**PHYSICS I**

**PART I**

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

0

pointer

1

Fig. 1 N (1mk)

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.

String

Fig. 3

Sphere

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 90oC and mixed it with 0.25kg of cold water at 22oC . After stirring,

the mixture attained a uniform temperature of 42oC. 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.

4 Distance (m)

0 0.02 Time(s)

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

S1 and S1..  2mks

S1

waves

S2

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.

C

trolley

B 3m D

A

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=h1P1g+h2g 1mk

= (02x103x10) + (0.1x8x102) 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 = 360-1 = a 1mk

0

6. High expansivity

Regular expansivity (any two) 1mk

Does not wet glass 1mk

7. (a)

Tension (arrow + name) 2mks

Weight (or Gravity)

8.

9. m1v1 = m2v2

v2 = m1v1

m2

= 0.5 x 20

0.3 x 0.5 = 1.25m5-1

10.

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

12.

d = 0.62 + 0.62 = 0.846 m

= 0.85m

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) = M

r

= 50 = 50cm3

Density of object = 300

50

= 6f cm-3 3mks

17.

18. 1 = 1 + 1

Ce 5 2+3

= 2/5

Ce = 2.5mF 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. 0.6 = 3

0.2 1mk

23. (a) CA 1mk

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

24. ½ mv22 = 2

½ mv1

v2 = Ö2

v1

= 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. I1x2+I1x3 = 1.5

I1x2+I1x3= 0.3A

VAB = (0.3X3) – (0.3X2) 3mks

= 0.3V

28. From B to A 1mk

29. Distance

Time

Period T = Circumference

Velocity.

= 5

1.25

= 4s

f = ¼

= 0.25H2 2mks

30. (I) ¾ l = 4m

= 5.33m 1mk

(ii) V = fl (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(V1-V2)

= 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=DF

Dl

= 4.0-0

0.35-0.1

= 16Nm-1

II W = ½ ke2

= ½ x16x0.25

= 2J 2mks

(b) ½ mv2 = 2

V = Ö2x2

0.02

= 14.14ms-1 3mks

(c) mc q = mgh

= gh

c

= 10x115

4200

= 0.270C. 3mks

2. (a)(i) V = D/t

= 5.5 x 10-2

1/50 x 11

= 0.25ms-1

(ii) P =MDV

= 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 at2. U=O

t = Ö2S

a

= Ö2x45

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) L

E X 100 = 80

V.R

# Or 400

E x 100 = 80

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 = Dv

DI

= 1.50 – 0.5

0.5-0.25

= 4.6W

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 = 6PnVr

= 6x3.14x1.8x10-4x20x10-2x2.0x10-3 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 ÖT/m

= 1/1 Ö14.4

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) mv2 = mg

r

v = Örg

= Ö3x10

= 5.48ms-1 3mks

(iii) 10ms2 1mk

(b) (I) w = V

r

= 8.4

3

= 2.8 rad s-1 3mks

(ii) F = mv2 + mg

= 400 x 8.42 + 400 x 10

3

= 1.34 x 104N 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/s2*

*Density of water = 1000 kgm-2*

*Density of mercury = 1.36 x 104 kgm-3*

*Speed of sound in air = 330ms-1*

*L(f) ice = 3.4x105 Jkg-1*

*L(v) steam = 2.3 x 106 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 /s2 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 0o are in a container. Steam at 100o 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 5W 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

1. Which sphere has a larger potential than the other ? (1mark)
2. 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 W Show how you would adapt it to a voltmeter to read 5V and determine the total resistance of the

voltmeter (3mks)

1. 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)

1. A thunder cloud has a horizontal lower surface area of 40km² and is 1km above the Earth . Treating this

arrangement as a capacitor, Calculate the electrical energy stored when its potential is 2 x 105 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)

1. Determine the r.m.s. of gas molecules in a container if their speeds are 2ms-1 ,3ms-,  4.5ms-1 and 3.5-1ms-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 0.4m2 encloses a gas in a tube at a pressure of 105 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 1 + 1 = 1

v u f

**PHYSICS II**

**PART II**

Instructions

*i) g = 10ms-2*

*ii density of water = 1 x 103 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 0.80cm2.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 100c. An electrical heater heats the water and

calorimeter to 900c in 3 minutes. Take the specific heat capacity of copper and water to be 400 Jkg-1K-1 and

