1 2	 Substitution Answer
31.	(i) Length (ii) Tension (iii) Density *total*	1 1 2	 Any two

32.	$E = mc\Delta\theta$ $E = 1000\ J/s \times 30s$ $= 30000J$ $c = \frac{30000}{0.6 \times 40}$ $= 1250\ Jkg^{-1}\ k^{-1}$ *total*	1 1 1 3	Energy worked Substitution Answer - units must be stated.

NO **SOLUTION** **MKS** **REWARDING**

1.	(a) graph – labelling	1	
	P_1 – plotting	1	
	L_1 - best line	1	
	S_1 - scale on both axes	1	
	(b) slope S = $\frac{(100 - 91)g}{(0 - 400)s}$	1	Calculation
	$= - 0.0225 gs^{-1}$	1	Answer
	(c) Rate of vaporisation per second	1	
	Taking absolute value of slope S = 2.25×10^{-5} kgs^{-1}	1	
	P = VI = 4x12 = 48W		
	E = $\frac{48}{2.25 \times 10^{-5}}$ Jkg^{-1}	1	Substitution
	$= 21.33 \times 10^5$	1	Answer
	$= 2.133 \times 10^6$ Jkg^{-1}	10	
	total		

2.	(a) Speed is rate of change of distance.	1	
	Velocity is rate of change of displacement.	1	
	(b) PQ - car moves at constant speed of $30ms^{-1}$	1	
	QR - the car is accelerating.	1	

	RS - the car is decelerating.	1	
	(c) (i) QR	1	Substitution
	$a = \frac{(40 - 30)\ ms^{-1}}{180s}$	1	Answer
	$= 0.056 m/s^2$		
	RS	1	Substitution
	$a = \frac{(0 - 40)\ ms^{-1}}{240s}$	1	Answer
	$= -0.167 m/s^2$		
	(d) distance covered :		
	$=30 \times 300 + 30 \times 180 + \frac{1}{2} \times \frac{10}{180} \times 180 \times 180 + \frac{1}{2} \times 240 \times 40$	1	Calculation (substitution)
	$= 20100$ metres		
	Average speed $= \frac{20100}{720}$	1	Answer
	$= 27.92 ms^{-1}$	1	Substitution
	total	1	Answer
		13	
3.	(a) Insulators have static electrons	1	
	Conductors have free electrons	1	
	(b) (I) Parallel resistance $= \frac{6x3}{6+3} = 2\Omega$	11	Substitution and answer
	$R_T = 2 + 4 + 2 + 2 = 10\Omega$	1	Answer
	(ii) P.d. $= 3x3 = 9V$	1	Answer
	(iii) $I = 1.5 + 3 = 4.5A$	1,1	Addition and answer
	(iv) Lost volts $= 2x4.5$	1	Multiplication
	$= 9V$	1	Answer
	(v) $E = I(R + r)$	1	Substitution
	$= 4.5(8+2)$	1	Answer
	$= 45V$	12	
	Total		
	(b) 15Ω I = 0.02A Multiplier $V_2 = 14.7V$ $V_1 = 15 \times 0.02 = 0.3V$	1	Diagram or equivalent
		1,1	Finding R(m)
	Resistance of multiplier	1	Answer
	$R(m) = \frac{14.7}{0.02} = 735\Omega$		
	$R_T = 735 + 15 = 750\Omega$	16	
	total		
4.	(a)		
	(i) Friction between moving parts - A lot of friction reduce M.A	1 1	
	(ii) Weight of machine parts - heavy parts reduce M.A.		
	(b) 		Correct wheels arrangement
		1	

			'Chains'
		1	ropes with tension (i.e. straight)
		1	first sentence
		1	second sentence
	(ii) Attach a spring balance on effort arm and pull at constant velocity. Reading of balance is the effort.	1	substitution
		1	answer
	(iii) $4 = \frac{80cm}{x}$	1	finding M.A ; substitution
	$4x = 80$ $x = 20cm$	1,1	answer
	(iv) $M.A = \frac{480}{160} = 3$	1	finding V.R.
	$E = \frac{3}{4} \times 100 = 75\%$	1	finding M.A
	$V.R. = \frac{1}{\text{Sin } 30} = 2$	1,1	substitution and answer
	(c) $\frac{80}{100} = \frac{M.A}{2}$ $= M.A = 1.6$ $\quad E = \frac{750}{1.6} =$ 468.75N	15	
	total		
5.	(a) A floating object displaces its own weight of the fluid in which it is floating.	1	
	(b) (i) Spring balance reads less.	1	
	Pan balance reads more.	1	
	(ii) There is upthrust due to liquid (water) weight of object is added to the water less upthrust.	1	
	(iii) upthrust = 0.5N		OR mass of water displaced=50g
	wt. in air = 2.0N	1	Vol. of water displaced=$50cm^3$
	$R.D. = \frac{\text{wt. in air}}{\text{Upthrust}} = \frac{2.0}{0.5} = 4$	1	Density = $\frac{m}{} = \frac{200g}{} = 4g/cm^3$
	Density = $4000kgm^{-3}$	1,1	V $50cm^3$
	(c) volume of water displaced $= \frac{4x10^6 \text{ kg}}{1x10^3 \text{ kg}} m^3 = 1x10^3 m^3$	1	$= 4000kgm^{-3}$ finding volume – ratio and
	$h = \frac{V}{A} = \frac{1x10^3}{2x10^3} = 0.5M$	11	answer.
	total		Find height.

6. (a) longitudinal wave — 1
transverse wave — 1

(b)

F	256	288	341	512	
L	0.94	0.84	0.72	0.64	0.48
$^1/_L$	1.0	1.2	1.3	1.5	2.1

2-marks - values worked to 2d.p. 1 - mark if any one value is wrong ; zero if two or more are wrong.

2 Gradient Δ

Division 1

1 Answer

(iii) slope = $\frac{(440 - 300)\ Hz}{1.81 - 1.24}$ — 1

= $\frac{140}{0.57}$ Hzm — 1

= 245.6 Hzm — 1 Lines for reading frequency — 1 Answer.

= 246 ± 5 Hzm

(iv) when L = 0.5

$\frac{1}{L} = 2m^{-1}$

f = 482Hz ± 10

graph L_1 - labelling both axes.

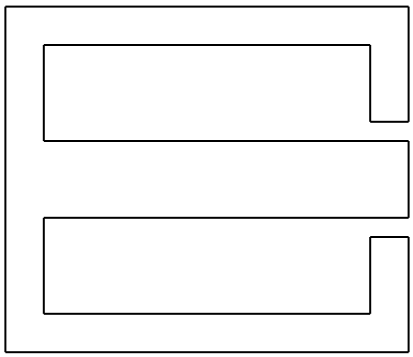
S_1 - scale on x axis.

S_1 - scale on y – axis. — 5

P_1 – plotting.

L_1 - best line through 'his' points.

