6

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

PHYSICS 5055/2

PAPER 2 Theory

NOVEMBER 2015 SESSION 1 hour 45 minutes

Candidates answer on the question paper.
Additional materials: Electronic calculator and/or Mathematical table
Graph paper

Allow candidates 5 minutes to count pages before the examination

This booklet should not be punched or stapled and pages should not be removed.

TIME 1 hour 45 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and Centre number and candidate number on top of the right corner of every page of this paper. Check if the booklet has all the pages and ask the invigilator for a replacement if there are duplicate or missing pages.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **two** questions.

Write your answers on the spaces provided on the question paper

Do not fasten the booklet

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question paper.

Candidates are reminded that **all** quantitative answers should include appropriate units.

Candidates are advised to show **all** their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

This question paper consists of 20 printed pages.

Centre Number	Candidate Number

Section A

Answer all questions from this section.

1 (a) Complete **Table 1.1** to describe some of the basic quantities in physics.

Table 1.1

basic quantity	base unit + symbol	measuring instrument
	metre, m	
		triple beam balance
time		

[3]

(b) **Fig.1.1** shows two vectors.

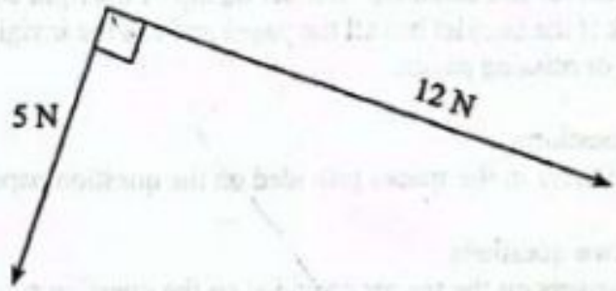

Fig.1.1

Determine the resultant vector.

resultant vector = _____ [2]

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2 (a) A spacecraft is orbiting the Earth at a steady speed of 8 km/s.

Find the time, t, in seconds, taken to complete a single orbit 40 000 km long.

$t =$ _____ s [3]

(b) A trolley moves at a steady speed for a time, t, and then moves an equal distance slowing down.

Sketch a length of a ticker tape that represents the motion of the trolley.

[2]

3 A bottle has a mass of 0.050 kg when empty. Its mass is 0.085 kg when filled with 25 cm^3 of a liquid.

Calculate the density of the liquid in g/cm^3.

density = _____ g/cm^3 [4]

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4 (i) The forces acting on an irregular object are shown in **Fig. 4.1.**

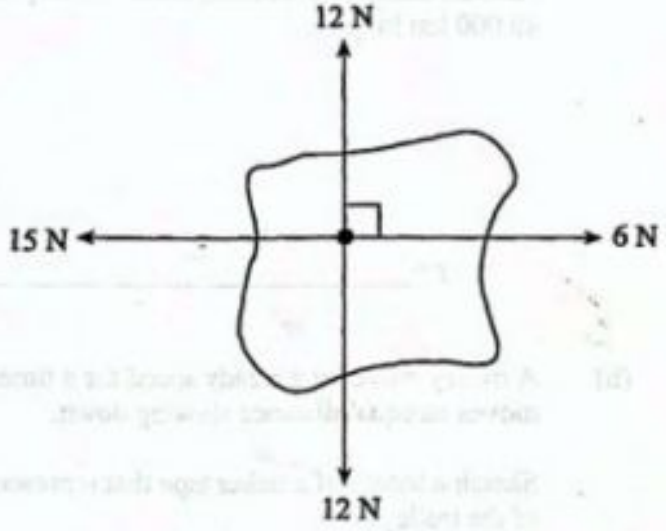

Fig. 4.1

Describe what happens to the object.

_____

_____

_____

(ii) Draw another force on **Fig. 4.1**, indicating its magnitude and direction, to balance the forces.

[4]

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5 (i) The diagrams in **Fig. 5.1** show two blocks of a material whose critical angle is 40°. In block A, the ray strikes the inner surface at an angle of incidence of 30° whereas in block B the angle of incidence in the inner surface is 50°.

Complete each diagram to show what happens after the ray strikes the inner surface.

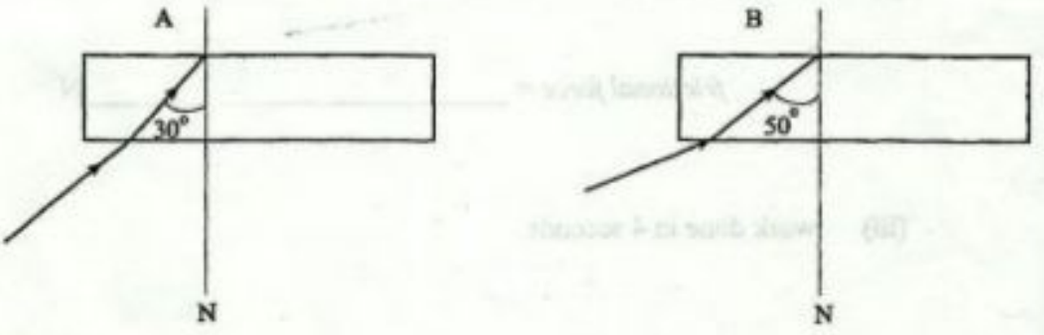

Fig. 5.1

[2]

(ii) Explain *total internal reflection* with reference to **Fig.5.1.**

_____

_____

_____

[4]

[Turn over

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Centre Number	Candidate Number

6 A boy pushes a case of mass 40 kg across a horizontal floor at a constant speed of 0.5 m/s by exerting a horizontal force of 200 N.

Find the

(i) resultant force on the case,

resultant force = _____ N [1]

(ii) frictional force,

frictional force = _____ N [1]

(iii) work done in 4 seconds.

work done = _____ J [3]

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Centre Number	Candidate Number

7 A student set up the apparatus in **Fig. 7.1** to demonstrate the effect of passing an electric current through a copper rod in a magnetic field. The copper rod is free to roll along the iron support rods.

(i) Show, on **Fig. 7.1,** the magnetic field.

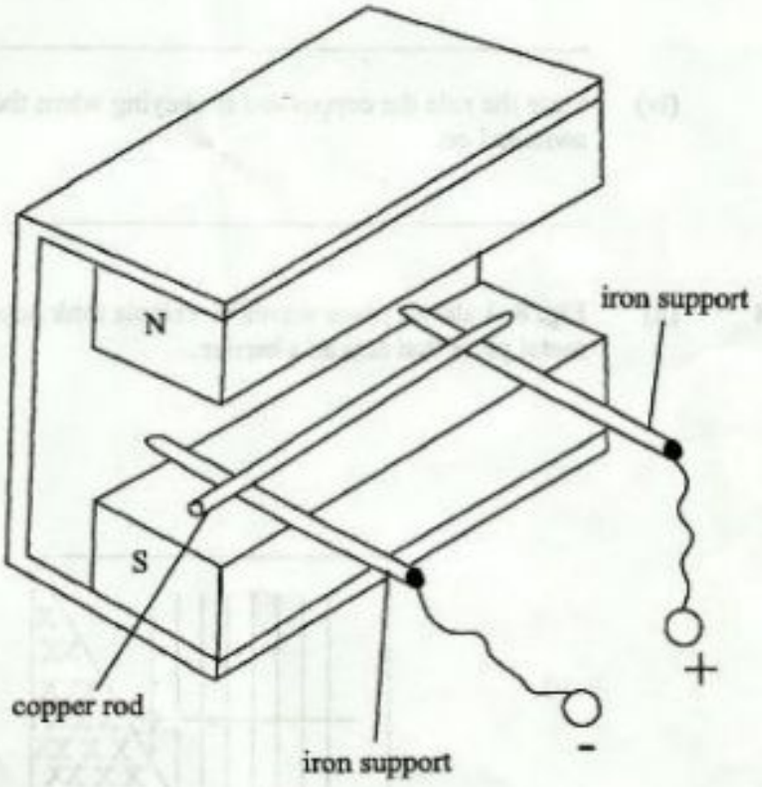

Fig. 7.1 [1]

(ii) Explain what happens to the copper rod when the electric current is switched on.

_____

_____ [1]

7 (iii) Describe what happens if the connections to the power supply are reversed.

_____

_____

_____ [1]

(iv) State the rule the copper rod is obeying when the current is switched on.

_____ [1]

8 (a) **Fig. 8 .1** shows plane waves in a ripple tank approaching a flat metal plate that acts as a barrier.

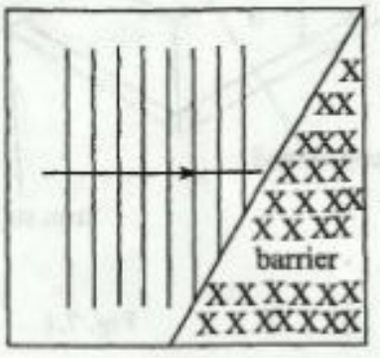

Fig. 8 .1

Complete the diagram to show the effect of the barrier on the wave motion. [3]

8 (b) **Fig. 8.2** shows some wave fronts approaching a shallow region in a ripple tank.

Complete the diagram to show what happens to the wave-fronts as they enter the shallow region.

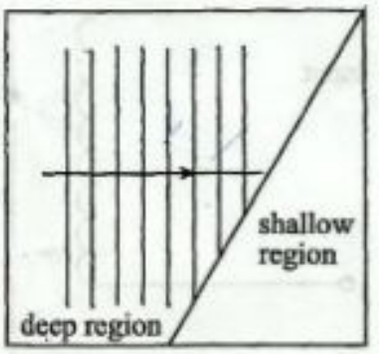

Fig. 8.2

[2]

9 Water of mass 20 kg, at 90 °C, was added to a plastic basin with 4 kg of water at 30 °C.

[Specific heat capacity of water = 4 200 J/kg/°C]

Calculate the final temperature of the mixture.

temperature = _____ °C [5]

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10 The diagram in **Fig. 10.1** represents a device that is used in an electric power circuit.

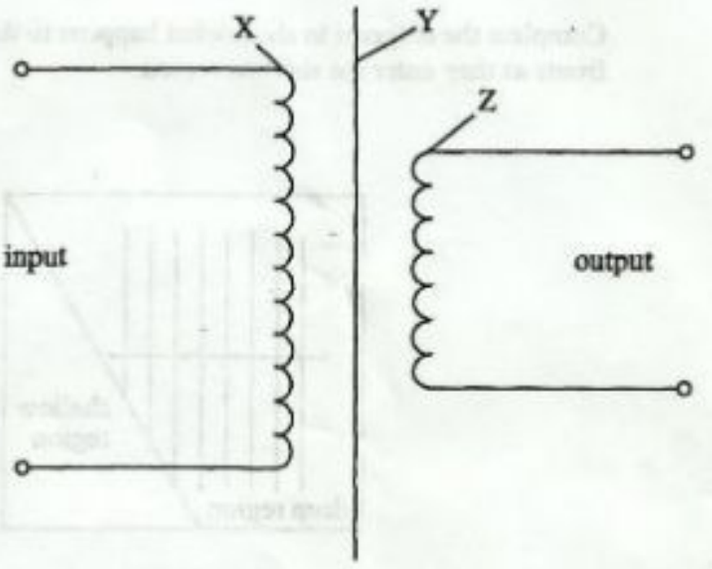

Fig. 10.1

(i) Identify the device.

_____ [1]

(ii) Name the parts labelled X, Y and Z.

X _____

Y _____

Z _____ [3]

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11

Section B

*Answer any **two** questions from this section.*

11 **(a)** **Table 11.1** shows how the stopping distance of a car depends on its speed.

Table 11.1

stopping distance/m	0	4	12	22	36	52	72
speed/ (m/s)	0	5	10	15	20	25	30

(i) Give **one** factor, other than the speed, that affects the stopping distance of a car.

_____ [1]

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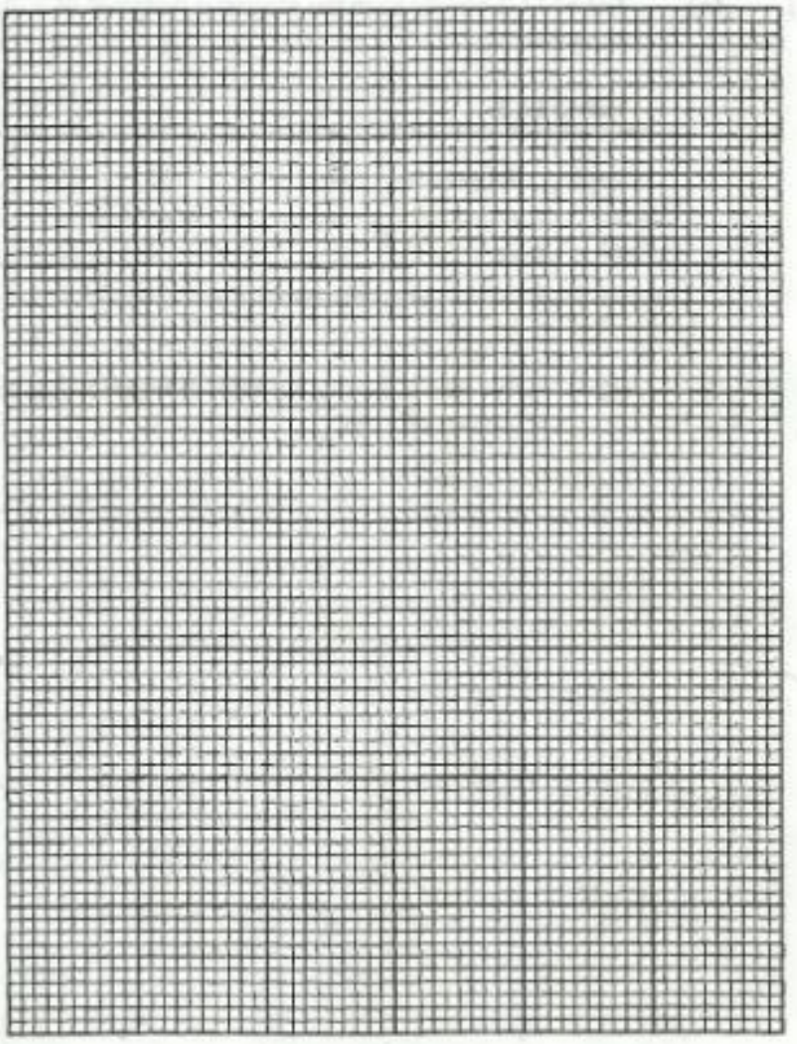
11 (a) (ii) Plot, on **Fig.11.1**, a graph of stopping distance (y-axis) against speed (x-axis).



[4]

Fig.11.1

(iii) Estimate, from graph, the stopping distance of the car travelling at 7.5 m/s.

_____ [1]

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11 (a) (iv) Describe how the stopping distance changes with an increase in speed.

_____

_____

_____ [1]

(b) (i) Define *temperature*.

_____

_____

_____ [1]

(ii) When calibrating a thermometer, two fixed points are essential.

State the numerical values of the **two** points.

1._____

2._____ [2]

(iii) State the temperature range for a clinical thermometer.

_____ [1]

11 (b) (iv) In an electrical method to measure the specific heat capacity of brine, the measurements made were:

mass of aluminium calorimeter	=	0.1 kg
mass of brine	=	0.05 kg
temperature change	=	7.5°C
voltage across heating coil	=	5.0 V
current through the coil	=	1.0A
time current flowed	=	450 s
specific heat capacity of aluminium	=	900 J/kg/K

Calculate the specific heat capacity of brine.

heat capacity = _____ [4]

12 (a) (i) Describe how the focal length of a converging lens is determined by experiment.

_____

_____

_____

_____

_____

_____ [4]

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12 (a) (ii) A small object is placed on the axis of a converging lens of focal length 2 cm so that it is 5 cm from the lens.

Show, by a ray diagram inside the box, the nature and position of the image formed.

[4]

12 (b) (i) Describe how the field lines for a bar magnet are plotted using a plotting compass.

[4]

(ii) Draw the magnetic field pattern for a pair of bar magnets with the North poles facing each other.

[3]

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13 (a) **Fig.13.1** shows two coils of insulated copper wire, one inside the other. The inner coil is connected to a sensitive galvanometer, while the outer coil is connected to a direct current source via a switch, H.