4200 Jkg –1K-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 80cm3 which is attached to a container of volume 400 cm3 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

1. Show with an arrow the direction of the charging current (1mk)
2. What is the purpose of R? (1mk)

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

(c) (i) Find the Pds V1 and V2 in the capacitor arrangement below and the charges Q1, Q2 and Q3. (8mks)

(ii) What is the relationship between Q1,Q2 and Q3 (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)

1. 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 | | | |  | | | |
| 1. 36kmh –1 = 10ms-1   54 kmh-1 = 15ms-1  15 = 10 + 2t  t = 2.5 seconds  s = 10 x 2.5 + 1 x 2 x 6.25  2  = 31.25m | | | 1  1  1 | | | | S = 152 – 102 = 225 – 100  2 X2 4  31.25M  Substitution  Answer | | | |
| Total | | | 3 | | | |  | | | |
| 1. (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 | | | |  | | | |
| 1. (i) due to the spin of the earth   (ii) due to the shape of the earth | | | 1  1 | | | |  | | | |
| Total | | 2 | | | |  | | | |
| 1. 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 | | | |  | | | |
| 1. 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 | | | |  | | | |
| 1. (i) Rise of sap up plants   (ii) rising of kerosene up the wicks    2. (iii) top layers of soil draw water from wet sub-soil | | | | 1  1 | | | | Any two  Check for other alternatives | | | |
| Total | | | | 2 | | | |  | | | |
| 1. volume of water displaced   = 4/5 x 50= 40 litres  = 4 x 10-2 m3  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 | | | |  | | | |
| 1. current in (6+4 ) W = 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 V2 = 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.    R1 + R2 = 3.2N   * 1. x 0.5 + 2 x 0.75 = 1R2   0.6 + 1.5 = R2  2.1 = R2  R1 = 1.1N | | | | 1  1  1 | | | | Moments  R2 worked  R1 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  MC∆Ø | | | | 1  1  2 | | | | Definition  Derived C | | | |
| 24. 5 l = 10M  4 l = 40 = 8M  5  f = 1 = 1 = 2.5 HZ  T 0.4 | | | | 1  1 | | | | Correct l  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 = 8.85 x 10-12 x 40 x 106  d 1 x 103  = 3.54 X 10-7F  E = 1 CV2 = 1 X 3.54 X 10-7 X 4 x 1010  2 2  = 7.08 x 103J | | | | 1  1  1 | | | | Calculation of capacitance  Substitution in formula  Answer | | | |
| Total | | | | 3 | | | |  | | | |
| 27. | | | | 1  1  1 | | | | Marking of F1 and C1 behind  Mirror  Virtual image correctly drawn  Rays direction | | | |
| Total | | | | 3 | | | |  | | | |
| 28. c r.m.s = √ 22 + 32 + 4.52 + 3.52  4  = √ 45.5  4  = 3.4 ms-1 (Id.p) | | | | 1  1 | | | | Correct substitution  Answer | | | |
| Total | | | | 2 | | | |  | | | |
| 1. 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 | | | |  | | | |
| 1. Volume of gas compressed   = 2.5 10-2 x 4 x 10 –1 = 10 x 10-3m3  power = pressure x volume  time  = 105 x 10 x 10-3  2  = 500w | | | | 1  1 | | | | Substitution  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 HE = 1 x 0.15 = 0.075M  2 2  LB = 1 FE = 1 x 1.85 = 0.925M  2 2  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. 1 + 1 = 1 (multiply through by v)  v u f  1 + v = v  u f  1 + m = v  f  m = v – 1  f | | | | 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  (b)  Volume of water displaced =30g cm -3=30cm3  g  Volume of stem above water = 0.8 x 3.2  = 2.56 cm3  Total volume of hydrometer = 30 + 2.56  = 32.56cm3  Vol. of liquid displaced = 30 = 20cm3  1.5  Vol. Of the stem above the liquid = 32.56 –20  = 12.56 cm3  Length of the stem above liquid  = 12.56 = 15.7cm  0.8    (d) (i)graduations would be further a part    (ii) hydrometer would be more sensitive | | | | 1  1  1  1  1  1  1  1  1  1  1  1 | | | | For vol.of water  For vol. of stem  For total volume  Vol. of stem above liquid  Substitution  Answer  Divisions gap  Highest volume bottom  If values intercharged  Wrong | | | |
| Total | | | | 12 | | | |  | | | |
| Q2 (a) (i) Displacement is distance covered in a particular   direction  (ii) Retardation is rate of decrease of velocity    (ii)Displacement =1x 20x4 – 1x10x4  2 2    = OM  (iii) Average velocity = 0  8  = 0ms-1  (iv) Distance = 2 ( ½ x 20 x 4)  = 80m  (v) Average speed  = 80 = 10ms-1  8 | | | | 1  1  1  1  1  1  1  1  1  1  1  1  1  1 | | | | Area above x – axis  Area below x-axis  1st area above axis  2nd area above axis  substitution  answer all  substitution this  working  answer must be  shown-  substitution  penalise  answer 4 mks if  working  substitution is not  answer shown | | | |
| Total | | | | 14 | | | |  | | | |
| 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   1. 180   P = 180,800  180 x 0.85  = 1181.7w  j 1200w (2sf)  (c) P1 = 720 V1 = 400  v2 = 480 from Boyle`s  law 720 x 400 = P2 x 480  P2 = 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 | | | | 12 | | | |  | | | |
| Q4. (a) (i) Distance between plates  (ii)Area between plates  (iii)Dielectric used  (b)  (i)    (ii)To protect the ammeters in the circuit   1. (iii)A current flows until the P.d across the capacitors is equal to 2. the P.d of the charging cells     (c)CT1 ( Parallel = 1 + 2 = 3lF  CT = 2 x 3 = 6 = 1.2lF  2 + 3 5    Q = CV = 1.2 X 10-6 X 240  = 288 X 10-6C    V1 = 288 X 10-6 = 144V  2 X 10-6  V2 = 240 – 144 = 96V  Q1 = 288lC  Q2 = 2 X 10-6 X 96  = 192lC.    Q3 = 1X 10-6 X 96 = 96lC    Q1 = Q2 + Q3 | | | | 1  1    1  1  1 | | | | Any two  Arrows show direction  Of charging current  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.  1. V = f x   = 100000 x 0.05 = 5000 ms-1  d = 5000 x 6 x 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 + 1 gt2 u = 0   2  h = 1 gt 2 =>g = 2h  2 t2  (iv)Air resistance as the ball falls may reduce volume of g.  (b)  0.2N    Anti clockwise moments = 16 x 0.2  Clockwise moments = 5w  5w = 16 x 0.2  w = 3.2 = 0.64 N  5  m = 0.64kg  10  = 0.064kg  = 64g | | | 1  1  1  1  1  1  1  1  1  1 | | | | Electromagnet well positioned  Position of cells  Hinged plate  Clock  Noting time  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 = F A = 22 x (3.5 x 10-4)  A 7  = 3.85 X 10-7M2  Stress = 25  3.5x10-7 = 6.4g x 107 NM-2  Strain = 5 x 10-4m  2.1  = 2.35 x 10-4   1. Young modulus   E = Stress  Strain  = 6.49 x 107  2.38v10-4  = 2.7 x 1011 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.   (iii) House bricks are porous and draw water up the walls making a house damp | | | 1  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 | | | |
| Total | | | 15 | | | |  | | | |
|  | | |  | | | |  | | | |