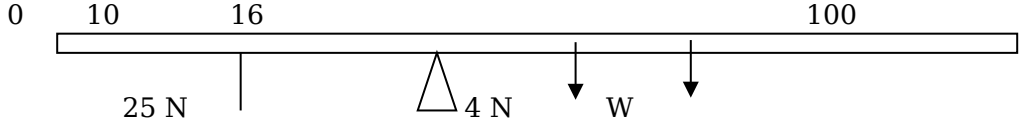
Total — 15

7.		1 1 1 1 1	1mk for north 1mk for south 1mk for north 1mk for each sentence
	(b) - When current flows a force acts on the wire. - The force is perpendicular to field and current. - The coil vibrates left and right with change of current direction. - The cone vibrates at 50Hz to produce a note of the same frequency. (ii) - When p.d. doubles - the amplitude of vibration doubles - a louder note is heard. - The vibration increases to 100Hz. (c) (i) *total*	1 1 1 1 1 1 1 12	 Thermometer dipped into water Tube to vacuum pump Tube to vacuum pump; should not touch water
	(ii) - Flask contains water at 80^0 C initially. - Switch vacuum pump to lower pressure. As pressure decreases b.p. of water goes down. Water boils and continues to do so. *total*	1 1 1 15	

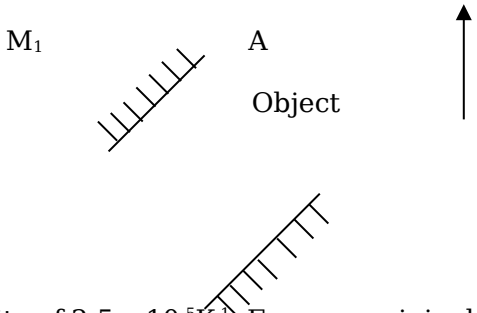
PHYSICS IV
PART I

1. A wide narrow tube open on both ends is filled with water and closed at the bottom with a finger and then inverted and finger removed.
   i) Explain what happens and why (1 mk)
   ii) What would happen if a wide tube was used (1 mk)

2. The metre rule shown below is balanced, find the value of W (2 mks)

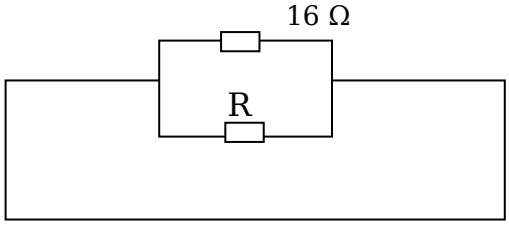


3. The Mirrors shown below are inclined at 45^0, An object is placed in the position shown. Complete the ray diagram to show how an observer sees the image through M_2
(2 mks)



4. A metal has linear expansivity of 2.5 x $10^{-5}K^{-1}$. From an original length of 0.8m at 0°C it becomes 0.8115m after
heating. Determine the range of temperature it was heated through.
(3mks)

5. In the simple circuit shown below, the effective resistance is 80/9 Ω. Find the Value of R
(2 mks)



6. State two factors that affect the capacitance of a capacitor
(2 mks)

7. Light of frequency 3 x 10^{14} Hz is incident on a diffraction grating of 2000 Lines Per cm.
i) Calculate the wavelength of the Light
(1 mk)
ii) Find the angle of the first order diffracted wavefronts
(2 mks)

7. A tone mass 250g is whirled in a vertical circle of radius 2m at 14ms^{-1}. Determine the tension in the string at the
highest point. (2 mks)

9. A current of 4A flows through a heating coil of resistance 75Ω. Calculate the power of the heater (1 mk)

10. A radioactive substance has a half-life of 20 minutes. If the initial mass of the substance is 2 grams how much of
it has decayed in one hour ? (2 mks)

11. A string supports a solid iron object of mass 200g totally immersed in a liquid of density 800Kgm^{-3}. Calculate the
tension in the string if the density of iron is 8000Kgm^{-3}
(3 mks)

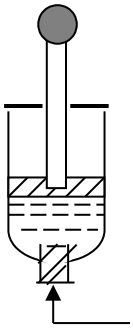
12. A train moving at 25Kmh^{-1} accelerates uniformly to attain a speed of 50Kmh^{-1} after covering a distance of
0.75Km. what is the acceleration of the train (2 mks)

13. State two factors that determine the force of two conductors carrying a current
(2 mks)

14. In the diagram shown below a conductor is shown carrying a current. Show the direction of the thrust of the
conductor and state the rule used to determine the thrust
(3 mks)



15. The Piston of the syringe shown below was suddenly pulled upwards



- glass syringe

Closed end

State two observations that were made (2 mks)

16. Draw a sketch to show how the diffraction of Plane straight water waves are diffracted when the gap is narrower
than the wavelength of the waves. (1 mk)

17. Sketch the display on a C.R.O tube screen when the time-base voltage is applied to the X – plates and the output
of an a.c dynamo is applied to the Y – plates . (2 mks)

18. An uncalibrated thermometer is placed in melting ice then in boiling water. The lengths of the liquid column are
22 mm and 79 mm respectively. What temperature is indicated by a length of 65 mm .
(2 mks)

19. The pressure of the atmosphere is about 1 x 10^5 Pa. What force does this exert on a desk top 0.8 m x 0.6 m. How
can the desk support this force.
(2 mks)

20. You are provided with three resistors 2Ω, 6Ω and 10Ω. Draw a circuit to show how the three can be connected to
give a resistance of more than 6Ω but less than 8Ω. (1 mk)

21. A trolley of mass 2.5Kg moving at 3ms^{-1} collides head on with another trolley of mass 1.5 Kg moving at 4ms^{-1}.If
the two coalesce after collision find their common velocity V
(2 mks)

22. A large brass sphere and a small brass sphere are both charged equally and then joined by a conductor, which way
would charge flow and why ? (2 mks)

23. State two ways in which energy is lost in a step up transformer
(2 mks)

24. Give two examples of transverse waves
(2 mks)

25. Microwaves travel at the speed of light. If their wavelengths is 6 cm calculate their frequency and periodic time
(2 mks)

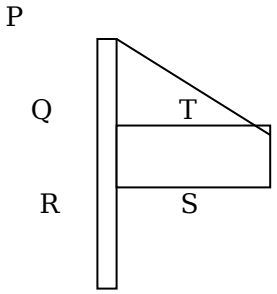
26. A police car is sounding a siren of frequency 300Hz and is moving towards you. What is the effect of sound heard
by your ear. Explain this phenomenon. (2 mks)

28. State the principal of conservation of Linear momentum
(2 mks)

29. 50 drops of oil were drawn from a burette initially reading 28.5cm. The level dropped to 29.0cm^3. One drop of the
oil formed a circular Patch of average diameter 21cm on water. Estimate the thickness of oil molecule to 1 s.
(3 mks)

30. State Hooke's law (1 mk)

31. The diagram below represents a structure of a signboard. State which of the girders are
(2 mks)
i) Struts
ii) Ties

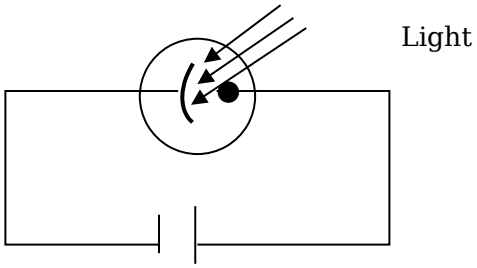


A step up transformer which is connected to a 12V a.c supply has its secondary coil connected to a 240V, 60W lamp. The transformer is 80% efficient. Use this information to answer question 32 and 33.