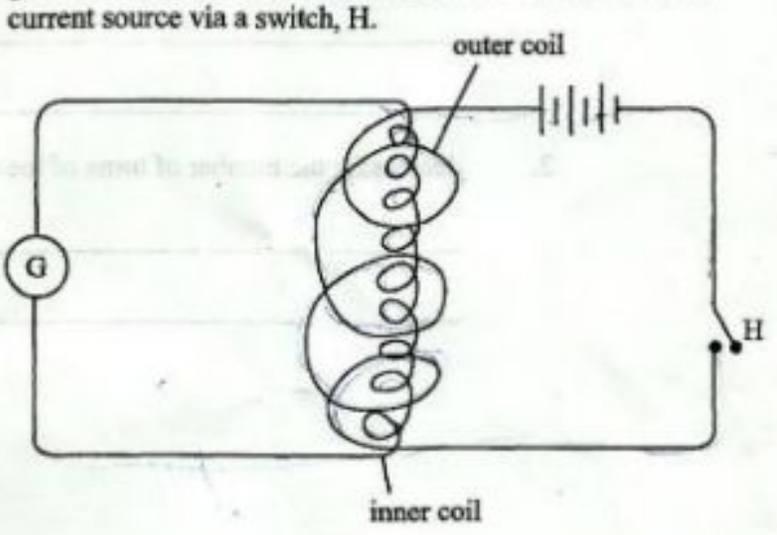

Fig.13.1

(i) Describe what happens when the switch is closed.

_____

_____ [1]

(ii) Explain the answer in **(i)**.

_____

_____

_____

_____

_____

_____ [4]

Centre Number	Candidate Number

13 (a) (iii) State the effect of

1. increasing the number of turns of the inner coil,

_____

_____ [1]

2. decreasing the number of turns of the outer coil.

_____

_____ [1]

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13 (b) **Fig.13.2** shows a device whose operation depends on thermionic emission.

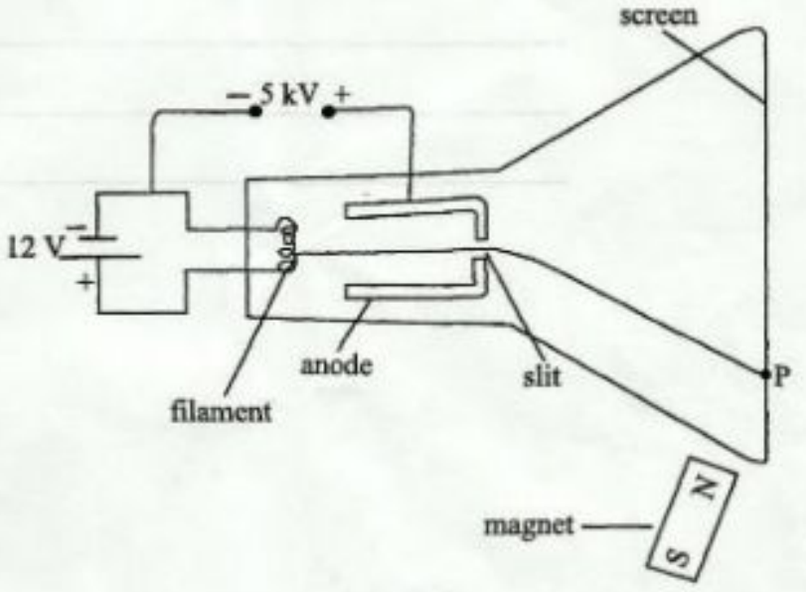

Fig.13.2

(i) Describe how the electron beam is produced and ends up at P.

[6]

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13 (b) (ii) State the **two** effects of increasing the slit width.

_____

_____

_____

_____ [2]

ZIMBABWE SCHOOL EXAMINATION COUNCIL

General Certificate of Education Ordinary Level

EXPECTED ANSWERS

NOVEMBER 2015

PHYSICS **4023/2**

1. (a)

Basic Quantity	Base Unit+Symbol	Measuring instrument
Length	Metre, m	Ruler
mass	Kilogram, kg	Tripple beam balance
Time	Second, s	Stopwatch/clock

(b) $R^2 = 12^2 + 13^2$

$R = 13N$

---

2. (a) $time = \frac{distance}{speed} = \frac{40\,000}{8}$

$= 5000s$

(b) -first dots are equally spaced for time *t* and are further apart as compared to the second part
-dots are close together

---

3. $density = \frac{mass}{volume} = \frac{0.035 \times 1\,000}{25}$

$= 1.4g/cm^3$

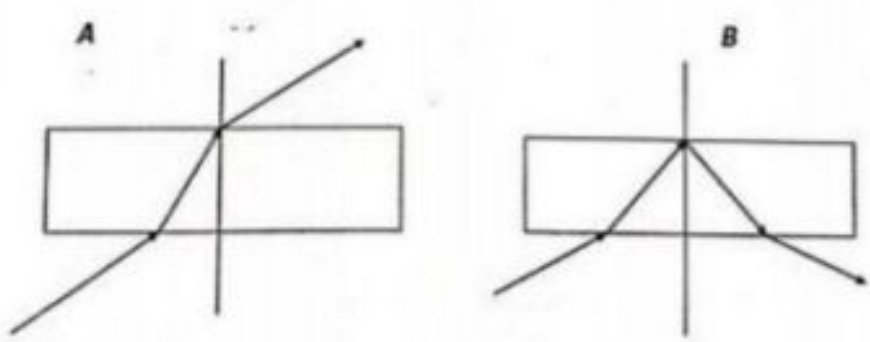
---

4. (i) -the object will move to the left with a resultant force of 9N

(ii) - a force of 9N drawn at an angle of 63°C above the force 6N

---

5. (i)



(ii) -is when a ray of light from an optically denser medium strike the medium boundary at an angle greater than the incident angle and is reflected back into the more dense medium e.g. *fig b* above.

6. (i) $Resultant\ Force = 0N$, constant velocity

(ii) $Frictional\ Force = 200N$

$Work\ done = force \times distance$

$Work\ done = 400J$

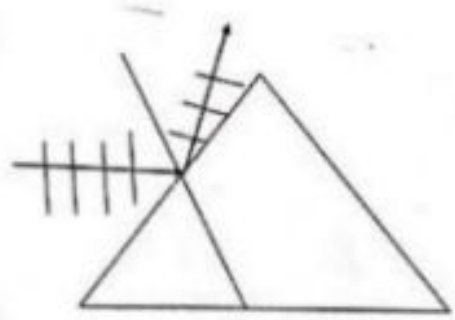
7. (i) -magnetic field from North to South Pole. Arrow pointing downwards.

(ii) -it will roll out of the horse shoe magnet

(iii) -it will roll inwards

(iv) -Fleming's left hand rule

8. (a)



-the ray must be parallel to the wave fronts
-there is reflection away from the barrier
-spacing of the wave fronts are the same before and after reflection.

(b) -wave fronts move closer to the normal
-wavelength reduces i.e. wave fronts become closer to each other
-wave fronts must be at right angle to the ray

9. (a) *heat supplied by water at* 90°C = *heat supplied by water at* 30°C

$Q = mc\Delta\theta$

$20 \times 4200 \times (90 - \theta) = 4 \times 4200 \times (\theta - 30)$

$\theta = 80°C$

10. (i) transformer

(ii) X – primary coil

Y – Iron core

Z – Secondary coil

11. (i) -reaction time; slippery of the road

(ii) -axes labelled
-scale 1cm to represent 5 units on the x axis, and 1cm to 10 units on the y axis
-correct plotting of points
-smooth curve correctly drawn, with an increasing gradient

(iii) 7.5m

(iv) -increases

(b) (i) -the degree of coldness or hotness of a body

(ii) 1. 1.0°C

2. 100°C

(iii) 35°C – 42°C

(iv) $Q = mc\Delta\theta$

$VIt = heat\ gained\ by\ aluminium + heat\ gained\ by\ brine$

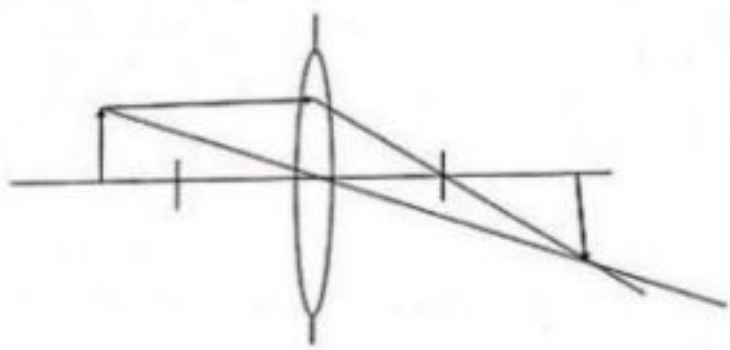
$5.00 \times 1.0 \times 450 = 0.1 \times 900 \times 7.5 \times c \times 7.5$

$\boldsymbol{heat\ capacity\ of\ brine = 4\,200 J/kg/k}$

---

12. (a) (i) -pass a ray of light on a converging lens.
-the rays appear to meet at a point
-measure the distance from the centre of converging lens to that point using a ruler.
-that's the focal length.

(ii)



(b) -place a bar magnet on a clean piece of paper
-take one plotting compass and place it at one end of the pole.
-make a mark at the tail of the compass arrow and at the tip of the compass arrow.
-move the plotting compass so that the tail of the arrow is on the point where the tip h been previously marked.
-repeat this procedure until a curve is drawn.

NB. A compass follows the magnetic field lines, with its north pointing to the magnet south.

---

13. (a) (i) -deflection of the galvanometer

(ii) -when the switch is closed, there is a change of magnetic flux cutting.

-Current/voltage is induced in the inner coil.

(iii) 1. –increase current or voltage

2. –decrease current or voltage

(b) (i) -when a filament is heated by a high potential difference supply, electrons are emitted
-they are accelerated by the anode and they pass through the slit.
-using Fleming's left hand rule, they move towards P due to the effect of the field produced by the magnet.

(ii) -more electrons will pass through the slit
-some electrons will go straight to the screen

Surname	Forename(s)	Centre Number	Candidate Number

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PHYSICS 5055/2

PAPER 2 Theory

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Section A

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Candidates are advised to show **all** working.

This question paper consists of 18 printed pages.

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Section A

*Answer **all** questions in this section.*

1 **Fig. 1.1** represents the motion of cyclists, **P** and **Q**, travelling along a straight path in the same direction.

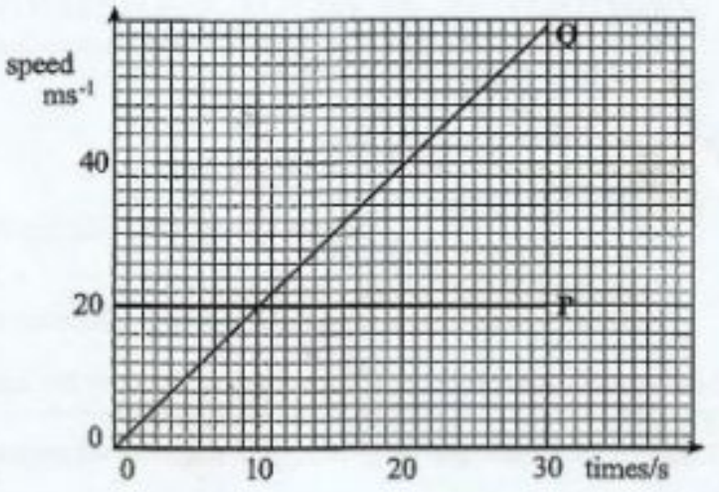

Fig. 1.1

(a) Calculate

(i) the distance travelled by **P** in the first 10 s,

distance = _____ [1]

(ii) the acceleration of **Q**,

acceleration = _____ [1]

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1 (a) (iii) the distance covered by **Q** in the first 10 s.

distance = _____ [1]

(b) **Q** catches up with **P** when the cyclists would have travelled the same distance from $t = 0$.

Calculate the

(i) speed of **Q** at the time of overtaking **P**,

speed = _____ [2]

(ii) time at which Q overtakes P,

time = _____ [1]

(iii) distance covered by each cyclist at this time.

distance = _____ [1]

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2 The sun produces energy from a nuclear fusion reaction.

(a) Explain what is meant by *nuclear fusion*.

_____

_____

_____ [2]

(b) State Einstein's mass-energy equivalence formula and define each symbol in it.

_____

_____

_____

_____ [2]

(c) Determine the decrease in the mass of the sun when it releases 1.8×10^6 J.

mass decrease = _____

[2]

3 Explain the following observations:

(i) the pressure inside a ball increases as air is pumped into it

_____

_____

_____ [2]

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3 (ii) the pressure in a ball decreases when the ball is left outside overnight

_____

_____

_____ [2]

4 Refraction of light occurs when it passes from one medium to another.

(a) (i) Explain the term *refraction*.

_____

_____

_____ [1]

(ii) State the condition in which light would pass through a boundary unrefracted?

_____

_____ [1]

Centre Number	Candidate Number

4 (b) **Fig. 4.1** shows wave fronts of light incident on a water-glass boundary.

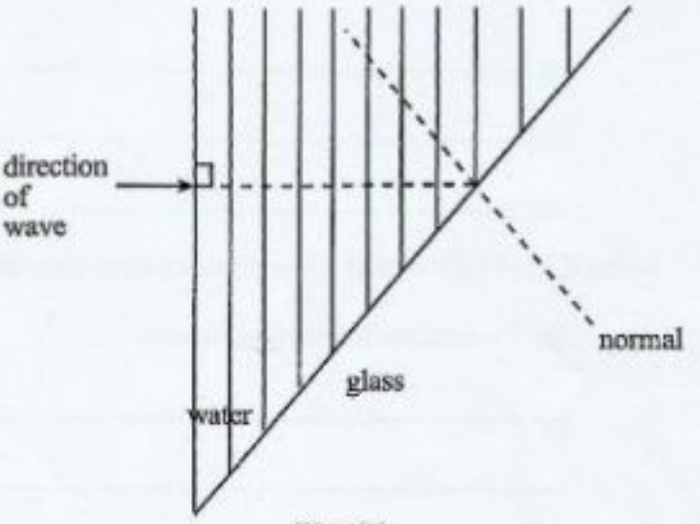

Fig. 4.1

Complete the diagram to show the wave fronts and the direction of travel in the glass block. [3]

5 (a) A light bulb is labelled 240 V; 60 W.

Calculate the

(i) current that flows through the bulb when it is on,

current = _____ [1]

(ii) charge that flows through the bulb in one minute,

charge = _____ [2]

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Centre Number	Candidate Number

5 (a) (iii) resistance of the bulb.

resistance = _____ [1]

(b) Three bulbs similar to those in (a) are then connected as shown in **Fig. 5.1**.

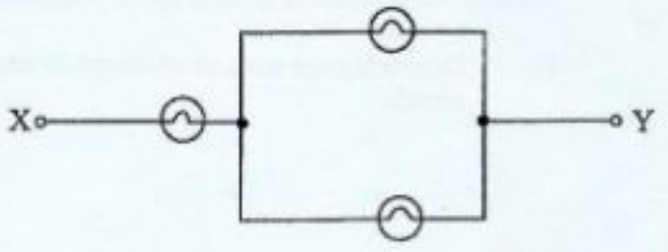

Fig. 5.1

Calculate the resistance between points X and Y.

resistance = _____ [2]

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6 (a) State

(i) any **three** effects of electricity,

1. _____

2. _____

3. _____ [3]

(ii) the commercial unit of electrical energy.

_____ [1]

(b) A 2 000 W electric kettle was used three times daily to boil a fixed mass of water. It takes an average of 5 minutes to boil the water.

(i) Determine the amount of electrical energy used in a 30 day month.

amount = _____ [2]

(ii) Calculate the cost of using the kettle per month if the cost per unit is 10 c.

cost = _____ [1]

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7 **Fig. 7.1** shows a current-voltage graph for an electronic device.

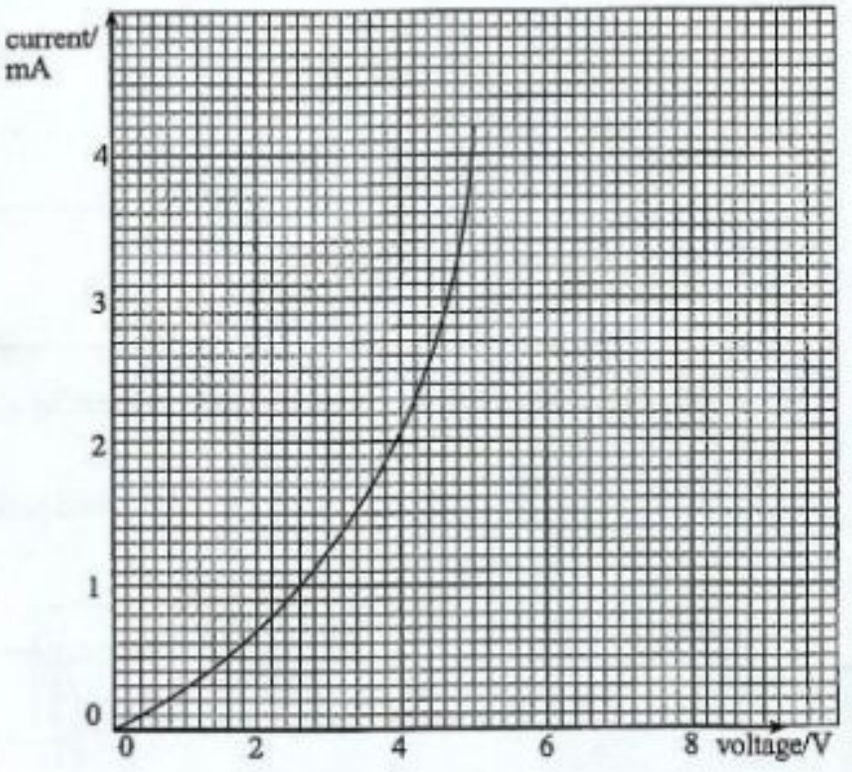

Fig. 7.1

(a) Comment on the resistance of the device.