**PHYSICS III**

**PART I**

Take the following constants where necessary;-

Acceleration due to gravity g= 10ms2

##### Density of water = 1000kgm-3

Density of mercury = 1.36 x 104kgm-3

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

Reading = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (1mk)

1. 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)

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)

1. 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)
2. A milliammeter with a coil resistance of 10W has a full - scale deflection of 15mA. How would you convert it to an ammeter with a f.s.d of 2A? (2mks)
3. 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/ 6th 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)

1. 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)

x

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 F1 and F2 if the beam weighs 100N. (3mks)

200N

1. 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)

1. A Force of 8.0N stretches a spring by 3.2cm. How much work is done in stretching this spring by 7.2cm? (2mks)
2. 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)
3. 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 .

25

5 15 25 35

-25

From the wave shown, determine :-

(a) The wavelength. (1mk)

(b) The frequency. (2mks)

1. The fundamental frequency of a stretched string is 200Hz. If its tension is doubled with length kept constant, find its new frequency. (2mks)
2. 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)

1. 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)

1. A man pushes a crate of mass 50kg along an inclined plane which is at 300 to the horizontal. He overcomes a frictional force of 50N. Find the mechanical advantage of the incline. (3mks)

50kg

1. 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)

1. What is the difference between the motion of smoke particles in Brownian motion and motion of dust particles due to convectional currents? (2mks)
2. 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 2.1m3 at a pressure of 1 x 105 Pa is compressed until the volume is 7.5 x 10-1m3. 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 250C to 650C. 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)

1. 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.