32. Calculate the current in the secondary coil (2 mks)

33. Calculate the current in the Primary coil
(2 mks)

34. The diagram below shows a photocell. Explain why a current flows when light is shone on the cathode



35. A metal has work function of 2.0 eV. Take e = 1.6 x $10C^{-19}$ and h = 6.6 x 10^{-34} Js.
i) Explain the term Work-function (1 mk)
ii) Calculate the threshold wavelength of the metal (3 mks)

PHYSICS IV
PART I
MARKING SCHEME

SOLUTION	Notes

1. - No water comes out because air pressure outside forces water back
1
- A wide tube would allow water to run out. Pressure at bottom would be higher than atmospheric pressure 1

Total 2

2. $25 \times 6 = 12 \times 4 + 34\ W$ 1

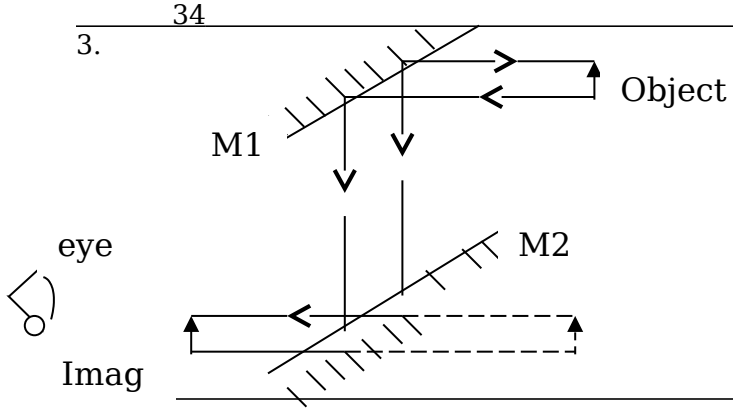
expression

$34W = 102$

$W = \frac{102}{34} = 3N$ 1 answer

Total 2

3.



1 direction of rays and 90^0 at each mirror

1 image (virtual)

Total 2

4. $l_1 = l_0 + l_0 \alpha \theta$

$\theta = \frac{l_1 - l_0}{l_0 \alpha} = \frac{0.8115 - 0.8000}{2.5 \times 10^{-8} \times 0.8}$ 1 expression 1

working

$= \frac{1.15 \times 10^4}{20}$

$= 575^0C$ 1 answer

Total 3

5. $\frac{16\ R}{16 + R} = \frac{80}{9}$ 1 expression

$144\ R = 1280$

$R = 20\ \Omega.$ 1 answer

Total 2

6. i) Distance of separation between plates 1

ANY TWO

ii) Dielectric material 1

iii) Area of the plates 1

Total 2

7. $\lambda = \frac{3 \times 10^8}{3 \times 10^{14}} = 1 \times 10^{-6}$ 1

working λ only

$\text{Sin}\ \theta = \frac{1 \times 10^{-6}}{5 \times 10^{-6}} = 0.2000$ 1

expression

$\theta = 11^0\ 32'$ 1 answer

Total 3

8. $T = \frac{mv^2}{r} - mg$

$= \frac{0.25 \times 196}{2} - 0.25 \times 10$ 1

expression

$= 24.5 - 2.5$ 1

simplifying

$= 22\ M$ 1 answer

Total 3

9. $P = I^2R$
$= 16 \times 75$
$= 1200W$ — 1 — for answer

Total 1

---

10. mass left $= 2 \times 2^{-3} = 2^{-2} = \frac{1}{4}$ g — 1 — for mass decayed
mass decayed $= 2 - \frac{1}{4}$
$= 1.75$g — 1 — for answer

Total 2

---

11. Volume displaced $= \frac{2 \times 10^{-1}}{8 \times 10^{3}}$
$= 2.5 \times 10^{-5} m^3$ — 1 — volume
Wt of liquid displaced = upthrust
$= 8 \times 10^{2} \times 10^{1} \times 2.5 \times 10^{-5}$
$= 0.2$N — 1
upthrust
T = 2 - 0.2 = 1.8 N — 1 — tension (answer)

Total 3

---

12. $u = \frac{25000}{3600} = 6.944 ms^{-1}$
$v = \frac{50000}{3600} = 13.89 ms^{-1}$
$a = \frac{v^2 - u^2}{} = \frac{13.89^2 - 6.944^2}{}$ — 1
expression for a
$= \frac{192.93 - 48.22}{1500}$
$= \underline{0.0965 m/s^2}$ — 1 — answer

Total 2

---

13. i.) amount of current flowing in the conductors — 1
ii) the distance between them — 1

Total 2

14.
thrust ↓ — 1 — direction of thrust
Fleming's left hand rule — 1 — rule

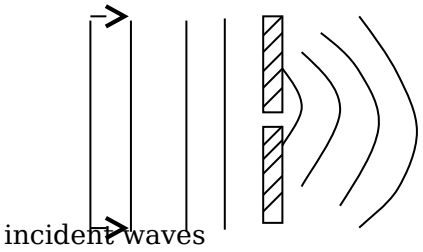
Total 2

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15. i.) A cooling effect due to atmospheric vapour condensing outside the syringe — 1
ii) Ether vaporises and the space above the liquid would have ether fumes — 1

Total 2

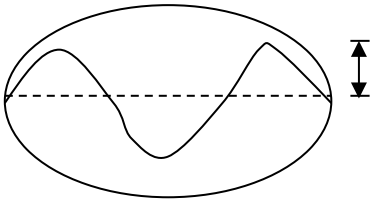
16.



1 — mark – correct diagram only

Total 1

17.



1 — ✓ diagram showing at least 1 cycle

|<– cycle –>| 1 amplitude

indicated

Total 2

---

18. 79 - 22 = 57 mm 100^0C

∴ temp = $\frac{65 - 22}{57}$ x 100 1 expression

= 75.4^0C 1 answer

Total 2

---

19. A = 0.48 m^2

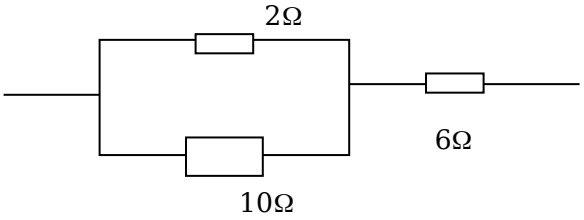
F = P x A = 1 x 10^5 x 0.48

= 4.8 x 10^4N 1 ✓ answer for pressure

The air beneath the desk exerts an equal force upwards 1

Total 2

20.