_____

_____ [1]

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7 (b) Calculate the resistance of the device when the voltage is 4.8 V.

resistance _____ [2]

(c) Suggest a suitable identity of this device.

_____ [1]

8 **Fig. 8.1** and **Fig. 8.2** show a burglar alarm operated by a reed switch.

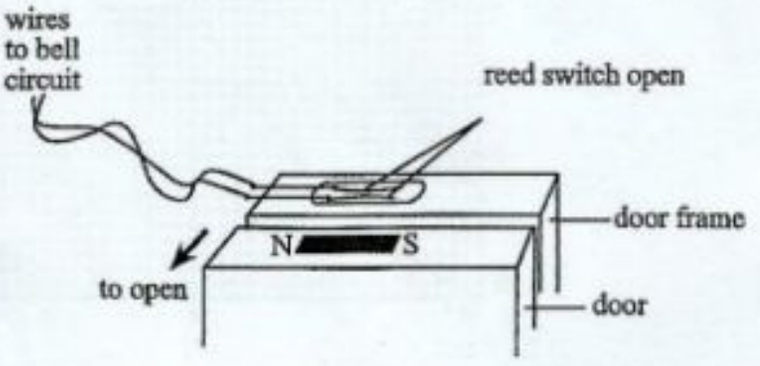

Fig. 8.1

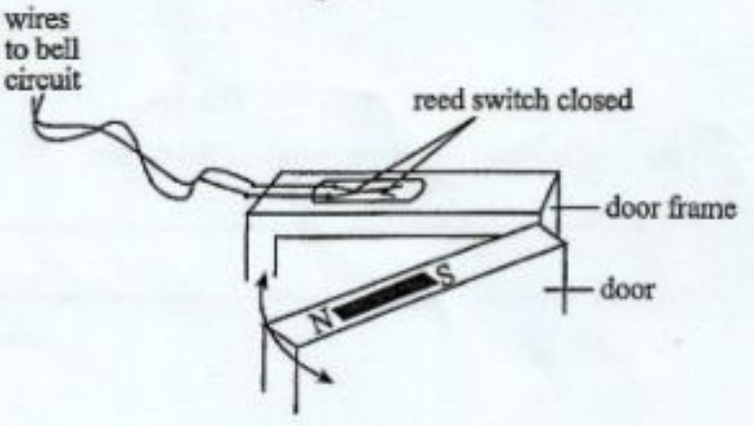

Fig. 8.2

(a) Name the material used to make reeds.

_____ [1]

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8 (b) Explain

(i) why the reed switch contacts are open in **Fig. 8.1**.

_____

_____ [2]

(ii) how, by opening the door, the burglar alarm is activated.

_____

_____

_____ [3]

Centre Number	Candidate Number

Section B

*Answer any **two** questions from this section.*

9 (a) (i) Draw a ray diagram to illustrate the formation of a virtual image of an object by a thin converging lens. Mark optical centre, C, and the principal focus, F, of the lens.

[3]

(ii) Name, with a reason, an instrument that makes use of such an arrangement.

_____

_____ [2]

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Centre Number	Candidate Number

9 **(b)** Describe an experiment to determine the speed of sound in air.

_____

_____

_____

_____

_____

_____

_____ [5]

(c) A fishing boat using sonar to detect a shoal of fish emits a short pulse of sound and detects the echo from the shoal 0.1 s later. The sound travels through sea water at 1 500 ms^{-1}.

(i) Calculate the depth of the shoal of fish.

depth = _____ [2]

(ii) Suggest a reason why several echoes are detected.

_____

_____

_____ [1]

(iii) State **two** changes that would be observed when the sonar emits sound of lower amplitude and higher frequency.

_____

_____ [2]

Centre Number	Candidate Number

10 (a) State the charge and nature of each of the **three** types of emission from radioactive sources.

[6]

(b) A radioactive radium isotope of half-life 15 days, decays to an isotope of actinium as follows:

$$^{225}_{88}\text{Ra} \rightarrow ^{225}_{89}\text{Ac} + \text{X}$$

(i) Name the particle **X** and state the proton and nucleon numbers of the actinium isotope.

[3]

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Centre Number	Candidate Number

10 (b) (ii) Sketch a decay curve for a sample of the radium isotope, with N atoms, over a period of 60 days.

[3]

(iii) State the fraction of N left at the end of the 60 days.

fraction = _____ [1]

(c) State **two** reasons why iodine-131, a beta-emitter with a half life of 2 hours, is used for medical purposes.

_____

_____ [2]

Centre Number	Candidate Number

11 **(a)** **(i)** In an experiment to investigate the behaviour of a spring under a force, the following measurements were obtained.

mass hung from spring (g)	0	100	200	300	400	500	600	700	800
stretching force (N)									
length of spring (mm)	60	72	84	96	108	120	132	150	180
extension (mm)									

Complete the table. [4]

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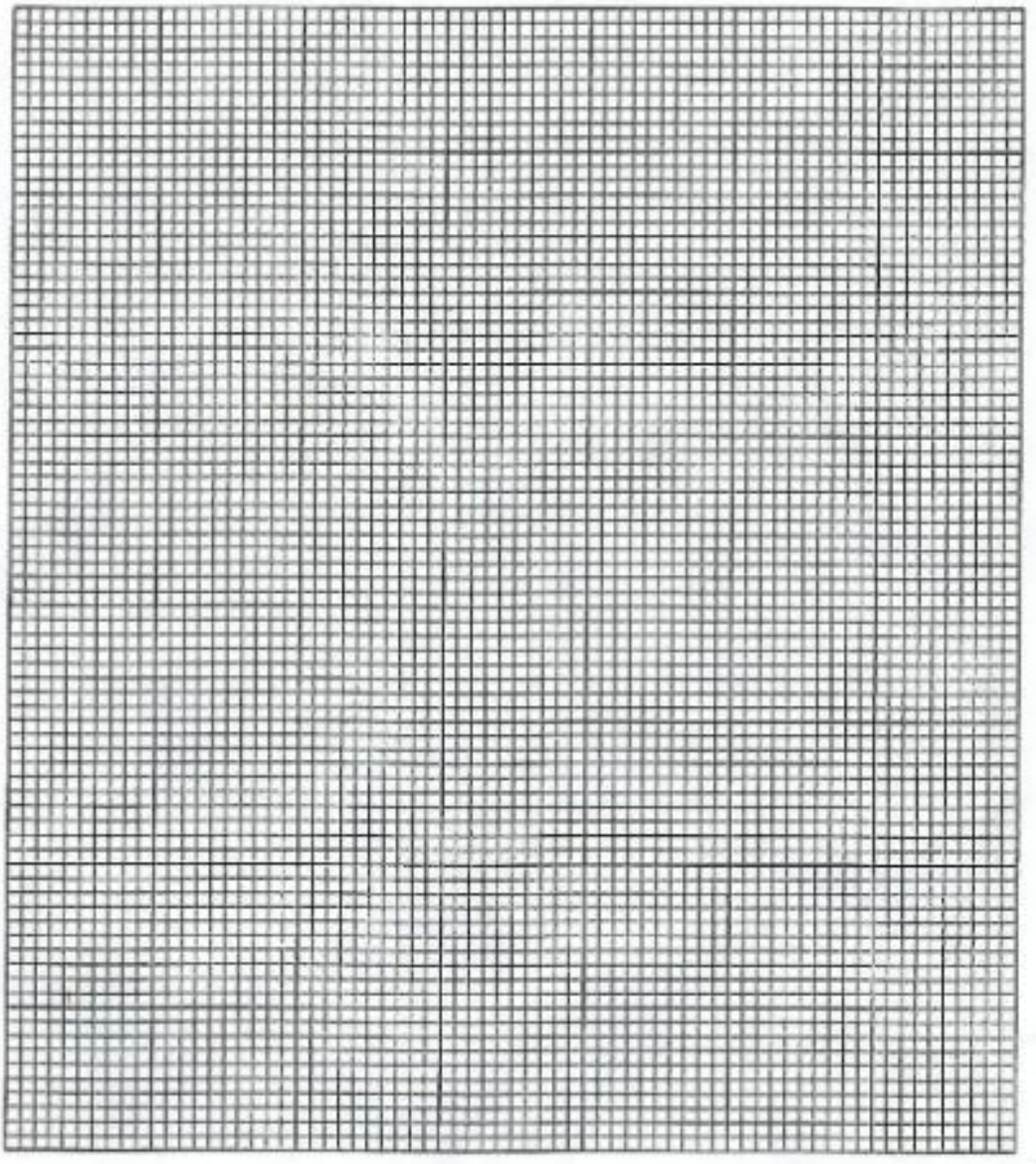
Centre Number	Candidate Number

11 (a) (ii) Plot a graph of stretching force against extension.



[4]

(iii) Indicate, with a letter E on the graph, the limit of proportionality. [1]

Centre Number	Candidate Number

11 (a) (iv) Deduce the relation between stretching force and extension of the string.

_____

_____ [2]

(v) Suggest a value for the length of the spring after all the masses have been removed.

_____

_____ [1]

(b) State the property on which each thermometer depends.

(i) a liquid-in-glass thermometer _____

(ii) a thermocouple thermometer _____

[2]

(c) Give **one** advantage of a thermocouple thermometer over a liquid-in-glass thermometer.

_____

_____ [1]

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ZIMBABWE SCHOOL EXAMINATION COUNCIL

General Certificate of Education Ordinary Level

EXPECTED ANSWERS

NOVEMBER 2016

PHYSICS **4023/2**

1. (a) (i) $Distance = 10 \times 20 = 200m$

(ii) $a = \frac{v-u}{t} = \frac{20}{10}$

$= 2ms^{-2}$

(iii) $= \frac{1}{2} \times 20 \times 10 = 100m$

(b) (i) $Distance\ travelled\ by\ P = 20 \times t = 20t$

$Distance\ travelled\ by\ Q = \frac{1}{2} \times bh$

$= \frac{1}{2} t \times v$

$but\ \frac{1}{2} t \times v = 20t$

$\boldsymbol{v = 20m/s}$

(iii) $20 \times 20 = 400m$

---

2. (a) -the joining of two unstable nuclei to form a stable nucleus.

(b) $\boldsymbol{E = mc^2}$ where $\boldsymbol{E}$ is the energy, $\boldsymbol{m}$ is the mass and $\boldsymbol{c}$ is the speed of light in a vacuum.

(c) $m = \frac{1.8 \times 10^9}{(3 \times 10^8)^2}$

$\boldsymbol{= 2 \times 10^{-11} kg}$

---

3. (i) -the force exerted by air molecules per unit area increases.
-number of air molecules increases
-number of collisions per unit area increases

(ii) -temperature decreases, therefore the rate of collision of particles inside the ball increases

---

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$= \frac{1}{2} t \times v$

$but\ \frac{1}{2} t \times v = 20t$

$\boldsymbol{v = 20m/s}$

(iii) $20 \times 20 = 400m$

---

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---

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-number of air molecules increases
-number of collisions per unit area increases

(ii) -temperature decreases, therefore the rate of collision of particles inside the ball increases.

---

4. (a) (i) -the bending of light as it passes through different medium of different optical density.

(ii) -when the boundary has the same refractive index, or passes through the normal

(b) -Ray drawn at right angle to the wave fronts
-Ray moves towards the normal
-wave fronts must be close together

---

5. (a) (i) $P = IV$

$I = \frac{60}{240}$

$= \mathbf{0.25A}$

(ii) $Q = It$

$= 0.25 \times 60$

$= \mathbf{15C}$

(iii) $P = \frac{V^2}{R}$

$= \frac{240^2}{60}$

$= \mathbf{960\Omega}$

(b) $Effective\ resistance = 960 + \frac{960 \times 960}{960+9}$

$= \mathbf{1\,440\Omega}$

---

6. (a) (i) 1. Heating
2. Lighting
3. Magnetic

(ii) Kilowatt hour

(b) (i) $E = Pt$

$= 2\,000 \times \frac{5 \times 3 \times 30}{60}$

$= 15\ KWhr$

(ii) $15\ KWhr \times 10\ cents$

=$1.50

---

7. (a) (i) -Resistance is not constant, it increases with an increase in voltage

(ii) -Draw a tangent at $V = 4.8v$

$R = \frac{4.8-3.4}{3.2mA - .4mA}$

$= 500\Omega$

---

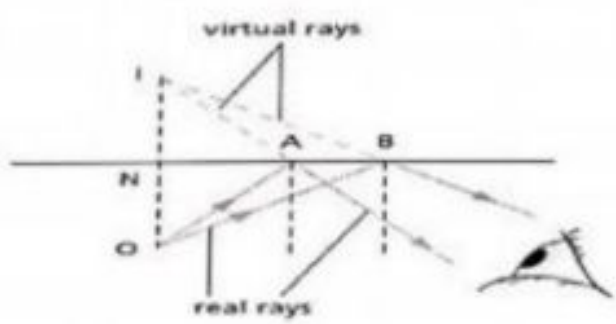
8. (a) -metal reeds/soft iron

(b) (ii) -the metal reeds repel each other because of the presence of the magnetic field

(iii) -when the door is opened, the reeds attract each other thereby completing the circuit.

---

9. (a) (i)



(ii) -Magnifying glass, to form an enlarged object

(b) -two pupils to stand at the same distance from a very big wall e.g 100m from the wall.
-the pupils must stand at opposite sides.
-One of them claps hands and immediately upon hearing the sound the other student starts the stop watch.
-the stopwatch is stopped after hearing the sound of an echo from the wall.

$$speed = \frac{2 \times distance}{time}$$

(c) (i)

$$s = \frac{2 \times d}{t}$$

$$d = \frac{1\,500 \times 0.1}{2}$$

$$= \mathbf{75m}$$

---

10. (a) -Alpha – helium nucleus, positively charged
-Beta – an electron, negatively charged
-Gamma – electromagnetic radiation, neutral

(b) (i) - X is a Beta particle

$$- Proton\ number = 89, Nucleon\ Number = 225$$

(ii) - correct shape of a decay curve

-X axes clearly labelled and time marked from 0, 15, 30, 45 and 60

-Y axes labelled and number of atoms N marked: N, $\frac{N}{2}, \frac{N}{4}, \frac{N}{8}, \frac{N}{16}$ corresponding to 0, 15, 30, 45 and 60

(iii) $fraction = \frac{1}{16}$

(c) -heals the patient fast, it is quickly removed from the body.

(a) (i)

Mass/g	0	100	200	300	400	500	600	700	800
Force/N	0	1	2	3	4	5	6	7	8
Length/mm	60	72	84	96	108	120	132	150	180
Extension/mm	0	12	24	36	48	60	72	90	120

(ii) -Labelled axis
-good scale Y axis 1cm to represent 1N, x-axis 1cm to represent 20mm
-correct plotting
-correct shape of the graph, straight from 0 to 72mm and curve from 72mm to 120mm

(iii) -E marked at 72mm

(iv) -Force is directly proportional to extension from 0mm to 72mm. And after 72mm it is not directly proportional to the extension.
-a small increase in force gives a greater increase in extension.

(b) (i) -length of liquid column

(ii) -potential difference between the two junctions

(c) -is more sensitive
-can measure rapidly changing temperature
-can measure a wider ranger

Surname	Forename(s)	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

PHYSICS 5055/2

PAPER 2 Theory

NOVEMBER 2017 SESSION 1 hour 45 minutes

Candidates answer on the question paper.
Additional materials: Electronic calculator and/or Mathematical table
Graph paper

Allow candidates 5 minutes to count pages before the examination

This booklet should not be punched or stapled and pages should not be removed.

TIME 1 hour 45 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and Centre number and candidate number on top of the right corner of every page of this paper.
Check if the booklet has all the pages and ask the invigilator for a replacement if there are duplicate or missing pages.

Section A

Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B

Answer any **two** questions.
Write your answers on the spaces provided on the question paper.
Do not fasten the booklet

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
Candidates are reminded that **all** quantitative answers should include appropriate units.
Candidates are advised to show **all** their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

This question paper consists of 20 printed pages.