144 R

108 P Q

S

0 5 8 12 time (min)

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 2W. The current through the 6W resistor is 1.5A.

Determine:

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

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

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

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

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

1. A milliammeter gives a full-scale deflection of 20mA. Its coil resistance is 15W. 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)

1. A man pushes a 75kg load through an inclined plane and raises the load through a vertical height of 5m. The incline is at 300 to the horizontal. If the incline is 80% efficient, calculate the effort needed.(4mks)

5m

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

1. 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.
2. 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 2000m2. By what depth will it sink in fresh water when a cargo of 4 x 106 kg is loaded into it? (3mks)

SECTION II

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

1. 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 |
| 1 (m-1)  L |  |  |  |  |  |

(i) Complete the table. (2mks)

(ii) Plot a graph of frequency f against 1 (5mks)

L

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

S =

1. 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 800C. (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 = 120g cm3  6g  = 20cm3  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  Forces of adhesion greater in water.  Forces of cohesion greater in mercury.  *Total* | | 1  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) = 0.15 = 7.56 x 10 -2 W  1.985  *total* | | 1  1 | |  | |
| 9. | | Weight on earth = 180 x 6  1  = 1080N  mass on earth = 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 F2  950 = 5F2  F2 = 190N  F1 = 300 - 190 = 110N  *Total* | | 1  1  1  3 | | Correct moments  1 mk for 190N  1 mk for 110N | |
| 14. | | Displacement = ½ x (20 x 4) + ½ (-20 x 4)  = 40 - 40  = 0 metres  *total* | | 1  1  1  3 | | Shape above x-axis  Shape below x-axis | |
| 15. | | Force needed = 8 x 7.2 = 18N  3.2  Work = ½ x 18 x 7.2 = 0.648J  100 *Total* | | 1  1  2 | | Force OR K = 250Nm-1  Answer:  w= ½kx2 = ½ x250x0.072x0.0  = 0.648J | |
| 16. | | M.A. X 100 = 75  V.R. 100  75 = 1200 Û 4E = 1200 x 100  100 4E 300  = 400N  *Total* | | 1  1  1  3 | | Expression  Substitution  Answer | |
| 17. | | Wavelength = 25 - 5 = 0.2M  100  f = v = 16ms-1 = 80Hz  l 0.2  *total* | | 1  1  1  3 | | Answer in metres.  Substitution  Answer | |
| 18. | | f 1 = f 2  ÖT1 ÖT2  f 2 = f1 Ö2T1  ÖT1  = 200 x 1.414  @ 283 Hz  *total* | | 1  1  2 | | Expression for f2  Answer | |
| 19. | | F = mR  F = 0.25 x 20  = 5N  *total* | | 1  1  2 | | Substitution  Answer | |
| 20. | | 1 = 1 + 1 + 1 + 1  CT 5 6 12 2  = 12 + 10 + 5 + 30 = 57  60 60  C T = 60 = 1.053mF  57  *total* | | 1  1  2 | | Expression for CT  Answer | |
| 21. | | (2x6) - (2.5x3) = 5V  4.5 = 5V  V = 4.5  5 = 0.9ms-1  *total* | | 1  1  2 | | Substitution  Answer | |
| 22. | | 1. strength of current in the coil 2. 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 = 500 = 5 = 1 2/3  300 3  *total* | | 1  1  1  3 | | Force parallel to plane  Total force  Answer | |
| 25. | | P = I2 R   1. = 25R   R = 1000 = 40W  25  *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 random. * Motion of dust particles follow a particular path 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. | | P1 V1 = P2 V2  P2 = P1 V1 = 1 x 105 x 2.1  V2 0.75  = 2.8 x 10 5 Pa  *total* | | 1  1  2 | | Substitution  Answer | |
| 31. | | 1. Length 2. Tension 3. Density   *total* | | 1  1  2 | | Any two | |