1 mark for ✓ diagram ONLY

Total 1

---

21. 2.5 x 3 - 1.5 x 4 = 4 V 1 expression

V = $\frac{1.5}{4}$ = 0.375ms^{-1} 1 answer

Total 2

---

22. – Charge would flow from smaller to larger sphere 1

NOTE‖- The smaller sphere has a larger charge density per unit area 1

Total 2

---

23. i.) Hysteresis loss ✓

ii) Eddy currents 1 ✓

iii) Heating in the coils ✓

iv) Loss of flux between Primary and Secondary coils 1 ✓ ANY TWO

Total 2

---

24. Light waves or any e.m 1✓

Water waves 1 ✓

Waves in a string 1 ✓ ANY TWO

Total 2

---

25. f = $\frac{v}{\lambda}$ = $\frac{3 \times 10^8}{6 \times 10^{-2}}$ = 5 x 10^9 Hz 1 Finding f

T = $\frac{1}{F}$ = $\frac{1}{5 \times 10^9}$ = 2 x 10^{-10}S 1 answer for periodic time

Total 2

---

26. – Sound heard is of higher (apparent) frequency 1

- This is doppler effect which is apparent change in frequency of sound relative to motion of source and observer 1

Total 2

---

27. t = $\frac{50}{20}$ = 2.5 seconds 1 for time

s = 0 + ½ x 10 x 6.25

= 31.25m 1 answer

Total 2

28. If no external forces act on a system of Interacting objects the total momentum in a given direction is a constant 1 1

Total 2

29. Volume of drop $= \frac{0.5}{50} = 0.01cm^3$ 1 Volume

area $= \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} = 346.5$ 1 area

$h = \frac{1 \times 10^{-2}}{346.5} \approx 3 \times 10^{-7}M$ 1 answer

Total 3

30. Extension of a spring is Proportional to the force applied provided the elastic limit is not exceeded 1

Total 1

31. Struts Q T, R S 1

ties P T T S 1

Total 2

32. $60 = 240I$ 1

expression

$I = 0.25$ 1 answer

Total 2

33. $\frac{80}{100} = \frac{P_s}{P_P} \Leftrightarrow P_P = \frac{100 \times 60}{80} = 75W$ 1 for P_p

$I_P = \frac{75}{12} = 6.25A$ 1

Total 2

34. - Light emits electrons from the cathode which are attracted by the anode 1

- The electrons then go through the external circuit causing an electric current 1

Total 2

35.i) The minimum amount of Work required to liberate an electron from a metal surface 1

$f_o = \frac{W_o}{h} = \frac{2 \times 1.6 \times 10^{-19}}{6.6 \times 10^{-34}}$ 1 for f_o

$= 4.85 \times 10^{14}Hz$

$\lambda_o = \frac{3 \times 10^8}{4.85 \times 10^{14}}$ 1 expression

$= 6.2 \times 10^{-7}m$ 1 answer

Total 3

PHYSICS IV
PART II

SECTION I

1.a) (i) State Newton's Second Law of Motion and write down the equation that summarises it (2 mks)

ii) The valve of a cylinder containing 10Kg of compressed gas is opened and the cylinder empties in one minute

20 seconds. If the gas escapes from the nozzle at $20ms^{-1}$, find the force exerted on the nozzle (2mks)

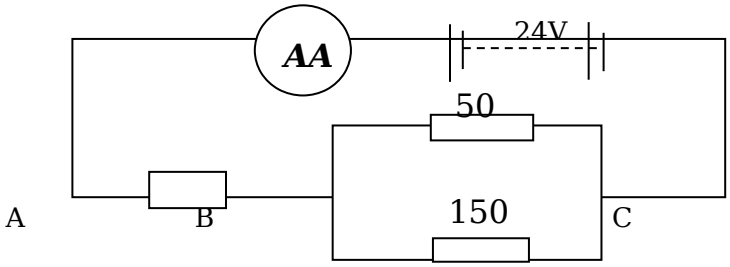
b) A car of mass 1200Kg travelling at 90kmh^{-1} is brought to rest over a distance of 75m. Find:-

i) The average retardation (3 mks)

ii) The average breaking force (2 mks)

c) Distinguish between elastic and inelastic collisions (3 mks)

2. The circuit shown below shows a 24V battery and an ammeter of negligible resistance connected in series. Fixed resistors of the values given are also connected



a) i) Calculate the effective resistance of the circuit (2 mks)

ii) Calculate the current through the ammeter (1 mk)

iii) Calculate the P.d between A and B (1 mk)

iv) Calculate the current through the 50Ω resistor (2 mks)

v) Suppose a voltmeter of resistance 100Ω was connected across A and B, what would be the p.d across AB. (2 mks)

b) A Milliammeter of coil resistance 15Ω and f.s.d of 20mA is to be converted to :-

i) An ammeter to read currents upto 5A. Draw a circuit to show how this can be done and calculate the resistance of the component used (3 mks)

ii) A Voltmeter to read p.ds up to 15V. Draw a diagram to show how this can be done and calculate the total resistance of the Voltmeter (3 mks)

3.a) (i) State Charles' law of gases (2 mks)

ii) Draw a diagram of the apparatus that can be used to verify the law and describe giving illustrations of how the law can be verified and the conclusions made (8 mks)

b) (i.) A balloon is filled with air to a volume of 250ml at 25^{0}C. The balloon is then transferred to hot water at 90^{0}C. Assuming it does not burst and no pressure change due to water, calculate the new volume of the balloon. (2 mks)

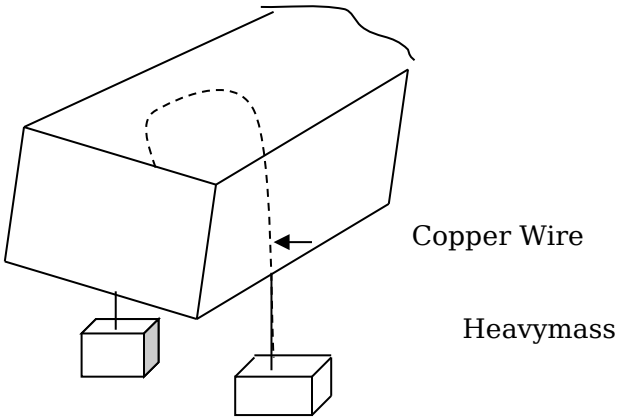
ii) Calculate the r.m.s of gas molecules in a container moving at 0.8ms^{-1}, 1.2ms^{-1}, 1.3ms^{-1} and 0.9ms^{-1} respectively. (2 mks)

4.a) (i.) Define specific heat capacity of a substance (1 mk)

ii) Dry steam is passed into a well- lagged copper can of mass 300g containing 450g of water and 40g of ice at 0^{o}C. The mixture is well stirred and the steam supply cut off when the temperature of the can and its contents reach 25^{0}C. Take $C_{(w)}$ = 4.2Jg^{-1}K^{-1}, $C_{(copper)}$ = 0.38Jg^{-1}K^{-1}, $L_{(v)}$ Steam = 2300Jg^{-1}, $L_{(f)\ ice}$ = 340 Jg^{-1} and steam

condensed (7 mks)

4.a) A copper wire is held by two heavy supports across a block of ice as shown below. After two hours or so the wire cuts through the block and falls leaving behind a solid block



i) Explain this Phenomenon and state its name (4 mks)

ii) What would happen if an iron wire was used instead of copper wire (2 mks)

5.a) A triangular glass Prism x y z has angle x = 90^0 and y = 30^o. A ray of light strikes face x y at right angle and passes through the prism to strike YZ from inside the prism.

i) Draw a diagram to show the passage of the ray through the Prism and its emergence from face YZ (2 mks)

ii) Calculate the angle of refraction as the light emerges from face YZ (2 mks)

iii) What angle has the ray been deviated in glass take n = 1.5 for Prism glass (1 mk)

b) State two conditions for total internal reflection of light to occur (2 mks)

c) Draw a ray diagram to show how a 45^0, 90^0, 45^0 Prism can be used to reverse the path of light through 180^0

Which optical instrument would such a prism be suitable for ? (3 mks)