[Turn over

Centre Number	Candidate Number

Section A

*Answer **all** questions from this section.*

1 (a) **Fig. 1.1** shows one of the basic laboratory instrument.

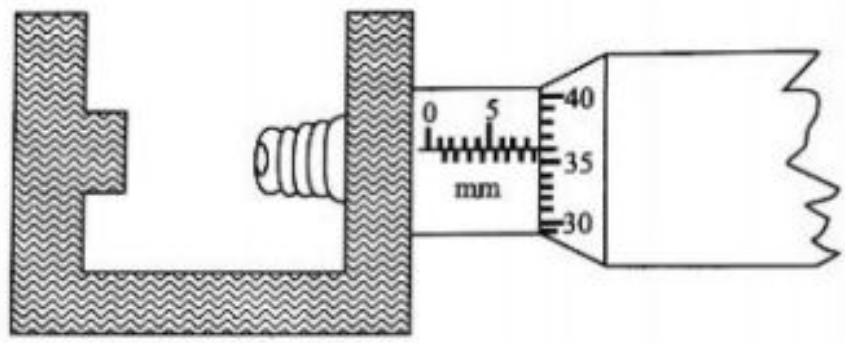


Fig. 1.1

(i) Name the instrument, and state its use.

Name: _____

Use: _____

_____ [2]

(ii) State the reading shown in **Fig. 1.1**.

_____ [1]

(iii) Give any **one** precaution that should be taken when using this instrument.

_____

_____ [1]

[Total: 4]

Centre Number	Candidate Number

2 **Fig. 2.1** shows a velocity-time graph for a ball which was rolled up a uniform slope.

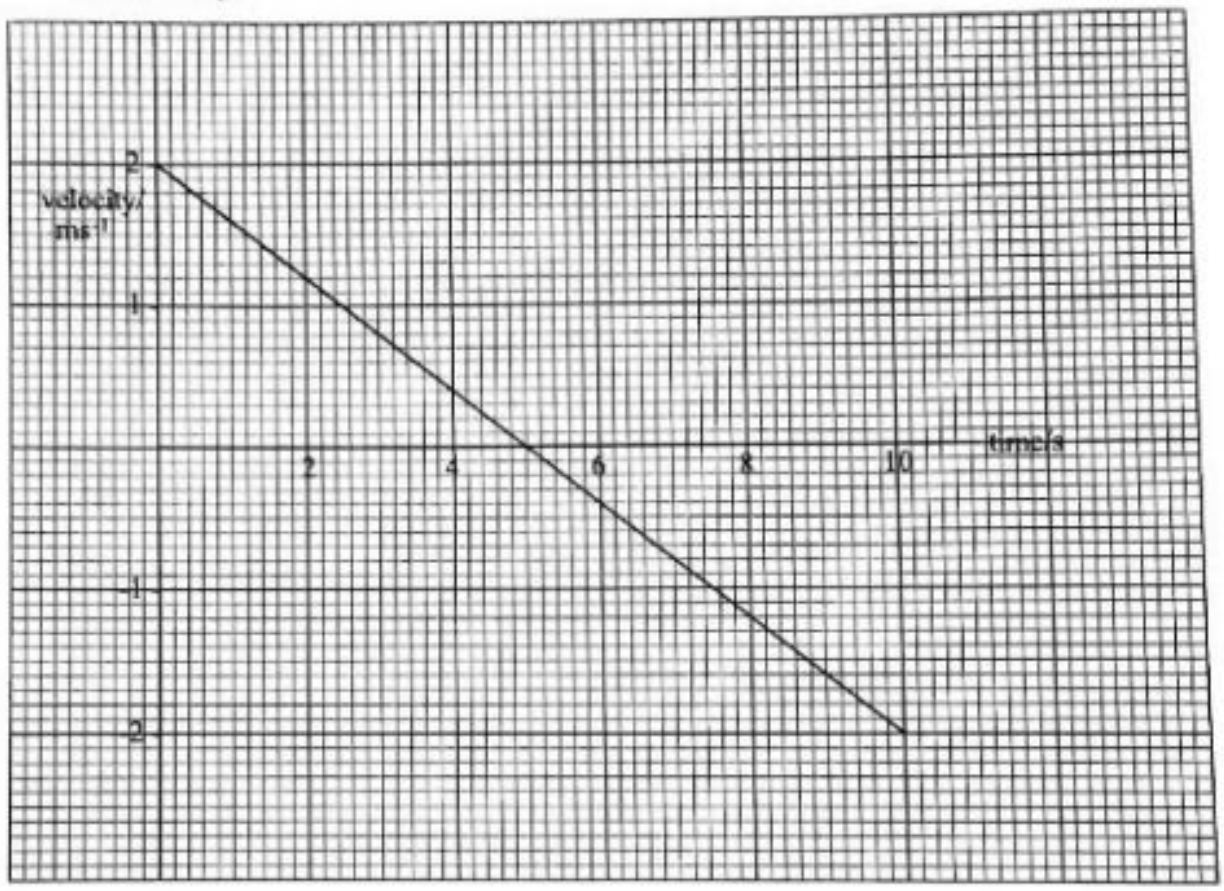


Fig. 2.1

(i) Determine the distance moved by the ball in 5 seconds.

distance = _____ [2]

(ii) State the velocity of the ball after 8 seconds.

_____ [1]

[Turn over

Centre Number	Candidate Number

2 (iii) Determine the displacement of the ball after 10 seconds.

_____

_____ [1]

(iv) Calculate the acceleration of the ball.

acceleration = _____ [2]

[Total: 6]

3 (a) **Table 3.1** shows base quantities and their SI units.

Table 3.1

base quantity	**S1 unit**
length	metre
temperature	
	ampere

Complete **Table 3.1**. [2]

(b) State the S1 unit of

1. volume, _____

2. density. _____

[2]

[Total: 4]

Centre Number	Candidate Number

4 A girl lifts a bucket full of water from a well at a steady speed, using a pulley as shown in **Fig. 4.1**.

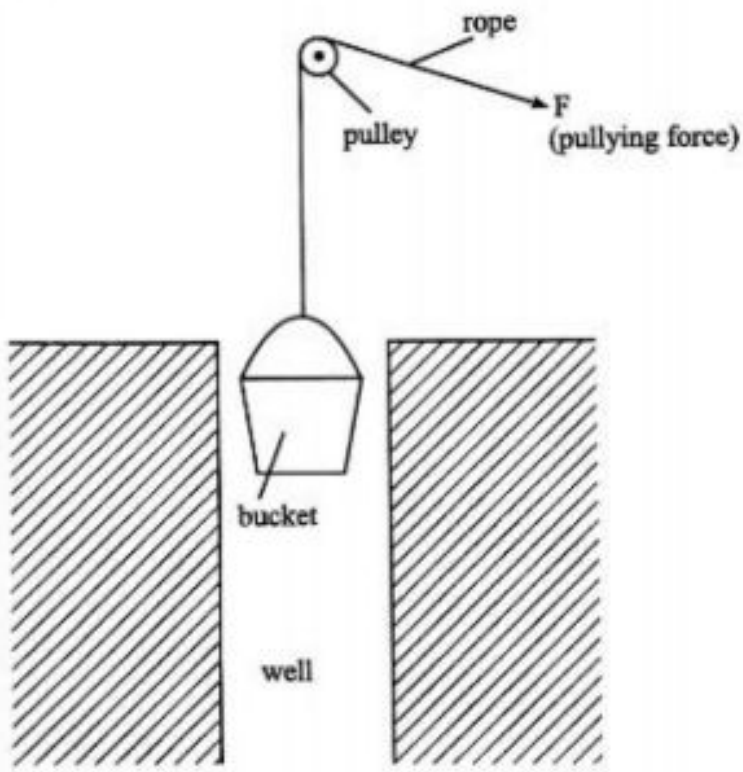


Fig. 4.1

The mass of the bucket and the water is 15 kg. The force, F, applied by the girl is 160 N.

(a) Determine the weight of the bucket and water given that $g = 10$ N/kg.

weight = _____ N [2]

(b) The bucket is raised through a height of 6 m.

(i) State the type of energy gained by the bucket.

_____ [1]

Centre Number	Candidate Number

4 (b) (ii) Calculate the work done by the girl.

work done = _____ J [2]

[Total: 5]

5 (a) State Newton's third Law of Motion.

_____

_____ [1]

(b) **Fig. 5.1** shows a uniform bar of length 10 m in equilibrium.

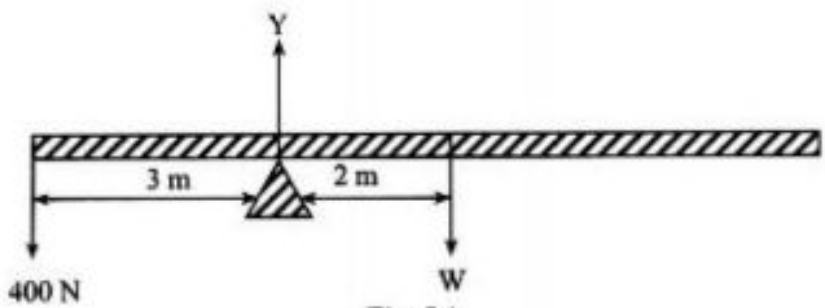


Fig. 5.1

Calculate the

(i) weight, W, of the bar

W = _____ [2]

(ii) force, Y, which the pivot exerts on the bar.

Y = _____ [1]

[Total: 4]

Centre Number	Candidate Number

6 **(a)** Define the term *pressure*.

_____

_____ [1]

(b) **Fig. 6.1** shows a water manometer used to measure the pressure of a gas.

(The density of water is 1 000 kg/m^3 and g = 10 ms^{-2}).

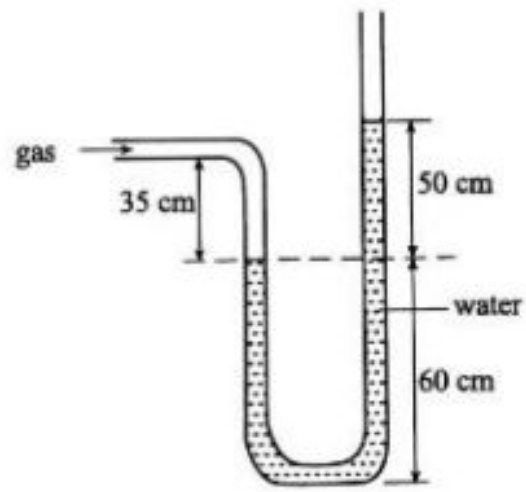


Fig. 6.1

Calculate the pressure of the gas if atmospheric pressure is 1.01×10^5 Pa.

[3]
[Total: 4]

Centre Number	Candidate Number

7 A balloon was rubbed against a wall and it became negatively charged as shown in **Fig. 7.1**.

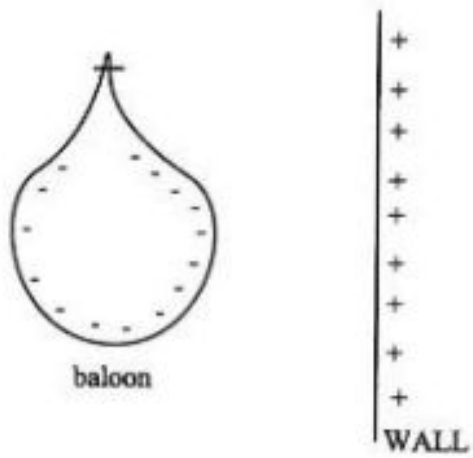


Fig. 7.1

(a) Draw on **Fig. 7.1** the electric field line pattern between the balloon and the wall. [2]

(b) **(i)** Explain, in terms of movement of electrons, how the wall and the balloon become charged.

_____

_____ [1]

(ii) Give a reason why the balloon would stick to the wall.

_____

_____ [1]

(iii) Explain why the balloon would drop after a short time.

_____

_____ [1]

[Total: 5]

Centre Number	Candidate Number

8 **Fig. 8.1** shows cross-sections of two conductors A and B. Conductor A carries current into the plane of the paper and conductor B carries current out.

Fig. 8.1

(a) **(i)** Draw **two** arrows to show the directions of the forces of interaction between the **two** currents. [1]

(ii) Name the type of field of force around the conductors A and B.

_____ [1]

(b) State **two** ways of increasing the sizes of the forces in **(a)(i)**.

1. _____

2. _____

[2]

[Total: 4]

Centre Number	Candidate Number

9 (a) Explain the term *thermionic emission*.

_____

_____

_____ [1]

(b) **Fig. 9.1** shows an electron beam entering into a magnetic field.

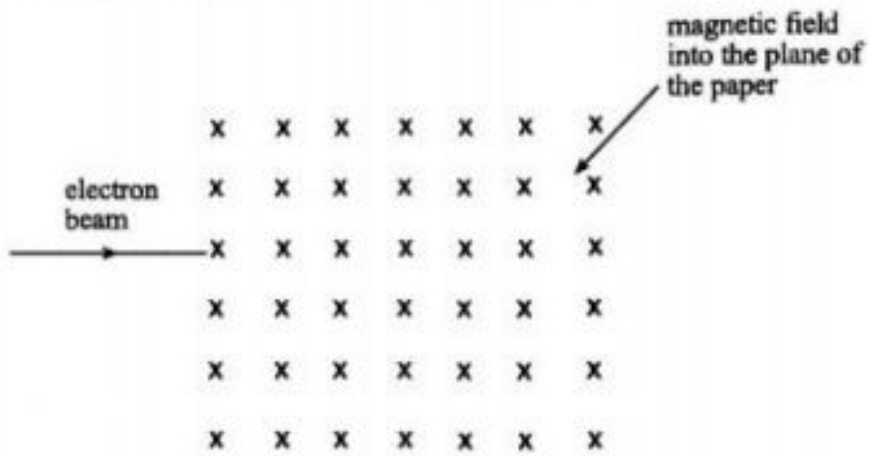


Fig. 9.1

(i) Complete the diagram to show the path of the electron beam. [1]

Centre Number	Candidate Number

9 (b) **Table. 9.1** shows values of colour codes of carbon resistors.

Table 9.1

0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Violet
8	Grey
9	White

Fig. 9.2 shows a colour coded carbon resistor.

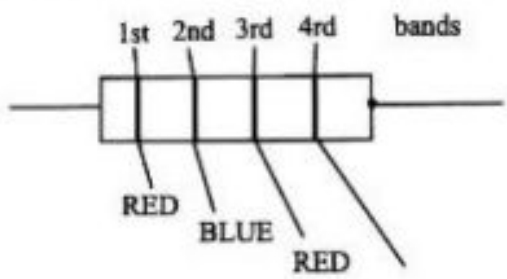


Fig. 9.2

Determine the value of the resistance of the resistor.

_____

_____ [2]

[Total: 4]

10 (a) **Fig. 10.1** shows a logic gate.

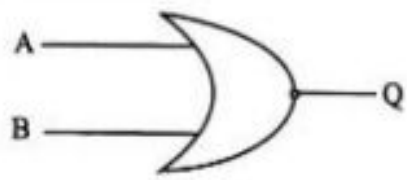


Fig. 10.1

(i) Name the logic gate.

_____ [1]

Centre Number	Candidate Number

10 (a) (ii) Construct its truth table.

[2]

(b) **Fig. 10.2** shows a circuit diagram which functions as a logic gate. The switches function as inputs and the bulb is the output.

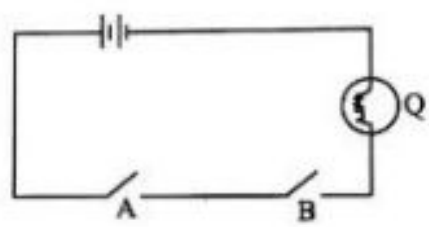


Fig. 10.2

(i) Complete the truth table in **Table 10.1**.

Table 10.1

A	B	Q
0	0	
0	1	
1	0	
1	1	

[1]

(ii) Name a logic gate which functions as the circuit.

_____ [1]

[Total: 5]

Centre Number	Candidate Number

Section B

*Answer any **two** questions from this section.*

11 (a) **Fig. 11.1** shows a car travelling at 20 m/s on a level road. It has to overcome a total resistive force of 400 N.

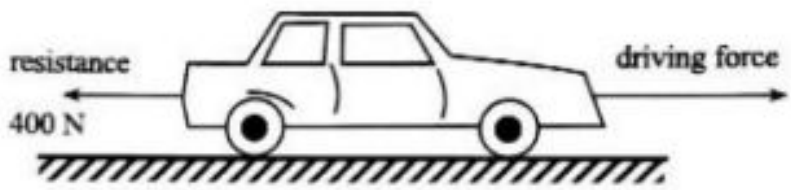


Fig. 11.1

(i) State the value of the driving force produced by the engine in order to maintain a steady speed of 20 m/s.