| 32. | | E = mcDq  E = 1000 J/s x 30s  = 30000J  c = 30000  0.6 x 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  P1 – plotting  L1 - best line  S1 - scale on both axes  (b) slope S = (100 - 91)g  (0 – 400)s  = - 0.0225gs -1  (c) Rate of vaporisation per second  Taking absolute value of slope S = 2.25 x 10-5 kgs-1  P = VI = 4x12 = 48W  E = 48 Jkg-1  2.25 x 10-5  = 21.33 x 105  = 2.133 x 106 Jkg-1  *total* | | 1  1  1  1  1  1  1  1  1  1  10 | | Calculation  Answer  Substitution  Answer | |
| 2. | | (a) Speed is rate of change of distance.  Velocity is rate of change of displacement.  (b) PQ - car moves at constant speed of 30ms-1  QR - the car is accelerating.  RS - the car is decelerating.  (c) (i) QR  a = (40 - 30) ms-1  180s  = 0.056m/s2  RS  a = (0 – 40) ms-1  240s  = -0.167m/s 2  (d) distance covered :  =30 x 300 + 30 x 180 + ½ x 10 x 180 x 180 + ½ x240x40 180  = 20100 metres  Average speed = 20100  720  = 27.92ms-1  *total* | | 1  1  1  1  1  1  1  1  1  1  1  1  1  13 | | Substitution  Answer  Substitution  Answer  Calculation (substitution)  Answer  Substitution  Answer | |
| 3. | | 1. Insulators have static electrons   Conductors have free electrons   1. (I) Parallel resistance = 6x3 = 2W   6+3  R T = 2 + 4 + 2 + 2 = 10W  (ii) P.d. = 3x3 = 9V  (iii) I = 1.5 + 3 = 4.5A  (iv) Lost volts = 2x4.5  = 9V  (v) E = I(R + r)  = 4.5(8+2)  = 45V *Total* | | 1  1  11  1  1  1,1  1  1  1  1  12 | | Substitution and answer  Answer  Answer  Addition and answer  Multiplication  Answer  Substitution  Answer | |
|  | | (b) 15W  I = 0.02A Multiplier    V2 = 14.7V  V1 = 15 x 0.02 = 0.3V  Resistance of multiplier  R(m) = 14.7 = 735W  0.02  R T = 735 + 15 = 750W  *total* | | 1  1,1  1  16 | | Diagram or equivalent  Finding R(m)  Answer | |
| 4. | | (a)  (i) Friction between moving parts - A lot of friction reduce M.A  (ii) Weight of machine parts - heavy parts reduce M.A.  (b)  (ii) Attach a spring balance on effort arm and pull at constant velocity. Reading of balance is the effort.  (iii) 4 = 80cm  x  4x = 80  x = 20cm  (iv) M.A = 480 = 3  160  E = 3 x 100 = 75%  4  V.R. = 1 = 2  Sin 30  (c) 80 = M.A  100 2  = M.A = 1.6 E = 750 = 468.75N  1.6 *total* | | 1  1  1  1  1  1  1  1  1  1,1  1  1  1,1  15 | | Correct wheels arrangement  'Chains'  ropes with tension (i.e. straight)  first sentence  second sentence  substitution  answer  finding M.A ; substitution  answer  finding V.R.  finding M.A  substitution and answer | |
| 5. | | 1. A floating object displaces its own weight of the fluid in which it is floating. 2. (i) Spring balance reads less.   Pan balance reads more.  (ii) There is upthrust due to liquid (water)  weight of object is added to the water less upthrust.  (iii) upthrust = 0.5N  wt. in air = 2.0N  R.D. = wt. in air = 2.0 = 4  Upthrust 0.5  Density = 4000kgm-3  (c) volume of water displaced  = 4x106 kg m3 = 1x103 m3  1x103 kg  h = V = 1x103 = 0.5M  A 2x103 *total* | | 1  1  1  1  1  1  1,1  1  11 | | OR mass of water displaced=50g  Vol. of water displaced=50cm3  Density = m = 200g = 4g/cm3  V 50cm3  = 4000kgm-3  finding volume – ratio and answer.  Find height. | |
| 6.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | F | 256 | 288 | 341 | 512 |  | | L | 0.94 | 0.84 | 0.72 | 0.64 | 0.48 | | 1/L | 1.06 | 1.20 | 1.39 | 1.56 | 2.10 | | | 1. longitudinal wave   transverse wave  (b)  (iii) slope = (440 – 300) Hz  1.81 - 1.24  = 140 Hzm = 245.6 Hzm  0.57  = 246 ± 5 Hzm  (iv) when L = 0.5  1 = 2m-1  L  f = 482Hz ± 10  graph L1 - labelling both axes.  S1 - scale on x axis.  S1  - scale on y – axis.  P1 – plotting.  L1 - best line through 'his' points.  *Total* | | 1  1  2  1  1  1  1  1  1  5  15 | | 2-marks - values worked to 2d.p. 1 - mark if any one value is wrong ; zero if two or more are wrong.  Gradient D  Division  Answer  Lines for reading frequency  Answer. | |
| 7. | | (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  1  1  1  1  1  12 | | 1mk for north  1mk for south  1mk for north  1mk for each sentence  Thermometer dipped into water  Tube to vacuum pump  Tube to vacuum pump; should not touch water | |
|  | | (ii) - Flask contains water at 800 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 )