SECTION II

6.a) State one use of radioactive decay in each of the following

i) Industry (1 mk)

ii) Medicine (1 mk)

b) State two factors that determine the extent of hazard caused by radioactivity (2 mks)

c) Explain how you can identify the three radiations emitted by radioactive substances (3 mks)

d) Explain the meaning of the term half-life

i) As used in radioactive decay (1 mks)

ii)The table below shows the count-rate from a G.M tube versus time for a radioactive substance

Count rate min^{-1}	480	372	312	252	204	186	165	144
Time min	0	5	8	12	16	18	21	24

Plot a graph of activity (Y – axis) versus time (4 mks)
Determine the half-life of the substance and hence calculate the decay constant
(3 mks)

7.a) i) State two conditions necessary for the interference of light to occur
(2 mks)
ii) A monochromatic light of wavelength 5.6×10^{-7} Passes through a double slit and forms 8 fringes of width
0.32cm. If the screen is 0.7m away from the slit, find the separation of the slits
(3 mks)
iii) What is monochromatic light (1 mk)
b) A string vibrates at 25Hz. The speed of the wave on the string is $20ms^{-1}$. Calculate the distance between two
successive crests (2 mks)
c) Explain the term resonance and state:-
i) One hazard caused by the Phenomenon (2 mks)
ii) A tube closed at one end resonates first at 12cm and second at 37cm. Calculate the frequency of the tuning
fork used given that speed of sound is $330ms^{-1}$ (3 mks)
ii) What would be the source of error if only one resonance length was used
(1 mk)
iv) State two factors that affect the frequency of a vibrating string
(1 mk)

PHYSICS IV
PART II
MARKING SCHEME.

NO.	SOLUTION		MKS AWARDING
Q1. (a)	(i.) The rate of change of momentum is proportional to the applied force and takes place in the direction of the force	1	
	F= ma	1	
	(ii) from F = ma		
	= $\frac{\text{mass x change in velocity}}{\text{time}}$	1	expression
	= $\frac{10 \times 20}{80}$ = 2.5N	1	answer
(b)	(i.) u = $\frac{90 \times 1000}{3600}$ = $25m/s^{-1}$	1	expression
	a = $\frac{v^2 - u^2}{150}$ = $-\frac{625}{150}$ = $-4.17ms^{-2}$	1	answer
	(ii) F = ma = $1200 \times \frac{-625}{150}$	1	expression
	= - 5000N	1	answer
	= 5000N (retarding force)	1	
	(c) In elastic collision only momentum is conserved	1	

In elastic collision both momentum and KE are conserved
1

Total 12

Q2. (a) (i) $R_T = 100 + \frac{150 \times 50}{200}$ $= 137.5\Omega$ 1
expression

(ii) $I = \frac{V}{R} = \frac{24}{137.5}$ $= 0.745$ 1
answer

(iii) $V_{(AB)} = 0.745 \times 100 = 17.45V$ 1

(iv) $V_{BC} = 24 - 17.45 = 6.55V$ 1 for p.d
or

otherwise
$I = \frac{6.55}{50} = 0.131A$ 1

(v) $R_{(AB)} = \frac{100 \times 100}{200} = 50\Omega$
total R = 50 + 375
= 87.5 1 resistance
$I = \frac{24}{87.5} = 0.2743$ 1
current
$V_{(AB)} = 0.2743 \times 50$
=13. 715V 1 answer

(b) (i.) $V_{(s)} = 15 \times 0.02 = 0.3$ V 1 Vs

$R_{(s)} = \frac{0.3}{4.98} = 0.0602\Omega$ 1

1 diagram

1 diagram

$R_{(m)} = \frac{14.7}{0.02} = 735\Omega$ 1

$R_{(T)} = 735 + 15 = 750\Omega$ 1 $R_{(T)}$

Total 15

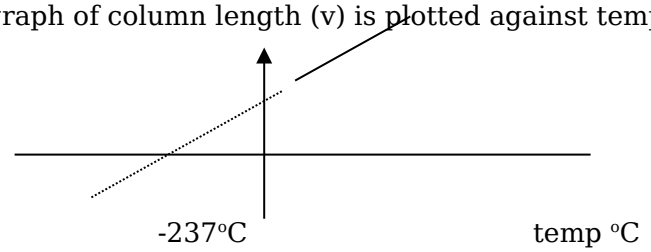
Q3 (a) (i.) Volume of a fixed mass of a gas is proportional to its 1
Absolute temperature at constant pressure 1

(ii)

3	complete diagram
2	any special apparatus missing
0	any two missing.

- A drop of conc. $H_2 SO_4$ is trapped in a closed uniform tube open at One end.
- It acts drying agent – pressures constant
- Heating is started and temperature and length of air column read
  At 10°c intervals or so. Stirrer maintain constant temp.
- Volume is proportional to length and air columns as x-area is constant.

A graph of column length (v) is plotted against temp.



It should intercept x-axis at - 237°C on intrapolation

$$\frac{V}{T} = K$$

(b) (i.) $V2 = \frac{V1\ T2}{T1} = \frac{250 \times 363}{298}$ 1

$= 304.5mL$ 1

(ii) $C_{rms} = \sqrt{\frac{0.8^2 + 1.2^2 + 1.3^2 + 0.9^2}{4}}$ 1

$= \sqrt{1.145}$

$= 1.07 m/s^{-1}$ 1

Total 14

Q4 (a) (i.) The heat required to raise the temp of unit mass of a substance by 1K 1 1

(ii) Heat given out by steam = 2300 x m 1

Condensed steam cooling to 25°C = m x 4.2 x 75

Total = 2300m + 315m = 2615m 1

Heat gained by melting = 40 x 34

= 13600J 1

melted ice warming to 25°C = 450 x 4.2 x 25

= 47250J 1

calorimeter warming to 25°C = 0.38 x 300 x 5

= 2850J

Total = 67900J

2615m = 67900 1

m = $\frac{67900}{2615}$ = 26.0 grams 1,1 expression and answer

4.b)i.) Pressure of wire lowers M.P of ice in contact with it. Ice melts and flow above wire latent heat comes from wire. 1

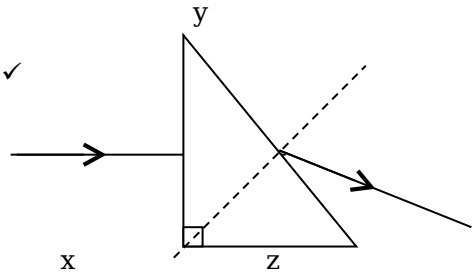
- Soon as water above it freezes and gives out latent heat again which is conducted through wire to provide heat to further melt the ice beneath. 1 1
- Process is known as regelation 1

ii) – It would cut the ice much more slowly 1

- Thermal conductivity of iron is less that of copper

. Total 14

5.a)i.)