_____ [1]

(ii) Suggest **two** examples of resistive forces acting on the car.

1. _____

2. _____

[2]

11 (b) While travelling on the level road at 20 m/s, the car then decelerates uniformly to rest in 50 s. The mass of the car is 1 000 kg.

(i) Calculate the deceleration of the car.

deceleration = _____ [2]

(ii) Determine the retarding force on the car.

retarding force = _____ [1]

(iii) Explain why the car speeds up as it moves down hill, even though the engine thrust remains unchanged.

_____

_____ [1]

(c) A mass of water was heated in a vessel with an immersion heater of 40 W. The heat produced was used to boil the water for 120 s and the mass decreased by 0.002 kg.

(i) State one assumption necessary in order to calculate the specific latent heat of vaporisation of water.

_____ [1]

(ii) Write a formula which relates energy to power.

_____ [1]

11 (c) (iii) Calculate the energy supplied by the heater during a time of 120 s.

energy supplied = _____ [2]

(iv) Hence, calculate the specific latent heat of vaporisation of water.

latent heat of vaporisation = _____ [2]

(v) Give a reason why the value calculated in part (iv) is greater than the actual one.

_____ [1]

(vi) Give a reason why water is used as a coolant in car radiators.

_____ [1]

[Total: 15]

Centre Number	Candidate Number

12 (a) (i) Gamma rays, ultra-violet rays and X-rays are components of the electromagnetic spectrum.

1. List the components in their order of increasing wavelength.

_____

2. State **one** use of each component.

X-ray:

_____

Ultra-violet rays:

_____

_____

Gamma rays:

_____

3. Give **one** danger associated with over exposure to X-rays.

_____ [5]

(ii) Distinguish between real and virtual images.

_____

_____

_____ [2]

Centre Number	Candidate Number

12 (b) (i) Sketch the magnetic field line pattern between two like poles of a bar magnet.

[3]

(ii) **Fig. 12.1** shows an electrical circuit.

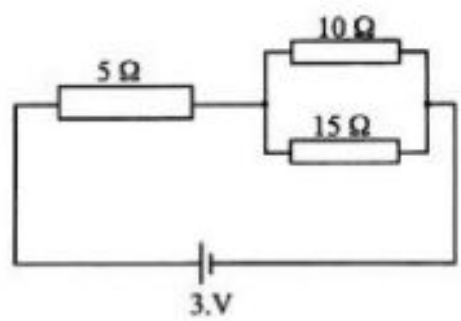


Fig. 12.1

1. Determine the effective resistance in the circuit.

effective resistance = _____

Centre Number	Candidate Number

12 (b) (ii) 2. Calculate the potential difference across the 15 Ω resistor.

potential difference = _____

[5]

[Total: 15]

13 **Fig. 13.1** shows a simple transformer.

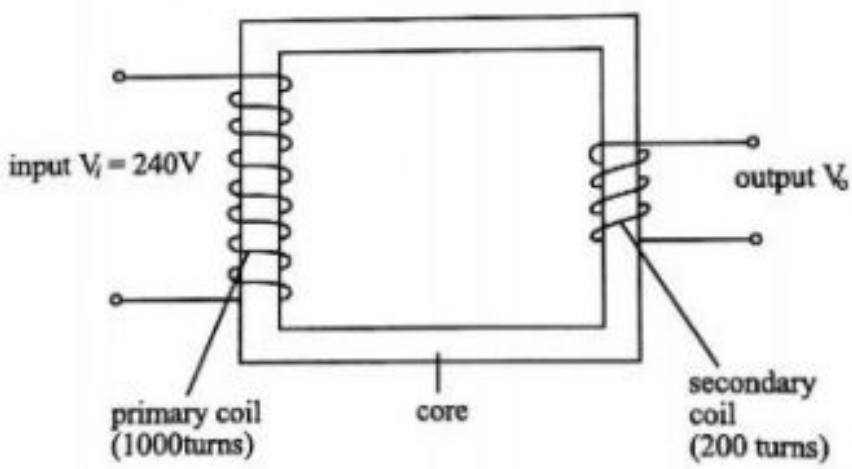


Fig. 13.1

(a) (i) Identify, with a reason, the type of transformer shown.

_____

_____ [2]

13 (a) (ii) State a suitable material for making the core of the transformer.

_____ [1]

(iii) Calculate the output voltage of the transformer if it is 100% efficient.

voltage = _____ [2]

(iv) State any **two** causes of energy losses in a real transformer.

1. _____

2. _____ [2]

(v) State any **two** ways of reducing the energy losses.

1. _____

2. _____ [2]

(b) **Fig. 13.2** represents an alarm system.

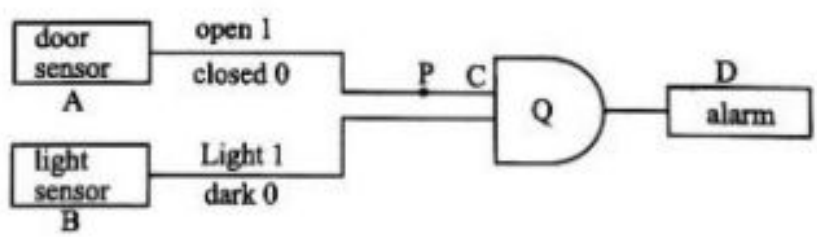


Fig. 13.2

(i) Identify the component Q.

_____ [1]

Centre Number	Candidate Number

13 (b) (ii) State **two** conditions necessary for the alarm to sound.

1. _____

2. _____ [2]

(iii) Complete the truth table for the alarm system in **Fig. 13.2** with a NOT gate at P.

A	B	C	D
0	0		
0	1		
1	0		
1	1		

[2]

(iv) Deduce the effect of putting the NOT gate at P.

_____

_____ [1]

[Total: 15]

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2017

PHYSICS **5055/2**

1 (a) (i) micrometer (screw gauge) reject micrometre. [1]
to measure small lengths/AW reject screw gauge. [1]

(ii) 8.5 + 0.36 mm = 8.86 mm [1]

(iii) wipe the ends of spindle and anvil/note the zero error (add or subtract) [1]
use the ratchet to avoid over tightening.

2 (i) distance = Area undergraph /

$= \frac{1}{2} \times 2 \times 5 = 5$ m · [2]

(ii) V = −1.20 ms^{-1} [1]

(iii) displacement = 0 (m); [1]

(iv) a = gradient $\left| \frac{-2-2}{10} = \frac{-4}{10} \right| = -0.4$ ms^{-2} reject T for t in formula. [2]

3 (a) [2]

Base quantity	SI unit
Temperature	kelvin
current	ampere

reject symbols.

(b) 1. Volume → m^3 .

2. density → kg m^{-3} accept words [2]

4 (a) W = mg | 15 × 10; = 150 N [2]

(b) (i) Gravitational potential energy [1]

(ii) W = Fd | 160 × 6 (1); = 960 J (1) 0,96kJ. [2]

5 (a) Newton's 3rd law Action and reaction are always opposite and equal | [1]

(b) (i) W × 2 = 400 × 3; | Clockwise = anticlockwise

W = 200 × 3 = 600 N ; [2]

(ii) Y = 400 + 600 N = | 1 000 N [1]

Allow error carried fowurd.

6 (a) Force per unit area [1] Pressure = force / Area = F/A (terms defined) 3

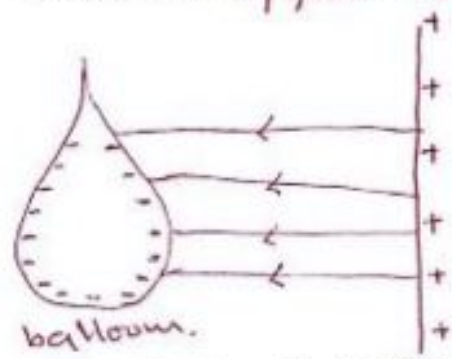
(b) gas pressure = $\rho gh + P_{atm}$ (C1) reject over/on.

= $1\,000 \times 10 \times 0.5 + 1.01 \times 10^5$ Pa (1) Liquid pressure (1) 5000 addition (1) answer (1)

= 5 000 + 101 000 (1)

= 106 000 Pa (1) (1) / $1,06 \times 10^{+5}$ reject gas pressure = ρgh [3]

7 (a)



[2]

(b) (i) electrons are transferred from the wall to the balloon. [1]

(ii) unlike charges attract / +ve and -ve attract [1]

(iii) charges neutralise / AW [1]

8 (a) (i)

[1]

(ii) magnetic field [1]

(b) increase size of current; reduce the distance between the currents carrying coils / factors [2]

9 (a) Emission of electrons from a hot metal / filament [1]

(b) (i)

[1]

(ii) (1) (1) 2 600 Ω reject Ω with wrong [2]

10 (a) (i) NOR (gate) (1) [1]

(ii)

A	B	Q
0	0	1
1	0	0
0	1	0
1	1	0

[2]

(b) (i)

A	B	Q
0	0	0
0	1	0
1	0	0
1	1	1

[1]

(ii) AND (gate) [1]

11 (a) (i) 400 N [1]

(ii) friction; air resistance / drag force [2]

(b) (i) $a = \frac{v-u}{t}$ / $\frac{0-20}{50}$; / $-0.4 m/s^2$ [2]

deceleration = $0.4\ m/s^2$

or deceleration = $\frac{20-0}{50} = 0.4 m/s^2$ reject $-0.4\ m/s^2$

(ii) F = ma = $(1\,000 \times 0.4) = 400$ N (1) accep -400 [1]

(iii) Gravitational force increases the resultant force/Aw / Pe changed to Ke. [1]

(c) (i) Heat supplied = Heat absorbed / no heat loss. [1]
(by heater) (by water)

(ii) $Q = Pt$ [1]
$E = Pt$.

(iii) $Q = 40 \times 120$ (1); $= 4\,800$ J ; [2]

(iv) Q = ml = 4 800 J = 0.002 × L; [2]

⇒ L = 2 400 000 J/kg / 2,4 × 10⁶ J/kg / 2,4 × 10³ kJ/kg.

(v) Energy supplied is greater than energy absorbed/There are energy losses. [1]

(vi) Water has a high specific heat capacity/AW [1]

12 (a) (i) 1. Gamma - X-rays – uv [1]

2. Gamma - ~~detect leaks/flows~~
- detect thickness (monitor) (medical purposes) max [1]
- Radiotherapy / destroying cancer cells
- sterilisation etc ~~Kill cancers~~ (imaging)

X-rays - radiography / detect fractures / imaging
- sterilisation etc (medical purposes) max [1]

UV - vitamin D manufacture/~~sun~~
- fluorescent plants ~~photosynthesis~~
- sterilisation max [1]

3. X-ray exposure - sterilisation / infertility (checking fating fake notes)
- cancer
- damage cells / burns max [1]

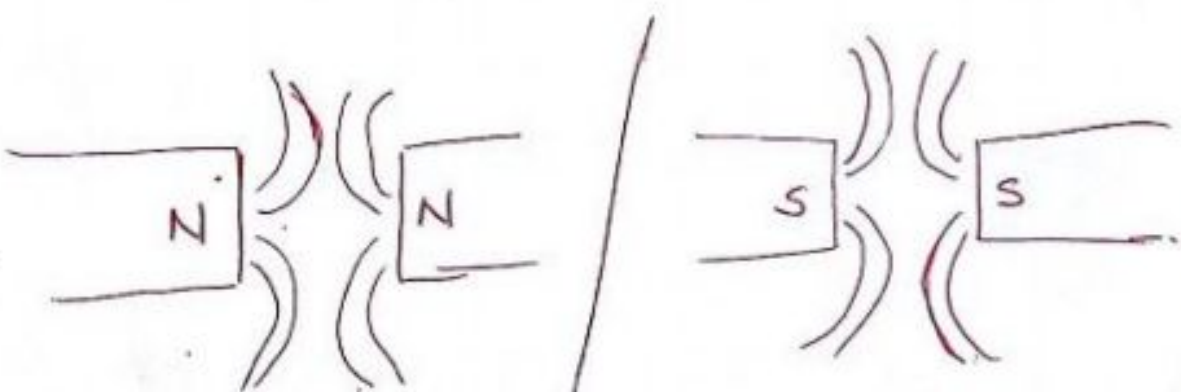
(ii) real can be formed on the screen/virtual cannot / [2]
real image is inverted/virtual are inverted (1) Causes eye cataracts.
Light passes through real image; but cannot on on virtual. (1)

(b) (i) correct sketch [3]

(ii) 1. $RT = 5\Omega + \frac{10 \times 15}{10+15} = 11\Omega$ [2] (1) / $= \frac{10 \times 15}{10+15}$ [1] / $= 5 + 6$ [1] / $= 11\Omega$ [1] [3]

2. $V = \frac{6}{11} \times 3$

$= 1.64\ V$ / Carry forward error. allow use of current. [2]



Poles
Pattern
direction.

Reject crossing lines

13 (a) (i) step down [1]

less turns in secondary coil/more turns on primary [1]

(ii) (soft) iron [1]

(iii) $\frac{V_o}{V_i} = \frac{200}{1000}$ (1) $\Big/ V_o = \frac{200}{1000} \times \frac{240}{1}$;

$\Rightarrow$ Vo = 48 V (1) [2]

(iv) Eddy currents/loss of field lines/ magnetic field leakage/flux leakage. Resistance/heating effect of current / heating effect of current in coils hysteresis loss. [Max 2] [2]

(v) Any two use thicker wires; wind coils one on top of heater. use better conductor; wind coils close to each other. use laminated core [2]

(b) (i) AND (gate) (1) [1]

(ii) (door) open; light (on) [2]

(iii)

C	D
1	0
1	1
0	0
0	0

[2]

(iv) door closed (light on) (1) alarm sounds / door open alarm not sound [1]

Surname	Forename(s)	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

PHYSICS 4023/2

PAPER 2 Theory

NOVEMBER 2018 SESSION 2 hour 15 minutes

Candidates answer on the question paper.
Additional materials: Electronic calculator

Allow candidates 5 minutes to count pages before the examination

This booklet should not be punched or stapled and pages should not be removed.

TIME 2 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page and Centre number and candidate number on top of the right corner of every page of this paper.
Check if the booklet has all the pages and ask the invigilator for a replacement if there are duplicate or missing pages.

Section A

Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B

Answer any **three** questions.
Write your answers on the spaces provided on the question paper
Do not fasten the booklet

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question paper.
Candidates are reminded that **all** quantitative answers should include appropriate units.
Candidates are advised to show **all** their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

This question paper consists of 21 printed pages and 3 blank pages.

Centre Number	Candidate Number

Section A

*Answer **all** questions from this section.*

1 (a) (i) Define *density*.

_____

_____ [1]

(b) **Fig. 1.1** shows apparatus used to measure the densities of an irregular stone and cork.

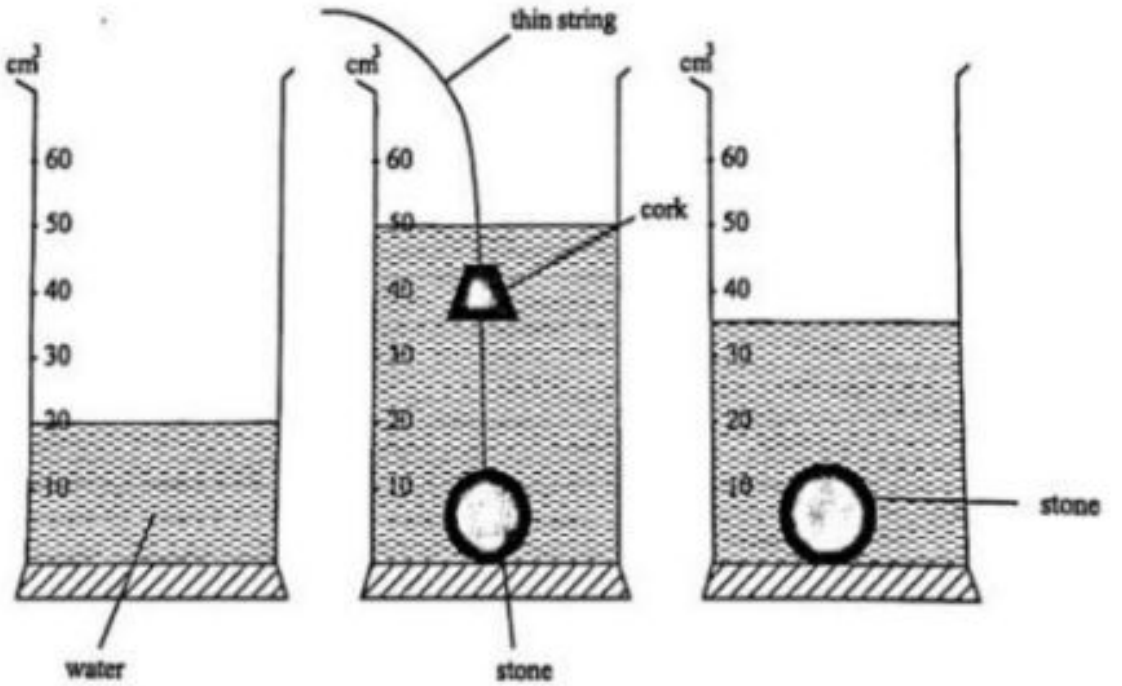


Fig. 1.1

The mass of the stone is 20 g and the mass of the cork is 5 g.