0 10 16 100

25 N 4 N W

3. The Mirrors shown below are inclined at 450, An object is placed in the position shown. Complete the ray diagram to show how an observer sees the image through M2 ( 2 mks )

M1 A

Object

M2

4. A metal has linear expansivity of 2.5 x 10-5K-1. From an original length of 0.8m at 0oC 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 )

16 Ω

R

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

7. Light of frequency 3 x 1014 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 )

1. 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 )

1. 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 )

S

N

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 105 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 29.0cm3. 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

P

Q T

R S

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

Light

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 x 6 = 12 x 4 + 34 W 1 expression

34W = 102

W = 102 = 3N 1 answer

34 Total 2

3.

Object

1. direction of rays and 900 at each mirror

M1

eye

M2

1. image (virtual )

Image

Total 2

4. l1 = l0 + l0 α θ

q = l1 – l0 = 0.8115 - 0.8000 1 expression

l0 a 2.5 x 10-8 x 0.8 1 working

= 1.15 x 104

20

= 5750C 1 answer

Total 3

5. 16 R = 80

16 + R 9 1 expression

144 R = 1280

R = 20 W. 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. l = 3 x 108 = 1 x 10-6 1 working l only

3 x 1014

Sin q = 1 x 10-6 = 0.2000 1 expression

5 x 10-6

q = 110 32’ 1 answer

Total 3

8. T = mv2 - mg

r

= 0.25 x 196 - 0.25 x 10 1 expression

2

= 24.5 - 2.5 1 simplifying

= 22 M 1 answer

Total 3

1. P = I2R

= 16 x 75

= 1200W 1 for answer

Total 1

10. mass left = 2 x 2-3 = 2-2 = ¼ g 1 for mass decayed

mass decayed = 2 - ¼

= 1.75g 1 for answer

Total 2

11. Volume displaced = 2 x 10-1

8 x 103

= 2.5 x 10-5m3 1 volume

Wt of liquid displaced = upthrust

= 8 x 102 x 101 x 2.5 x 10-5

= 0.2N 1 upthrust

T = 2 - 0.2 = 1.8 N 1 tension (answer )

Total 3

12. u = 25000 = 6.944ms-1

3600

v = 50000 = 13.89ms-1

3600

a = v2 - u2 = 13.892 - 6.9442 1 expression for a

= 192.93 - 48.22

1500

= 0.0965 m/s2 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

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

diffracted wave

incident waves

Total 1

17.

amplitude 1 ü diagram

showing at least 1 cycle

cycle 1 amplitude   
 indicated

Total 2

18. 79 - 22 = 57 mm 1000C

\ temp = 65 - 22 x 100 1 expression

57

= 75.40C 1 answer

Total 2

1. A = 0.48 m2

F = P x A = 1 x 105 x 0.48

= 4.8 x 104N 1 ü answer for   
 pressure

The air beneath the desk exerts an equal force upwards 1

Total 2

20. 2W

1. mark for ü diagram

6W ONLY

10W

Total 1

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

V = 1.5 = 0.375ms-1 1 answer

4

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 ü

ii) Eddy currents 1 ü

iii) Heating in the coils ü

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

Total 2

24. Light waves or any e.m 1ü

Water waves 1 ü

Waves in a string 1 ü ANY TWO

Total 2

25. f = v = 3 x 108 = 5 x 109 Hz 1 Finding f

* 6 x 10-2

T = 1 = 1 = 2 x 10-10S 1 answer for periodic

F 5 x 109 time

Total 2

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

- This is doppler effect which is apparent change in frequency of sound 1

relative to motion of source and observer

Total 2

27. t = 50 = 2.5 seconds 1 for time

20

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 1

1. momentum in a given direction is a constant 1

. Total 2

29. Volume of drop = 0.5 = 0.01cm3 1 Volume

50

area = 22 x 21 x 21 = 346.5 1 area

7 2 2

h = 1 x 10-2 ≈ 3 x 10-7M 1 answer

346.5

Total 3

30. Extension of a spring is Proportional to the force applied provided the 1

elastic limit is not exceeded

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. 80 = Ps <=> PP = 100 x 60 = 75W 1 for Pp