✓ 1 two marks as shown. 1

ii) $\frac{\text{Sin i}}{\text{Sin r}} = \frac{2}{3}$ Sin r = $\frac{3 \times 0.5}{2}$ = 0.7500 1 expression

i = 30^0

r = 48.6^0 1

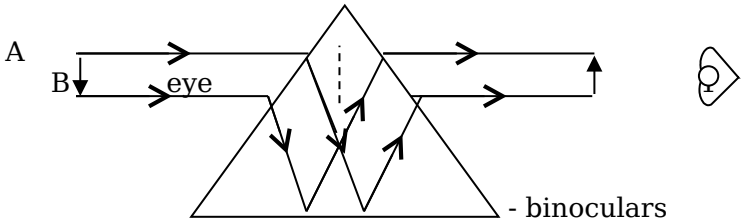
iii) Angle of deviation = 48.6 - 30

= 18.6^0 1

b)- Light should Pass from a denser medium to a rarer medium 1

- The angle of incidence in the denser medium should be greater than the critical angle 1 1

c)



direction of rays 1 1 Image right way-up

- binoculars 1

Total 10

SECTION II

6.a)i.) Nuclear energy Production / use of gamma radiation to detect cracks in metal — 1 — ANY ONE

ii) Medicine – treatment of cancer — 1 — any ONE
- or goitre

b) – Amount of radiation
- Part of body exposed — 1 — ANY TWO
- Nature of radiation — 1
- Whether ingested or Inhaled

c) i.) Piece of paper- stops α – particles
ii) Metal plate plate – stops β – particles — 1
iii) Thick lead block – stops γ – radiation — 1
OR Use G.M tube and an electric or magnetic field — 1
α – particles – deflection towards cathode
β – particles – deflection towards anode (N – Pole)
γ – radiation – not affected

d) i.) The time taken for a given radioactive sample element to decay to half its original value — 1
ii) See graph

Total 15

7.a)i.) Source of waves must be coherent — 1
Waves must have approximately the same amplitude — 1
ii) Fringe width $x = 3.2 \times 10^{-3} = 4 \times 10^{-4}m$ — 1 — width
$\lambda = \frac{ax}{D}$ (=) $a = \frac{\lambda D}{x} = \frac{5.6 \times 10^{-7} \times 7 \times 10^{-1}}{4 \times 10^{-4}}$ — 1 — substitution
$= 9.8 \times 10^{-4}m$ — 1 — answer
iii) Light of one colour and one wavelength — 1

b) $\lambda = \frac{v}{f} = \frac{20}{25} = 0.8m$ — 1 — expression; 1 — answer

c)i.) Resonance occurs when a body vibrates at its natural frequency as a result of vibrations from another system vibrating with the same frequency — 1
- Breaking of window panes in a house when a loud jet passes overhead — 1

ii) $l_2 - l_1 = \frac{\lambda}{2}$ — 1
$\frac{\lambda}{2} = 25$ =) $\lambda = 50cm = 0.5m$ — 1
$f = \frac{330}{0.5} = 660Hz$ — 1

iii) End correction — 1

iv) Length
Mass per unit length — 1 — ANY ONE
Tension

Total 15

PHYSICS V
PART I

Take:
Density of water = 1.0 x 10^3 Kg m^{-3}. Acceleration due to gravity = 10ms^{-2}.

1. Figure 1 below shows part of a micrometer screw gauge that is being used to determine the diameter of a wire.

State the diameter of the wire.
(1 mk)

2. Okinda claps his hands at 0.5 seconds intervals infront of a cliff 180m away. He realised that each echo produced by the cliff coincides with the next clap. Use this information to calculate the speed of sound in air. (2mks)
3. A small light table tennis ball is suspended by a silk thread. A charged ebonate rod is brought close to it. The ball is first attracted to the rod, but after touching it, it is repelled. Explain. (2mks)
4. The sketch in figure 2 below shows the cooling curve of a substance.

Which portion of the curve shows the melting point of the substance?
(1mk)

5.

The uniform beam above weighs 1KN. How much further can a man weighing 800N move to the left before the beam tips over?
(2 mks)

6. A boy of weight 600N displaces 50 litres of water when dunking. What volume of water must he swallow while floating in order to make him just sink?
(3mks)

7. Figure 4 below shows drops of water and mercury on a clean glass surface.

Explain the difference in the shapes. (2mks)

8. A glass block measures 5cm by 5cm by 8cm. When it is resting on its smallest face and it is viewed from above, it appears to be a cube. What is the refractive index of the glass?
(2mks)
9. Distinguish between thermionic emission and photoelectric effect.
(2mks)
10. Complete the ray diagram below to show the position of the image.
(2 mks)

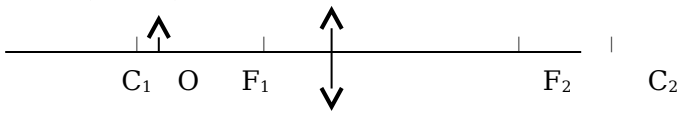


Fig 5.

11 State three reasons why any transformer is not perfect.
(3mks)

12. Find the effective capacitance of the net below.
(3 mks)

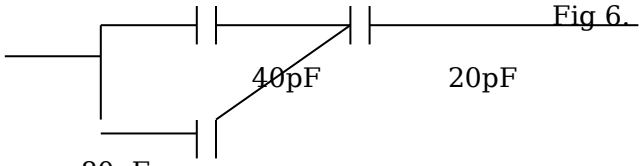


Fig 6.

13. Why is the inside of an X – Ray Tube highly evacuated?
(1mk)

14. Calculate the fuse rating of an electrical appliance rated 2KW, 250V.
(2mks)

15. Explain what makes a bubble of air rising from the bottom of a pond to increase in size as it rises. (2 mks)

16. A bullet of mass 20g is fired from a gun of mass 6 kg at 500 m/s. What is the recoil velocity of the gun? (3mks)

17. The end A of a uniform bar of metal is heated gently while its remaining length is exposed to air. On the axes below, sketch its temperature gradient.
(1mk)



Fig.7

18. A string with a fundamental frequency of 400 Hz is stretched so that its tension is doubled. Calculate its new frequency.
(3mks)

19. Estimate the diameter of an oil molecule if a drop of it, of volume 4.0×10^{-6} m^3 forms a patch of diameter 14 cm on a water surface.
(3mks)

20. State two industrial uses of gamma rays. (2mks)

21 A wire is placed between two magnetic poles as shown below.

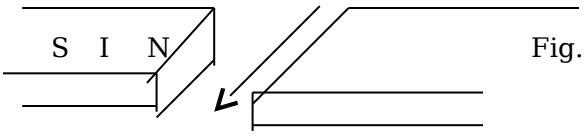


Fig.8

In which direction will the wire move?
(1mk)

22. Calculate the change in length of a metal 2m long at 20^0 C if it is heated to a temperature of 70^0 C given that its coefficient of linear expansivity is 1.0×10^{-5} mk^{-1}.
(3mks)

23. State one way by which a bicycle rider can increase the brightness of his headlamp.
(1mk)

A lady's dress appears white with blue stipes when viewed in blue light. Describe the actual colours of her dress.
(2mks).