Determine the density of the

(i) stone,

1 (b) (ii) cork.

[2]

2 (a) State the equation relating efficiency to mechanical advantage and velocity ratio.

_____

[1]

(b) A block and tackle system of 5 pulleys is used to raise a load of 500 N steadily through a height of 20 m. The work done against friction is 200 J.

Calculate the

(i) work done in raising the load,

[1]

(ii) work done by the effort,

[1]

2 (b) (iii) efficiency of the system.

[2]

3 (a) (i) Use the kinetic theory of matter to describe the movement of particles in a

1. solid,

2. liquid,

3. gas.

[3]

(ii) Explain why the pressure inside a bicycle tyre increases after cycling for some distance.

[2]

4 (a) State *Boyle's Law*.

[2]

4 (b) A sea-diver is working under water at a place where the pressure is 2.0 atmospheres. He is breathing out air bubbles which are each 0.5 cm^3 in volume. At the surface the pressure is 1.0 atmosphere.

Determine the volume of the bubble when it reaches the surface of the water.

[2]

(c) Explain why the air bubbles move upwards from the bottom of water.

_____

_____ [1]

5 (a) Arrange the following electromagnetic waves in order of increasing frequency: radio waves, x-rays, visible light, ultra-violet.

_____

_____ [2]

(b) State any **three** properties of electromagnetic waves.

1. _____

2. _____

3. _____ [3]

Centre Number	Candidate Number

6

6 Fig.6.1 shows wavefronts, A-K, for a wave moving in air.

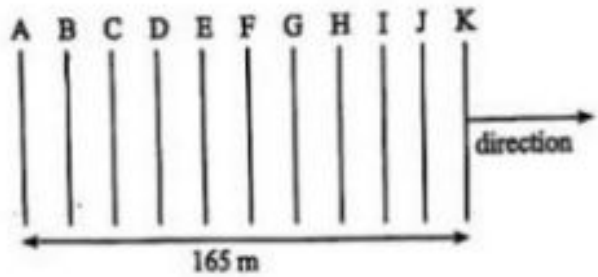


Fig.6.1

(a) Calculate the wavelength of the wave.

[2]

(b) Calculate, the speed of the wave, given that 0.5 seconds ago wavefront K was at the position occupied by A.

[2]

(c) Deduce a name for the wave.

[1]

Centre Number	Candidate Number

8 (a) Define *thermionic emission.*

_____

_____ [1]

(b) Explain how an output is produced on the screen.

_____

_____ [2]

(c) Describe how an electron gun works.

_____

_____

_____ [2]

Centre Number	Candidate Number

Section B

Answer any three questions from this section.

9 (a) (i) Define the term *momentum*.

_____ [1]

(ii) State Newton's third law and identify any **two** practical situations where it is applicable.

_____

_____

_____

_____

_____ [3]

(iii) A sledge of mass 40 kg is pulled along the ground by a horizontal force of 250 N. Due to friction the opposing force is 80 N.

Calculate the acceleration of the sledge.

[3]

9 (b) (i) Calculate the momentum of a

1. car of mass 1 200 kg moving with a velocity of 30 ms^{-1},

[2]

2. lorry of mass 3 000 kg moving with a velocity of 30 ms^{-1}.

[2]

(ii) State and explain which of the two vehicles requires a greater force to stop it.

[2]

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9 (c) (i) State *Hooke's Law*.

_____

_____ [2]

(ii) **Fig. 9.1** shows a force extension graph of two springs.

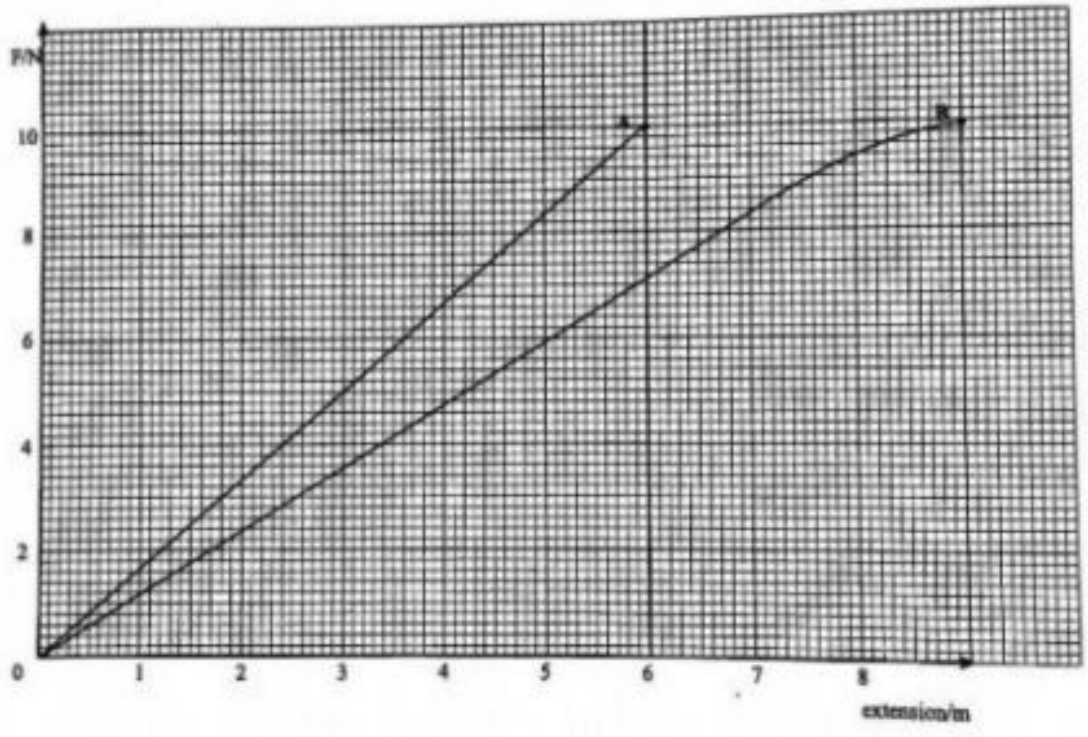

Fig. 9.1

Explain why spring **B** is easier to stretch than spring **A**.

_____

_____

_____ [1]

(iii) When a force of 8N is applied on both springs, spring B reaches its limit of proportionality but spring A does not.

Explain how **Fig. 9.1** shows this.

_____

_____

_____ [1]

9 (d) (i) State the *principle of moments*.

_____

_____ [1]

(ii) **Fig.9.2** shows a car whose door is closed.

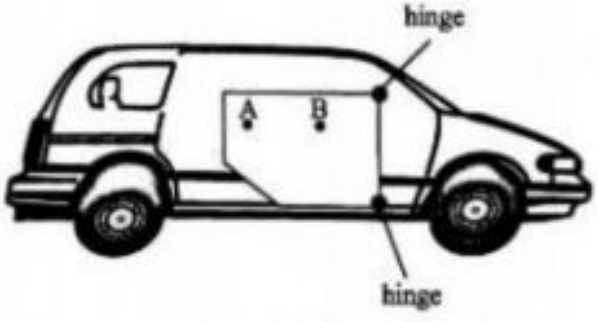

Fig.9.2

A car driver is about to push the door open from inside.

(iii) State with a reason which of the **two** points **A** or **B** will enable the driver to open the door with least force.

_____

_____

_____

_____ [2]

10 (a) (i) Define a *beam*.

(ii) Describe the advantages of using a hollow cylindrical beam over a solid cylindrical beam.

(iii) State and explain **two** advantages of using trusses over simple beams.

[6]

(b) **Fig.10.1** shows a roof truss.

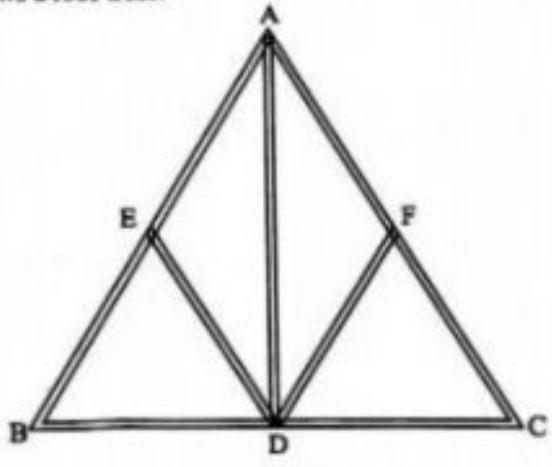

Fig.10.1

Identify members under

(i) compression,

(ii) tension.

_____ [4]

10 (c) **Fig.10.2** shows a cross-section of the floor of a flat and a balcony beam.

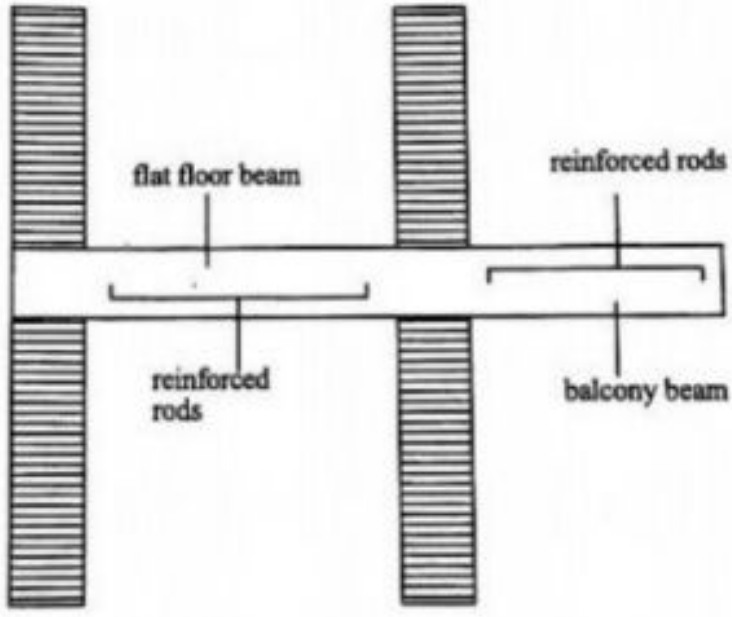

Fig.10.2

Explain why reinforced rods should be put on top for the concrete balcony and at the bottom for the concrete floor beam.

_____

_____

_____

_____

_____

_____ [4]

10 (d) (i) Use a labelled diagram to illustrate a loaded cantilever.

(ii) On the diagram in (i) show regions under compression and regions under tension using arrows.

(iii) Indicate the neutral layer using a dotted line. [6]

11 (a) Distinguish between transverse waves and longitudinal waves, and give an example of each.

[4]

11 (b) (i) Fig.11.1 shows water waves moving from shallow water into deep water.

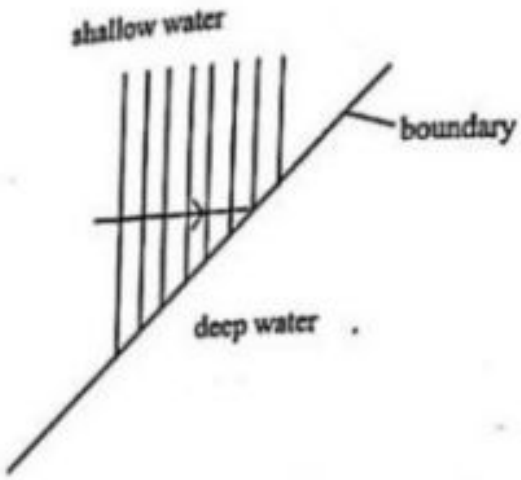

Fig.11.1

Complete Fig.11.1 to show the wave fronts and the ray in deep water.

(ii) Deduce what happens to the speed, direction of travel and wavelength if waves in shallow water are incident perpendicular to the boundary.

1. speed of waves

2. direction of travel

3. wavelength

[6]

11 (c) Fig.11.2 shows a child at the edge of a pond and a ball in the middle of the pond.

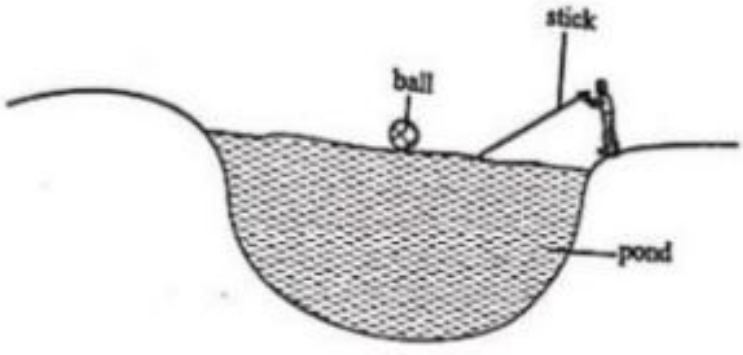

Fig.11.2

Deduce, with a reason, whether the ball will reach the other side of the pond, if the child hits the water continuously with a stick producing water waves.

[3]

(d) A ship transmits sound signal of frequency 30 kHz to the seabed. The signals take 2.5 seconds to be recovered by a ship detector after transmission.

[The speed of sound in water is 1 200 m/s.]

(i) Calculate the

1. wavelength of the sound used,

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2. depth of the sea bed.

_____

_____

_____

11 (d) (ii) Suggest, with a reason, whether the sound used was detected using human ears.

_____

_____

_____ [7]

12 A radio active nucleus is denoted by the symbol $^{288}_{92}W$.

(a) State the number of protons and neutrons in the radioactive nucleus.

protons _____

neutrons _____ [2]

(b) An element W, undergoes radioactive decay as shown by the equations:

$^{288}_{92}W \rightarrow X + \propto -particle$

$X \rightarrow Y + \beta - particle$

$Y \rightarrow Z +$ gamma emission

Deduce the nuclides X, Y and Z.

X _____

Y _____

Z _____ [6]

(c) Suggest why α – particles are considered better ionisers of gas than β – particles.

_____

_____

_____ [3]

12 (d) The average count rate of an α – particle emitter is 256 per second.

Calculate the average count rate 20 days later if the half life is 5 days.

average count rate_____ [3]

(e) State any **three** uses of radioactive isotopes.