100 PP 80

IP = 75 = 6.25A 1

12

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 1

metal surface

fo = Wo  = 2 x 1.6 x 10-19 1 for fo

h 6.6 x 10-34

= 4.85 x 1014Hz

λo = 3 x 108 1 expression

4.85 x 1014

= 6.2 x 10-7m 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 )

1. 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

24V

# AA

50Ω

A B L C

150Ω

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 250C. The balloon is then transferred to hot water at 900C.

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

0oC. The mixture is well stirred and the steam supply cut off when the temperature of the can and its contents

reach 250C. Take C(w) = 4.2Jg-1K-1, C(copper)  = 0.38Jg-1K-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

Copper Wire

Heavymass

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 = 900 and y = 30o. 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 450, 900, 450 Prism can be used to reverse the path of light through 1800

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 x 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 1

force and takes place in the direction of the force

F= ma 1

(ii) from F = ma

= mass x change in velocity

time 1 expression

= 10 x 20

80 = 2.5N 1 answer

(b) (i.) u = 90 x 1000

3600 = 25m/s-1 1 expression

a = v2 – u2 = - 625 = -4.17ms-2 1 answer

1. 150

(ii) F = ma = 1200 x – 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) RT = 100 + 150 x 50

200 = 137.5W 1 expression

(ii) I = V = 24

R 137.5 = 0.745 1 answer

(iii) V(AB) = 0.745 x 100 = 17.45V 1

(iv) VBC =24 – 17.45 = 6.55V 1 for p.d or   
 otherwise

I = 6.55 =0.131A

50 1

(v) R(AB) =100 x 100

1. =50W

total R = 50 + 375

= 87.5 1 resistance

I = 24

87.5 = 0.2743 1 current

V(AB) = 0.2743 x 50

=13. 715V 1 answer

(b) (i.) V(s) = 15 x 0.02 = 0.3 V 1 Vs

R(s) = 0.3 = 0.0602W 1

4.98

1 diagram

1 diagram

R(m) = 14.7 = 735W

* 1. 1

R(T) = 735 + 15 = 750W 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)

1. complete

diagram

2 any special apparatus missing

1. any two missing.

* A drop of conc. H2 SO4 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 10oc 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.

-237oC temp oC

It should intercept x-axis at - 237oC on intrapolation

V =K

T

(b) (i.) V2 = V1 T2 = 250 x 363

T1 298 1

= 304.5mL 1

(ii) Crms = 0.82 + 1.22 + 1.32 + 0.92

4 1

= 1.145

= 1.07m/s-1 1

Total 14

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

by 1K 1

1. Heat given out by steam = 2300 x m 1

Condensed steam cooling to 25oC = m x 4.2 x 75

Total = 2300m + 315m = 2615m 1

Heat gained by melting = 40 x 34

= 13600J 1

melted ice warming to 25oC = 450 x 4.2 x 25

= 47250J 1

calorimeter warming to 25oC = 0.38 x 300 x 5

= 2850J

Total = 67900J

2615m = 67900 1

m = 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 1  
  again which is conducted through wire to provide heat to further   
  melt the ice beneath. 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

y

5.a)i.)

ü 1 two marks as

shown.

ü 1

x z

ii) Sin i = 2/3 Sin r = 3 x 0.5 1 expression

Sin r 2

i = 300 = 0.7500

r = 48.60 1

iii) Angle of deviation = 48.6 - 30

= 18.60 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 1

critical angle 1

c)

A

B eye 1 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 x 10-3 = 4 x 10-4m 1 width

λ = ax (=) a = λD = 5.6 x 10-7 x 7 x 10-1 1 - substitution

D x 4 x 10-4

= 9.8 x 10-4m 1 answer

iii) Light of one colour and one wavelength 1

b) λ = v = 20 = 0.8m 1 expression

f 25 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) l2 - l1 = λ 1

2

λ = 25 =) λ = 50cm = 0.5m 1

2

f = 330 = 660Hz 1

0.5

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 103 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)

ê ê ê ê Fig 5.