25. How much water at 30^0 C is required to make 5kg of water at 70^0 C to be at 37^0 C?
(3mks)

26. Identify the transistor below.
(1mk)

Fig.9

27. Calculate the root mean square voltage of a source which has a peak voltage of 240V.
(2mks)
28. The paper ball below is falling freely through air and a slight wind is blowing it from left to right. Indicate all the forces acting on it.
(3mks)



Fig.10

29. Some students tried to grow a large crystal of copper sulphate by suspending a small copper sulphate crystal in a super-saturated solution of copper sulphate. Why did they use a super-saturated solution? (1mk)
30 State two uses of optical fibres. (2mks)
31. Why can't alternating current be used for recharging a car battery?
(1mk)
32. You are given an alcohol thermometer and a mercury thermometer. State, with a reason, which one you would use for measuring temperatures:
(4mks)
(a) below 10°C (b) above 120°C
33. What conditions are necessary for a conductor to obey ohm's Law?
(2mks)
34. Complete the ray diagram below to show how the eye, E sees the image of the point object, O formed in the plane mirror.
(2mks)



PHYSICS IV
PART II

SECTION I
1. Figure 1 below shows a plan view of two rooms M and N. A loudspeaker L is shown in room M.

i) On the diagram, draw waves showing how sound waves from L spread into room M
(1mk)

ii) Show how the waves behave when they reach room N.
(1mk)
iii) An observer at Y can hear the sound. By what process does the sound reach him?
(3mks)
iv) If the speaker produces a note at 3kHz, travelling at 330m/s, what is the wavelength of the note? (3mks)
v) Given that the frequency of the note doubles, what are now the wavelength and speed of the wave? (6mks)
vi) What happens to the sound when it strikes the concrete wall AB?
(2mks)

2. Figure 2 below shows the layout of a thermal power station.

a) Name any three suitable fuels that can be used in the boiler.
(3mks)
b) State the energy changes that occur from the boiler to the generator.
(3mks)
c) Which device produces the energy that turns the generator?
(1mk)
d) If a power output of 10MW is generated when the fuel produces 45 MJ of energy each second, what is the efficiency of the power station?
(3mks)
e) Suggest two ways in which power loss during transmission can be minimised?
(2mks)
f) State one reason why the power station is not 100% efficient.
(1mk)

3.a) The diagram below shows how the eye, E can see the image of an object, O. Draw suitable rays to show how the eye sees the image.
(3mks)

b) A convex lens produces an erect image when the object is placed 20cm from it. If the length of the image is twice that of the object, calculate the focal length of the lens.
(3mks)
c) What advantages does a convex mirror have over a plane mirror when used as a driving mirror? (2mks)
d) How will a red tie with green stripes appear when viewed in blue light?
(2mks)

4.a) Use the diagram of the cathode Ray oscilloscope to answer the questions that follow.

i) Name the parts labelled A,B & C.
(3mks)
ii) What is the function of D?
(1mk)
iii) Suggest why B is connected to a very high potential.
(1mk).
iv) What is the polarity at P & at Q? (2mks) P.___
Q.___
v) State the function of A. (1mk)
vi) Why is the inside of the CRO highly evacuated?
(1mk)
vii) Why is the fluorescent screen convex outwards?
(1mk)

b) Draw the trace that would appear on the screen of a CRO when it is connected to an a.c source and the time base switched on. (1mk)



c) State two properties of x-Rays.
(2mks)

5.a) A student used the set-up below to determine the boiling point off a liquid. Add to the diagram, the thermometer. (1mk)

b) Why does a liquid-in-glass thermometer have:
i) A thin-walled bulb? (1mk)
ii) A safety bulb?
(1mk)
iii) A thick stem? (1mk)

c) A metal 2cm long is at the temperature of pure melting ice. What would be the final temperature if its length was to decrease to 199.4cm? (coefficient of linear expansivity of the metal is 0.0002 K^{-1}) (4mks)

d) What advantages does mercury have over alcohol as a thermometric liquid?
(4mks)

e) Describe the changes that occur in the density of water when its temperature changes from -10^0C to 10^0C.

(3mks)

SECTION II

6.a) A bubble rises from the bottom of a pond to the surface. Write down three quantities that change as it rises.

(3mks)

b) In an experiment to verify Charles Law, the following results were obtained.

Length of air column(mm)	64.0	69.0	73.3	77.5	82.0
Temperature (^{0}C)	20	40	60	80	100
Temperature (K)					

i) Complete the table.
(2mks)
ii) Plot a graph of length of air column against temperature in ^{0}C.
5mks)
iii) Determine the slope of your graph.
(3mks)
iv) Draw a set-up that can be used to obtain the above results.
(2mks)

7. A cyclist moves at a constant speed of 20cm/s for 5 minutes and then accelerates uniformly to a speed of 30m/s over a period of 30 seconds. This speed is maintained for 2 minutes before he comes to rest within 30 seconds.

a) Complete the table below showing how his velocity changes with time.
(2mks)

Time	0	300	330	450	480
Velocity (m/s)					

b) Draw a velocity- Time graph representing the journey described above.
(5mks)

c) From your graph, find:

i) The acceleration when the velocity changes from 20m/s to 30m/s.
(2mks)

ii) The total distance travelled after 5 minutes.
(3mks)

iii) The cyclist's average acceleration.
(3mks)

PHYSICS V
PART I
MARKING SCHEME

KEY: ; (colon) means one mark.

1. 4.75 mm ;

2. Speed = $\frac{180\ m}{0.5\ s}$ = 360 ms^{-1}

3. Ebonite rod is negatively charged ; When it is touched, electrons flow to the earth and the like charges repel. ;

4. DE ;

5. X x 800N = 2m x 1000N ; X = 2.5 m.

6. He will sink when he displaces 600N of water ;

10(1000 x 0.050 + 1000 x V) = 600N
50 + 1000 V = 60 ;
V = 0.01m^3 = 1000cm^3

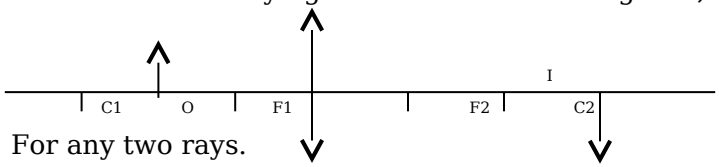
He should swallow 110 litres of water.

7. For mercury, cohesive forces between its molecules exceed adhesive forces.
For water, adhesive forces between its molecules and glass molecules exceed cohesive forces. ;

8. $n = \frac{\text{Real Depth}}{\text{Apparent Depth}} = \frac{8cm}{5cm} = 1.6$

9. Thermionic emission is the production of electrons from a metal surface when it is heated. ; Photoelectric effect is the production of electrons from the surface of a metal when it is struck by light of suitable wavelength. ;

10.



; ; For any two rays.

11. – Loss of flux linkage. ;
Production of eddy currents. ;
Hysterisis ;

12. $C = C_1 + C_2$
$= (40 + 80)$ pF
$= 120$ pF ;
$\frac{1}{C_T} = \frac{1}{120} + \frac{1}{20}$;
$= \frac{1 + 6}{120}$
$C_T = 1.7$ pF. ;

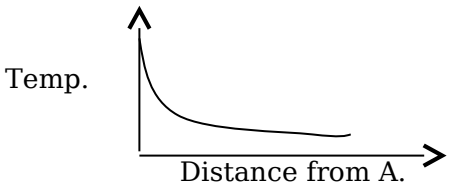
13. To minimise loss of energy of electrons due to collision with air molecules. ;

14. $I = \frac{P}{V} = \frac{2000}{}$;
$= 8$ A ;

15. As it rises, pressure acting on it decreases and hence its volume increases since temperature is constant. ;

16. $6000 \times Vr = 20 \times 500$; ;
$Vr = \frac{20 \times 500}{6000}$
$Vr = 1.67\ ms^{-1}$;

17.