1. _____

2. _____

3. _____ [3]

(f) Explain the terms

(i) *random,*

_____

_____

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(ii) *spontaneous,*

_____

_____

(iii) *activity.*

_____

_____ [3]

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2018

PHYSICS **4023/2**

1 (a) is the mass per unit volume/ $\rho = m/v$ terms defined [1]

(b) (i) $\frac{20(g)}{(35-20)(cm^3)}$; $= 1,3\ g/cm^3$ / with correct unit / $1300\ kg/m^3$ (ignore s.f) [2]

(ii) $\frac{5}{(50-35)}$; $= 0,\dot{3}\ g/cm^3$ with correct unit [1]

[1]
[Total:5]

2 (a) Efficiency $= \frac{M.A}{V.R} (\times 100(\%))$ [1]

(b) (i) work done $= 500\ N \times 20\ m$ /

$= 10\ 000\ J$ Accept Nm for J only [1]

(ii) $200\ J \times 20\ m = 4\ 000\ J$ $10000\ J + 2000\ J = 12000\ J$ correct answer only [1]

(iii) Efficiency $= \frac{500 \times 20}{14\ 000\ J} \times 100\ \%$ $\frac{500 \times 20}{12\ 000} \times 100\%$; [1]

$E = \frac{W_{out}}{W_{in}}$ $= 71\ \%$ $= 98\% / 0,98$ [1]
[Total:5]

3 (a) (i) 1. Particles (molecules) vibrate about their fixed positions reject same point A/W

Particles slide over each other

2. Liquid particles move within the liquid (from one place to another). A/W

free movement

3. Gas particles move at high speed in all directions A/W [3]

(ii) Heat is generated due to friction / temperature of air increases in the type; kinetic energies of particles increases; resulting in more collisions. A/W

[3 max 2]

4 (a) $P \propto \frac{1}{V}$ B1 $PV = \text{const}/P_1V_1 = P_2V_2$; provided thermodynamic temperature is constant B1 / $P \propto T$ when V is constant [2]

(b) $V_2 = \frac{P_1V_1}{P_2}$ / $\frac{2 \times 0,5}{1}$; $1,0\ cm^3$ / $1 \times 10^{-6}\ m^3$ B1 B1 [2]

(c) The density of bubble (air) is less than that of water/ AW [1]

5 (a) radio waves, visible light, ultra-violet, X-rays, [2]

all four (2)

First 2 (1)
All (2)

(b) - Same speed (3×10^8 ms^{-1}) in a vacuum; [1]
- Can be reflected; refracted; polarized; [3]

6 (a) $\lambda = \frac{165}{10}$; [1]

$= 16{,}5$ m; [1]

(b) $V = \left(\frac{x}{t}\right) / \frac{165}{0{,}5}$; $/ \frac{16{,}5}{0{,}05} / \frac{2}{T}$; [1]

$= 330$ m/s; [1]

(c) Sound waves; [1]

7 (a) - concentric circles round the wire with anticlockwise direction [1]

(b) - Upper side North lower side South [1]

(c) (i) 460 N [1]

(ii) - Increase number of turns [1]
- Increase area of coil/ thickness of coil [1]

8 (a) - release/ escape of electrons from a metal when heated sufficiently [1]

(b) - electrons hit/ strike screen; [2]
- screen produces light/ fluoresces;

(c) - heated metal cathode emits electrons; [1]
- electrons collimated by the anode; [1]
- electrons accelerated by the anode (tve); [1]
[Max 2]

9 (a) (i) Product of mas and velocity [1]

(ii) - Action and reaction are always opposite and equal; [1]
- Boxer punching a bag; [1]
- Man seated on a chair; [1]
- earth and moon [1]
[Max 2]

(iii) Resultant = 250 N - 80 N

= 170 N [1]

$F = m\,a$

$a = F/m = \frac{170\ N}{40\ kg} =$ [1]

$= 4{,}25\ ms^{-2}$; accept $N kg^{-1}$ [1]

(b) (i) 1. $(P = mV)$

$= 1\,200\ kg \times 30\ ms^{-1}$ [1]

$= 36\,000\ kg\ ms^{-1}$ [1]

2. $(p = mV)$

$= 3\,000\ kg \times 30\ ms^{-1}$ [1]

$= 90\,000\ kg\ ms^{-1}$ [1]

(ii) Lorry; even though objects are moving with same speed, their momentum depends on mass a lorry has more / lorry has greater inertia [2]

(c) (i) If the elastic limit is not exceeded extension is directly proportional to the force applied / $F = kx$ [2]

(ii) two forces values with $F_A > F_B$ for the same extension, OR two extension values with $e_B > e_A$ for the same force [1]

(iii) Idea that A is a straight line and B is not OR gradient constant in A but not in B A/W [1]

(d) (i) At equilibrium, clockwise moments = anticlockwise moments [1]

(ii) A; and idea of bigger distance from the hinge/ pivot [2]

10 (a) (i) Beam – bar supported which bears a load [1]

(ii) Hollow beam has greater strength to mass ratio; hollow beam is higher; cost is less for hollow beam. [3]

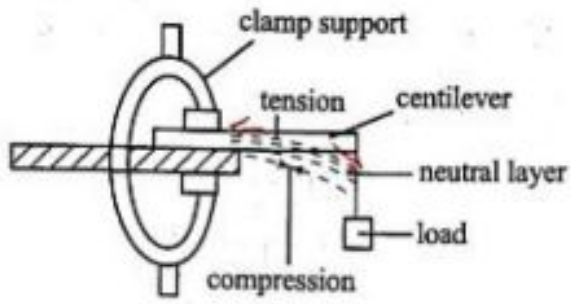
(iii) Truss has greater strength to mass ratio; unnecessary material is removed

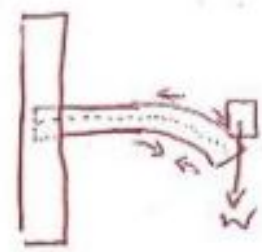
Truss is made up of triangular shapes; this makes the structure rigid and stable. [3]

(b) Members in compression: ~~AD~~; DE; DF AB AC 3
Member in tension: BC AD 1 [4]

(c) Top of balcony is under tension;
bottom of floor under tension;
steel is strong in tension; resist tension
prevents (reduces) collapse of structure due to tensile forces/AW; [4]

(d) (i)



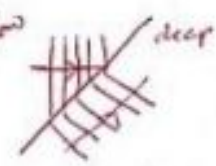


cantilever [1]
support [1]
load [1]
(ii) Area of compression [1]
Area of tension [1]
(iii) Neutral buyer layer [1]

11 (a) - transverse wave – vibrations are at right angles to the direction of travel /AW; [1]
e.g. water waves/ waves in strings/ electromagnetic waves [1]
- accept movement at right angles to ε wave

- longitudinal waves – vibrations parallel to the direction of travel of wave/ AW; e.g. sound waves; [1] [1]

(b) (i) - S wave fronts separated; [1]
- r ray bend away from normal; [1]
- ρ ray perpendicular to wave fronts; [1]



(ii) 1. Speed – increase; [1]
2. direction of travel – not changed; [1]
3. wavelength – increase; [1]

(c) Will not reach; ball will move up and down about same place;
waves do not transmit materials of the medium; [3]
reject slide along the wave

(d) (i) 1. $\lambda = \frac{v}{f} / \frac{1\,200}{32,5}; = 0,04;m$ $\frac{1200m/s}{30KHz} = 0,04m;$ [2]

2. $2d = Vt;/$ [1]

$d = \frac{Vt}{2}; / \frac{1\,200 \times 2,5}{2}; = 1\,500\ m;$ [2]

(ii) Can Not human ear; / not detected [1]

Its frequency is not audible to human ear; / beyond audible range [1]

Reject Not human ear with wrong explanation

12 (a) (i) 92

(ii) 196 [2]

(b) (i) $^{234}_{90}X$ - carbon dating [2]

(ii) $^{234}_{91}Y$ - biochemical tracer [2]

(iii) $^{234}_{91}Z$ - Radio therapy [2]

Mass number - 1 } for each
proton number - 1 }

(c) - ∝ - particles have a much greater mass [1]

∝ - particles have a much greater charge [1]

∝ - particles are slower moving producing more ions/cm [1]

(d) 20 days = 4 half lives [1]

$\frac{256}{2^4}$ / $\frac{256}{2}$ $\frac{128}{2}$ $\frac{64}{2}$ $\frac{32}{2} = 16$; [1]

Ans = 16 counts/second Accept Bq [1]

(e) - carbon dating ; Sterilisation ; Geological dating [1]

- biochemical tracer ; thickness control [1]

- radio therapy [1]

- power generation , military bombs (max 3)

(f) (i) - can not be predicted/where, how and when it can start. [1]

(ii) - once started can not be controlled or stopped by external influence [1]

(iii) - decay rate/~~every radioactive element has its own specific rate decay~~ number disintegrating per second [1]

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

PHYSICS 4023/2

PAPER 2 Theory

NOVEMBER 2019 SESSION 2 hours 15 minutes

Candidates answer on the question paper.

Additional materials: Electronic calculator

Allow candidates 5 minutes to count pages before the examination.

This booklet should not be punched or stapled and pages should not be removed.

Time 2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page and centre and candidate number in the boxes on the top right corner of every page of this paper. Check if the booklet has all the pages and ask the invigilator for a replacement if there are duplicate or missing pages.
Do not fasten the booklet.

Section A

Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B

Answer any **three** questions.
Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question.
Candidates are reminded that **all** quantitative answers should include appropriate units.

This question paper consists of 18 printed pages and 2 blank pages.

Candidate Name | Centre Number | Candidate Number

Section A

*Answer **all** questions from this section.*

1. **(a)** The total mass of a cyclist and the bicycle is 90 kg. The cyclist accelerates from rest with a driving force of 135 N against a frictional force of 30 N.

Calculate the acceleration.

[3]

(b) State any **two** factors that affect the size of the frictional force in **(a)**.

.....

.....

[2]

2 (a) Distinguish between displacement and distance.

.....

.....

.....

[1]

(b) **Fig. 2.1** shows a stone attached to a string being whirled around at a constant speed of 10 m/s.

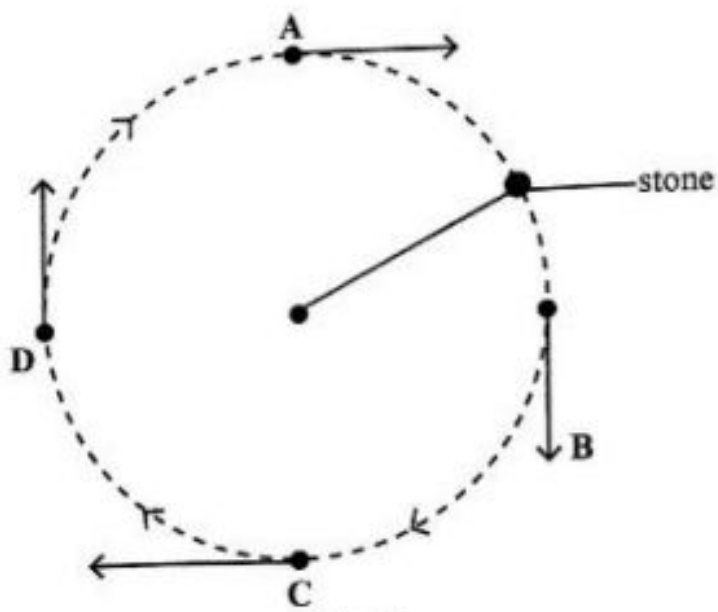


Fig. 2.1

(i) State the velocity at B and velocity at D.

velocity at B .....

velocity at D .....

[2]

(ii) Explain why the stone in **Fig. 2.1** is accelerating.

.....

.....

.....

[2]

3. (a) State any **two** reasons why concrete dam walls are usually arch shaped.

1 .....

2 .....

[2]

(b) Suggest any **three** environmental hazards associated with dam construction.

1 .....

2 .....

3 .....

[3]

4. (a) **Fig. 4.1** shows a liquid being heated.

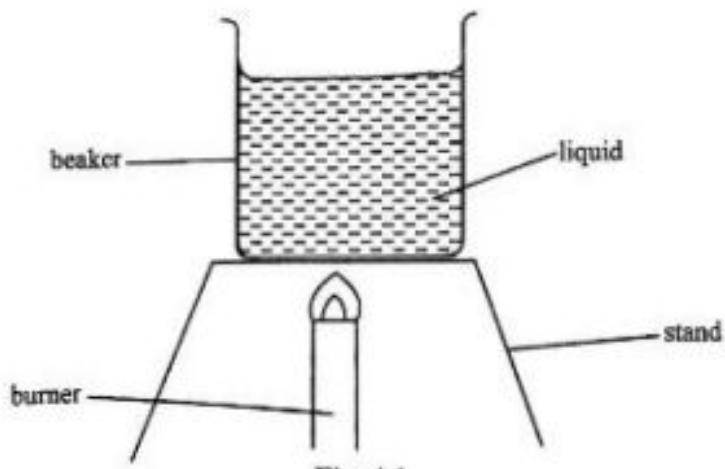


Fig. 4.1

Draw arrows to show convection currents on **Fig.4.1**. [1]

(b) Explain how convection currents are produced when a liquid is heated.

.....

.....

.....

[2]

(c) Describe heat transfer by conduction.

.....

.....

.....

[2]

5. (a) Define *specific latent heat*.

.....

.....

.....

[2]

(b) Calculate the amount of heat required to melt 80 g of ice at 0 °C.
[specific latent heat of fusion of ice = 330 J/g]

heat required = _____ J.

[2]

(c) State the effect of impurities on the melting point of ice.

.....

.....

[1]

Candidate Name | Centre Number | Candidate Number

6. **(a)** In an experiment, a plastic rod was charged by rubbing it on a piece of cloth.

State the type of charge on the cloth.

.....

[1]

(b) Describe how the rod became charged.

.....

.....

.....

.....

[2]

(c) The charged rod was brought close to small pieces of paper.
Explain why the pieces of paper were attracted to the rod.

.....

.....

.....

.....

[2]

7. **(a)** State any **one** limitation of Ohm's law.

.....

[1]

(b) Sketch an I-V characteristic graph for a filament lamp.

[2]

(c) A 3 Ω resistor is connected to a 1.5 V supply. Calculate the amount of current passing through the resistor.

[2]

8. (a) Two atoms of mass numbers 20 and 21 have a proton number of 10.

(i) State the name given to the atoms.

.....

[1]

(ii) Determine the number of neutrons in the atom of mass number 21.

.....

[1]

(b) A radioactive sample has a mass of 10 g and a half-life of 5 days.

Calculate the number of days taken for the sample to decay to 1.25 g.

[3]

Candidate Name | Centre Number | Candidate Number

8

Section B

*Answer **any three** questions from this section.*

9. (a) (i) State the SI unit of density.

.....

[1]

(ii) Describe how the density of a regular object is measured.

.....

.....

.....

.....

.....

.....

[3]

(iii) Explain why ice floats on water.

.....

.....

.....

.....

[2]

(b) **Fig. 9.1** shows a velocity-time graph of a body in motion.

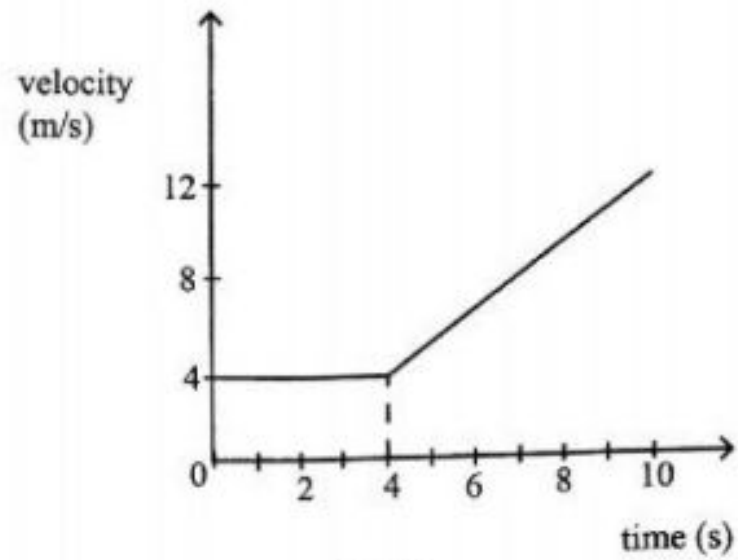


Fig. 9.1

(i) Define *acceleration.*

.....

.....

[1]

(ii) Calculate the distance covered in 10 seconds.

[3]

(iii) Determine the acceleration between 4 seconds and 10 seconds.

[2]

(c) (i) State the conditions for an object to experience free fall.

[2]

(ii) Describe how a falling body attains terminal velocity.

[4]

(iii) Suggest good experimental techniques to be observed during an experiment to determine terminal velocity of an object dropped into oil.

[2]

10. (a) **Fig. 10.1** shows a pulley system used to lift a load of mass 20 kg with an effort of 95 N.

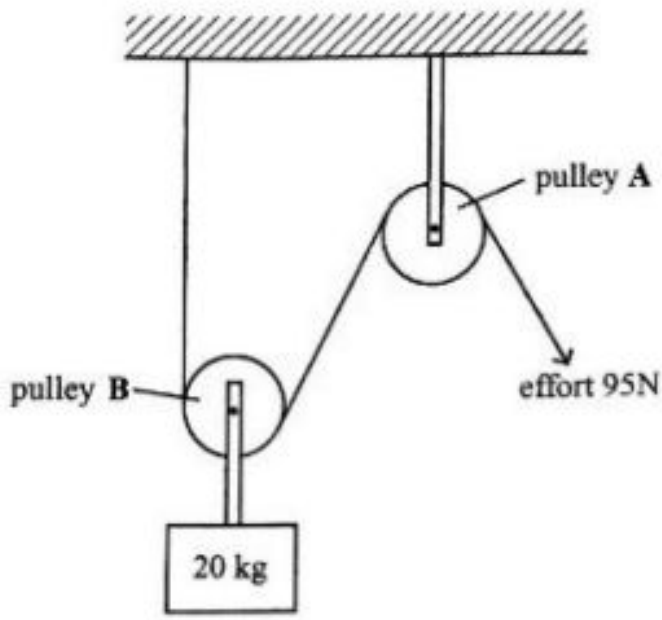


Fig .10.1

(i) Name a single pulley that has the same velocity ratio as the pulley system in **Fig. 10.1**.

.....

[1]

(ii) State the purpose of pulley A.

.....

[1]

(iii) Calculate the mechanical advantage of the pulley system.

[2]

(iv) Suggest why the mechanical advantage can never be greater than the velocity ratio for any pulley system.

.....

.....

[2]

(b) Water in a river flows over a cliff 70 m high.