C1 O F1  F2 C2

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

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

Fig 6.

40pF 20pF

80pF

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)

Temp. Fig.7

Distance from A.

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 x 10-6 m3 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.

S I N Fig.8

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

22. Calculate the change in length of a metal 2m long at 200 C if it is heated to a temperature of 700 C given that its coefficient of linear expansivity is 1.0x 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 300 C is required to make 5kg of water at 700 C to be at 370 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 10oC (b) above 120oC

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)

O ·

## 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 -100C to 100C.

(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 (0C) | 20 | 40 | 60 | 80 | 100 |
| Temperature (K) |  |  |  |  |  |

i) Complete the table. (2mks)

ii) Plot a graph of length of air column against temperature in 0C. 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 = 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 = 0.01m3 = 1000cm3

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 = Real Depth = 8cm

Apparent Depth 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.

I

C1 O F1 F2 C2

; ; For any two rays.

11. – Loss of flux linkage. ;

Production of eddy currents. ;

Hysterisis ;

12. C = C1 + C2

= (40 + 80) pF

= 120 pF ;

1 = 1 + 1 ;

CT 120 20

= 1 + 6

120

CT = 1.7 pF. ;

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

14. I = P

V = 2000 ;

= 8 A ;

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

16. 6000 x Vr = 20 x 500 ; ;

Vr = 20 x 500

6000

Vr = 1.67 ms-1 ;

17.

Temp.

Distance from A.

18. f1 = f2 ;

ÖT1  ÖT2

f1 = ÖT1  400 = ÖT1 ;

f2 ÖT2  f2 Ö2T1

f2 = 400 x Ö2

= 465.7 Hz ;

19. d = V

pr2 ;

= 4.0 x 10-6  ;

3.14 x 0.07 x 0.07

= 2.67 x 10-4m ;

20. – Packaging in industries.

Detecting leaks in pipes. ; ; ANY TWO

Detecting flaws in metals.

21. Upwards. ;

22. Dl = kl Dq ;

= 1.0 x 10-5 x 2 x (70 – 20) ;

= 1.0 x 10-3m

= 1mm ;

23. – Riding faster.

- Using a dynamo with a stronger magnet. ; ; ANY ONE

- Using a dynamo with more turns.

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. Vrms = Vm

Ö2 = 240 ; = 170 V ;

1.41

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.

O · · I

; ; FOR TWO RAYS.

E

# PHYSICS V

**PART II**

MARKING SCHEME

1.(i) & (ii)

A

B

(iii) Transmission through air.

(iv) v = fl

l = 330

3 x 1000 = 0.11 m.

(v) v = 2fl

l = 330

2 x 3 x 1000 = 0.055 m

v = 2fl

= 2 x 3 x 1000 x 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= power output x 100

power input

10x106 x100

45x106  = 22.2%

(e)-Use of thick cables.

-Transmitting at a high voltage.

(f) Energy loss due to inefficient

fuel conversion.

3.(a) o

(b) 1 + 1 = 1

u v f

u + u = u

u v f

1 + ½ = 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) Dq = 0.6

200 x 0.0002 = 15oC

q2 = 0 – 15 = - 15oC.

(d) - Doesn’t stick to glass. - Expands uniformly.

High b.p. - Low m.p.

Opaque.

(e) From –10oC to 0oC ® Density decreases.

From 0oC to 4oC ® Density increases.

From 4oC to 10oC ® Density decreases.

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

(b) i.)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Temperature (k) | 293 | 313 | 333 | 353 | 373 |

(ii) LABELLING -

Length SCALE –

PLOTTING –

LINE –

Temp.

(iii) Slope = L2 – L1

q2 - q1

= 0.225 mmoC-1

(iv) Stirrer

7.(a)

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

(b)

(c)(i.) a = 30 – 20

30 = 0.33 ms-2

(ii) Distance = Area under curve.

= 20 x 300 = 6,000 m.

OR s = ut + ½ at2

= 20 x 300 + 0 = 6,000 m.

(iii) a1 = 20 – 20 = 0

300

a2 = 30 – 20 = 0.33

30

a3 = 30 – 30 = 0

20

a4 = 0 - 30 = - 1

30

Average acceleration = 0 + 0.33 + 0 – 1

4 =  - 0.17 ms-2