18. $\frac{f_1}{\sqrt{T_1}} = \frac{f_2}{\sqrt{T_2}}$;
$\frac{f_1}{f_2} = \frac{\sqrt{T_1}}{\sqrt{T_2}}$ $\frac{400}{f_2} = \frac{\sqrt{T_1}}{\sqrt{2T_1}}$;
$f_2 = 400 \times \sqrt{2}$
$= 465.7$ Hz ;

19. $d = \frac{V}{\pi r^2}$;

$= \frac{4.0 \times 10^{-6}}{3.14 \times 0.07 \times 0.07}$;

$= 2.67 \times 10^{-4}$m ;

20. – Packaging in industries.
Detecting leaks in pipes.
Detecting flaws in metals. } ; ; ANY TWO

21. Upwards. ;

22. $\Delta l = kl \Delta\theta$;
$= 1.0 \times 10^{-5} \times 2 \times (70 - 20)$;
$= 1.0 \times 10^{-3}$m
= 1mm } ;

23. – Riding faster.
- Using a dynamo with a stronger magnet.
- Using a dynamo with more turns. } ; ; ANY ONE

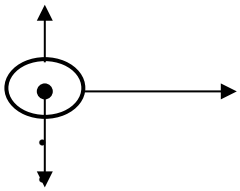
24. Yellow ; dress with white ; stripes.

25. Heat gained by cold water = Heat lost by hot water. ;
m x (37 – 30) = 5 x (70 – 37) ; = m = 23.6 Kg. ;

26. npn transistor. ;

27. $V_{rms} = \frac{V_m}{\sqrt{2}} = \frac{240}{1.41}$; = 170 V ;

28. Upthrust OR Buoyancy. ;



Wind ;

Gravity ;

29. So that the crystal does not dissolve. ;

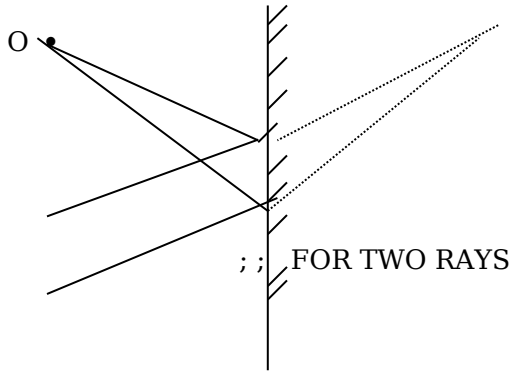
30. – Medical diagnosis ;
- Advertisement. ;

31. A.C continually changes polarity. ;

32.(a) Alcohol ; - it has a low melting point. ;
(b) Mercury ; - it has a high boiling point. ;

33. – Temperature remains constant. ;
- Other physical conditions do not change. ;

34.

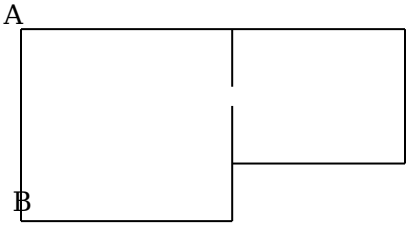


PHYSICS V

PART II

MARKING SCHEME

1.(i) & (ii)



(iii) Transmission through air.

(iv) $v = f\lambda$

$\lambda = \frac{330}{3 \times 1000} = 0.11$ m.

(v) $v = 2f\lambda$

$\lambda = \frac{330}{2 \times 3 \times 1000} = 0.055$ m

$v = 2f\lambda$

$= 2 \times 3 \times 1000 \times 0.055 = 330$ m/s

OR speed is unchanged.

(vi) - Some is reflected.
- Some is absorbed

-

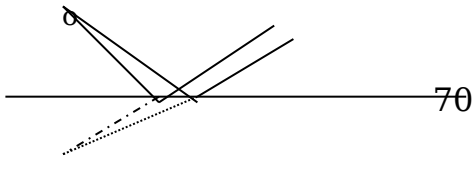
2. (a) coal, charcoal, firewood, petrol, diesel.
(b) heat energy → electrical energy.
(c) Turbine
. (d) $E = \frac{\text{power output}}{\text{power input}} \times 100$

$\frac{10 \times 10^6}{45 \times 10^6} \times 100 = 22.2\%$

(e)-Use of thick cables.
-Transmitting at a high voltage.

(f) Energy loss due to inefficient fuel conversion.

3.(a)



(b) $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$

$\frac{u}{u} + \frac{u}{v} = \frac{u}{f}$

$1 + \frac{1}{2} = \frac{20}{f}$

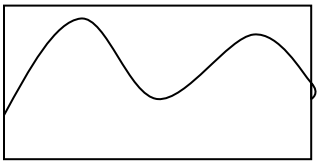
$f = {}^{+}13.3$ cm.

(c) – A wide field of view
Erect, virtual images.

(d) Magenta with cyan stripes.

4.(a)(i.) A – Metal grid.
B – (cylindrical) anode.
C – Y plates.

(ii) To deflect the path of the electrons horizontally.
(iii) to accelerate the electrons.
(iv) P – Negative.
Q – Positive.
(v) To control the number of electrons reaching the anode.
(vi) To minimise loss of energy of electrons to collision with air particles.
(vii) To increase surface area hence reduce accidental breakage since pressure is reduced.
(b)



(c) – Carry no charge. - Travel at the speed of light.
Not deflected by magnetic / electronic field. - Penetrate matter of low density.
Cause ionisation. - Cause fluoresence on some materials.

5.(a)

(b)(i) To enable heat reach the mercury quickly.
(ii) To take up mercury during accidental overheating.
iii) To avoid breakage when it falls accidentally.

(c) $\Delta\theta = \frac{0.6}{200 \times 0.0002} = 15^{o}C$

$\theta_2 = 0 - 15 = {}^{-}15^{o}C.$

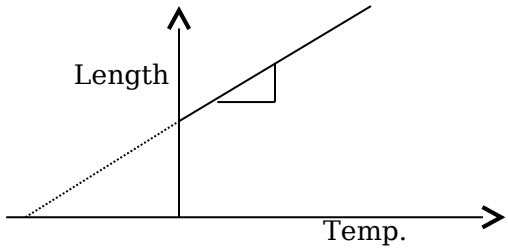
(d) - Doesn't stick to glass. - Expands uniformly.
High b.p. - Low m.p.
Opaque.

(e) From –10°C to 0°C → Density decreases.
From 0°C to 4°C → Density increases.
From 4°C to 10°C → Density decreases.

6. .(a) Volume, Temperature & Pressure.
(b) i.)

Temperature (k)	293	313	333	353	373

(ii)



LABELLING -
SCALE –
PLOTTING –
LINE –

(iii) Slope = $\frac{L_2 - L_1}{\theta_2 - \theta_1}$

$= 0.225\ mm^oC^{-1}$

(iv) Stirrer

7.(a)

Time (s)	0	300	330	450	480
Velocity (m/s)	20	20	30	30	0

(b)

(c)(i.) $a = \frac{30 - 20}{30} = 0.33\ ms^{-2}$

(ii) Distance = Area under curve.

$= 20 \times 300 = 6{,}000$ m.

OR $s = ut + \frac{1}{2}at^2$

$= 20 \times 300 + 0 = 6{,}000$ m.

(iii) $a_1 = \frac{20 - 20}{300} = 0$

$a_2 = \frac{30 - 20}{30} = 0.33$

$a_3 = \frac{30 - 30}{20} = 0$

$a_4 = \frac{0 - 30}{30} = -1$

Average acceleration $= \frac{0 + 0.33 + 0 - 1}{4} = -0.17\ ms^{-2}$