(i) Calculate the change in gravitational potential energy of each kilogram of the water.

[$g = 10\ ms^{-2}$]

[2]

(ii) Determine the speed at which a kilogram of the water hits the bottom of the cliff.

[3]

(iii) State the assumption made in (ii).

.....

[1]

(c) (i) Name **two** methods of welding.

1 .....

2 .....

[2]

(ii) State any **two** safety precautions taken during welding.

1 .....

2 .....

[2]

(iii) Give a reason for cleaning metal surfaces before welding.

.....

.....

[1]

(iv) Suggest, giving **two** reasons, a method of joining a capacitor to a computer motherboard.

Method .....

Reasons .....

1 .....

2 .....

[3]

11. (a) (i) State what happens to electromagnetic waves when they

1.change medium, ...

.....

2. pass through a magnetic field. .....

.....

[2]

(ii) State any **two** uses of visible light.

.....

.....

.....

[2]

(iii) Explain why the frequency of ultra violet light is greater than that of microwaves.

.....

.....

.....

.....

[2]

(b) **(i)** Define a *wavefront*.

.....

.....

.....

[1]

(ii) Sketch a diagram showing straight wavefronts for a water wave passing normally from shallow end to deep end.

[3]

(iii) State **two** characteristics of a wave which will change if the water in **(ii)** passes the boundary at an angle.

.....

.....

.....

.....

[2]

(c) Temperature measurement involves two fixed points.

(i) Define the

1. lower fixed point, ...

..... [2]

2. upper fixed point. .....

..... [2]

(ii) The length of a mercury thread in a thermometer is 10 mm at ice point and 110 mm at steam point.

Calculate the temperature that corresponds to 70 mm length of mercury.

[3]

(iii) Suggest, with a reason why a mercury in glass thermometer **cannot** measure melting point of carbon dioxide.

.....

.....

[1]

12. (a) (i) Describe how electricity may be used to

1. make a permanent magnet, ...

.....

2. demagnetise a magnet. .....

.....

.....

[4]

(ii) Explain why an electric current can be used to separate iron from copper.

.....

.....

.....

.....

[2]

(b) (i) State **two** differences between the magnetic properties of iron and steel.

iron	steel

[4]

(ii) A piece of metal was found in the school yard.
Describe how a student may determine whether the metal is a magnet or not.

.....

.....

.....

.....

[2]

(c) In household circuits, several components are connected across two common points.

(i) Suggest **two** advantages of connecting the components in this way.

1. .....

.....

2. .....

.....

[2]

(ii) State **two** dangers of electricity.

1. .....
2. .....

[2]

(iii) Suggest a suitable rating for a fuse to be used on an appliance rated 800 W, 240 V.

[3]

(iv) Explain why the fuse must be connected to the live wire.

.....

.....

[1]

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2019

PHYSICS

4023/2

1. (a) Resultant force = (135 - 30) N — B1
= 105 N

Acceleration = $\frac{force}{Mass}$

= $\frac{105N}{90\ kg}$ — B1 units must be correct if present

= 1.17 ms^{-2} (3 sig fig) — A1 Correct unit
or 1.2 ms^{-2} accept N/kg
[3]

(b) (combined) weight of cyclist and bicycle / mass of bicycle & cyclist — B1
- nature of surfaces in contact / whether smooth or rough / AW — B1
reject surface area
[2]

2. (a) Both sides should be shown
Displacement is a vector whilst distance is a scalar / shortest distance btwn two pts — B1
quantity/distance is any length covered by a moving object whilst
displacement is distance covered in a specific direction.
Accept correct diagram
[1]

(b) (i) Velocity at B must show opposing directions
10 m/s due south / downwards / in the negative direction. — B1
Velocity at D
10 m/s due North/upwards/in the positive direction — B1
[2]

(ii) ~~stone~~ Velocity is changing ; — B1
- ~~velocity is changing direction~~
- ~~velocity change is an acceleration~~
direction changing — B1
[2]

3. (a) 1. Distribute force to embarkment [1] — B1 reject "arch is strong"
2 (Concrete) is strong in compression [1]
arch is strong in compression — B1
[2]

(b) - flooding up and down stream — B1
- displacement of human and animals — B1
- damage of ecosystems / AW — B1
- increase in diseases — B1
- damage in vegetation — B1
- Destruction of animals — B1
- Destruction of plants. — B1
max 3
[3]

opposite directions — B1

4. (a) - at least two arrow and correct directions; [1]

(b) - heated ~~particles~~ liquid expand/become less dense and rise; — B1 reject "particles expand"
- cold and dense ~~particles~~ liquid sink to the bottom; — B1 [2]

(c) - particles near/close to heat ~~some~~ gain energy and vibrate (more;) — B1 reject "particles move"
- pass energy to neighbouring particles; — B1 [2]
or Vibrations accept "electron diffusion in metals"
accept electrons pass energy to i next

5. (a) Amount of heat required to change state of a substance per unit mass; [1] — B1 Accept 1 kg

at constant temperature; [1] — B1 [2]

(b) $Q = ml_f$

$Q = 80\ g \times 330\ J/g$; [1] — B1

$Q = 26\ 400\ J$; [1] — B1 [2]

(c) lowers/decreases/reduces; [1] — B1 [1]

6. (a) positive charge [1]
reject attraction of electrons

(b) - electrons move from cloth to plastic rod [1]
- negative charge produced as a result of (excess of electrons) [1] [2]

(c) - electrons repelled from paper leaving a positive charge [1]
- unlike charges attract [1]
opposite charges attract [2]

7. (a) - temperature must remain constant / change in temperature B1 max 1
- physical conditions (like tension) must remain constant B1
max 1 / change in physical conditions

[1]

(b) ignore double labelling
A - labelling of axis — B1
L - correct shape — B1

[2]

(c) $I = \frac{V}{R} \Big/ \frac{1.5\ V}{3\Omega}$ / — B1

= 0.5 A — A1

[2]

8. (a) (i) Isotope — B1

[1]

(ii) 21 - 10 = 11 neutrons — B1

[1]

(b) $m = \frac{m_o}{2^n}$ — B1

$1.25\ g = \frac{10\ g}{2^n}$ — B1

$2^n = 8$

$2^n = 2^3$

n = 3

t = 3 × 5 days

= 15 days — A1

[3]

9. (a) (i) kg/m^3 accept $\frac{kg}{m3}$
kgm^{-3}
reject over -
[1]

(ii) - measure mass using a balance
- determine volume considering dimensions
- density = $\frac{mass}{volume}$
[3]

(iii) - when water freezes its volume increases
- mass remains the same
- therefore density = $\frac{mass}{volume}$ decreases
accept density of Ice is less than ℮ water
[2]

(b) (i) The rate of change of velocity.
[1]
Formular no mark.

(ii) Displacement = $(L \times W) + \frac{1}{2}(4 + 12)(b + a)h$
Stating Area under graphy

$= \left[(4 \times 4) + \frac{1}{2}(4 + 12)(10 - 4)\right]$

$= \left[16 + \frac{1}{2}(16)(6)\right]$

$= 16 + 48$
$= 64$ m
[3]

(iii) Acceleration = $\frac{\Delta\ velocity}{\Delta\ time} = slope\ of\ graph$

$= \frac{(12-14)\,ms}{(10-4)\,s}$

$= \frac{8}{6}$ m/s2

$\approx$1,33 m/s^2
$\approx$1,3 m/s^2 (2 sig. figs)

[2]

(c) (i) No significant force of air resistance [1]
Objects will fall out with the same rate of acceleration/acted upon by gravity only [1]

[2]

(ii) - air resistance increases with speed of falling object
- acceleration of object decreases as a result
- eventually upward air resistance equals weight of body acting downwards
- resultant force being zero, object falls at constant velocity, which is the terminal velocity

[4]

(iii) Coat object with oil to avoid air bubbles,
Release object near oil surface,
Avoid splashing of oil,
Repeat experiment several times and find the average of results
Max 2

[2]

10. (a) (i) Single movable pulley [1]

(ii) To change direction of effort. / force [1]

(iii) $MA = \frac{L}{E} = \frac{Mg}{E}$

$= \frac{200}{95}$

$= 2,1$ [2]

(iv) if ~~MA > VR~~

$E = \frac{MA}{VR}$

- efficiency will be greater than 100%
- which is not possible [2]

(b) (i) $\Delta PE = mgh$

$= 1 \times 10 \times 70$

$= 700\ J$ [2]

(ii) $Ep = Ek$

$E_k = \frac{1}{2}mv^2$

$v = \sqrt{2 \times 700}$

$= 37.4\ ms^{-1}$ [3]

(iii) No energy losses / no air resistance [1]

Energy is conserved.

Because $E_p = E_k$

(c) (i) - Arc/electric current
- gas/oxyacetylene
- plastic
- Laser welding
- spot welding
reject brazing oxyge welding soldering
max 2 [2]

(ii) - wearing googles
- wear heat proof materials
Safety Shoes gloves / except well ventilated except helmet
protective Clothing [2]

(iii) To remove impurities/oxide layer / rust [1]

(iv) - soldering ✓ 1
-joining at a point (small area)
- solder conducts electricity
- solder has low melting point
- solder sets/dry quickly
- does not damage mother board
any 2 Max 2 [3]

11. (a) (i) ~~refrd~~
1. - their speed changes; / Change wavelength
- they are refracted; / Change direction
max 1
2. - they are not deflected/pass in a straight line; [1]
nothin happen [2]

(ii) - stimulating retina/enabling vision;
- for photosynthesis in plants;
- in photography/taking pictures;
max 2
generating electricity (Solar panel)
& photopier [2]

(iii) - ultra violet has shorter wavelength than microwave/ microwave has longer wavelength; [1]
- ratio $\frac{speed}{wavelength}$ / $\frac{c}{\lambda}$ is greater for ultra violet/ $\frac{c}{\lambda}$ is smaller

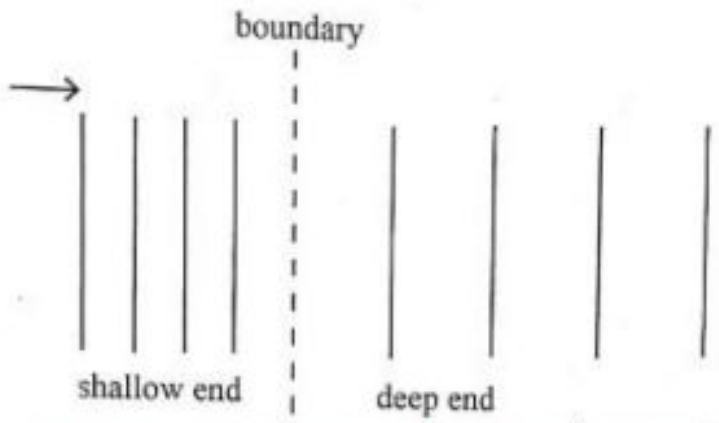
for microwave; [1]
Same speed in vacuum or air ; UV ~~Microwave~~ has shorter than microwave hence, greater frequency [2]

line joining the same crest or troughs

(b) (i) - a line joining all identical points on a wave; — B1
- a line joining all points in phase

[1]

(ii)



S - spacing
D - direction
A - arrow/labelling

wave fronts must show ~~a~~ increased spacing towards deep end.

- greater spacing on deep end;/
increasing / - ~~uniform~~ separation of wavefronts on one side; [1] — B1
~~- labelled ends;~~ [1]
- ~~direction shown;~~ [1] no change in direction/— B1
~~max 2~~ Wavefronts parallel to boundary
Direction shown/arrow perpendicular to wavefronts [3] — D1

any changes
(iii) /direction;/refraction — B1
- velocity; — B1
- wavelength; — B1 per max 2
~~max 2~~

[2]

reject freezing point

(c) (i) 1. Temperature of pure melting ice, [1] — B1
STP /at standard atmospheric pressure; [1] — B1
2. Temperature ~~of steam~~/pure boiling water; at standard — B1
atmospheric pressure [2] /STP — B1
~~Temp of steam above boiling water/steam point~~
steam point

[4]

(ii) $\theta = \frac{X_\theta - X_0}{X_{100} - X_0} \times 100°C$; — B1

$= \frac{70 - 10}{110 - 10} \times 100°C$; [2] — B1

$= 60°C$ / [1] — A1

[3]

(iii) - mercury freezes at $-39°C$ / mercury will be frozen at $-56°C$; / it is below freezing point of mercury / out of range of mercury thermometer [1]

12. (a) (i) 1. Insert a piece of **steel** into a solenoid [1] — B1
- pass **direct current** (d.c) through the solenoid [1] — B1

2. - insert the magnet into a solenoid and pass **alternating current** through the solenoid [1] — B1
- withdraw the magnet slowly (in a west-east direction) [1] — B1

[4]

(ii) - flowing electric current produces a magnetic field [1] — B1
- iron (easily) attracted to a magnet / [1] — B1
Copper not attracted to a magnet

[2]

(b) (i)

Iron	Steel
- easily magnetised and demagnetised. — B1	- difficult to magnetise and retains its magnetism[1] [1] — B1
- soft magnetic material — B1	- hard magnetic material [1] [1] — B1
- suitable for use in temporary magnets — B1	- suitable for use in permanent magnets [1] [1] — B1

easily

max 4

[4]

(ii) - bring the ends of the metal close to a known permanent magnet [1] / use a permanent magnet — B1
- one end of the metal must **repel** the permanent magnet [1] — B1

[2]

(c) (i) 1. Each component receives maximum voltage [1] — B1
2. Each circuit can be operated independently [1] AW — B1

[2]

Electrocution/death — B1

(ii) 1. Electric shocks [1] — B1 max 2
2. Fires [1] — B1
damage to property

[2]

(iii) Current I = $\frac{P}{V}$ / $\frac{800\ W}{240\ V}$ [1] — B1

= 3.33 A — B1 [1] (accept 1 sig fig)

- suitable fuse 5A [1] — B1
- ~~accept value slightly above 3.33 A~~
accept 1 A e 5A

[3]

(iv) When fuse blows, (no current flows to the appliance) — B1 the appliance will not remain live/ [1]
will be at zero potential/live wire is disconnected

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

PHYSICS

PAPER 2 Theory

4023/2

NOVEMBER 2020 SESSION

2 hours 15 minutes

Candidates answer on the question paper.

Additional materials:
Electronic calculator
Answer paper

Time 2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page and on any separate answer paper used.

Section A

Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B

Answer any **three** questions.
Write your answers on the separate answer paper provided.
At the end of the examination fasten the answer paper used securely to the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question.
Candidates are reminded that **all** quantitative answers should include appropriate units.

This question paper consists of 16 printed pages.

Section A

Answer all questions.

For Examiner's Use

1 **Table 1.1** is an incomplete table showing basic SI quantities, units and symbols.

Quantity	Unit	Symbol
Mass		kg
Time	Second	
	Kelvin	K

Table 1.1

(a) Complete **Table 1.1**. [3]

(b) A cuboid with dimensions 7 cm, 6 cm, 6 cm has a mass of 500 g.
Calculate the density of the cuboid.

[2]

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For Examiner's Use

2 (a) **Fig. 2.1** shows a velocity-time graph for a moving body.

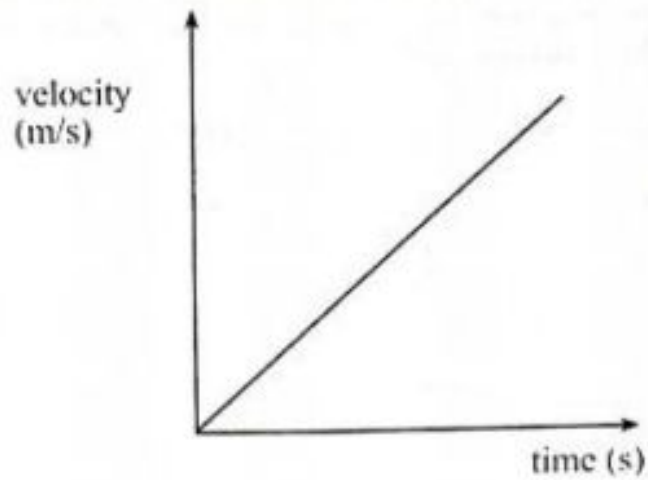

Fig. 2.1

(i) State what the gradient of the graph in **Fig. 2.1** represents.

_____

_____ [1]

(ii) Using **Fig. 2.1** state how distance covered is obtained.

_____

_____ [1]

(iii) The gradient of a graph can be classified as being positive, negative or zero. State how the gradient of **Fig. 2.1** can be classified.

_____

_____ [1]

For Examiner's Use

(b) A body accelerates from rest and attains a velocity of 20 m/s in 2 seconds. It then maintains this velocity for another 4 seconds, 2 seconds later, it decelerates uniformly to rest.

Complete **Fig. 2.2** to show this motion.

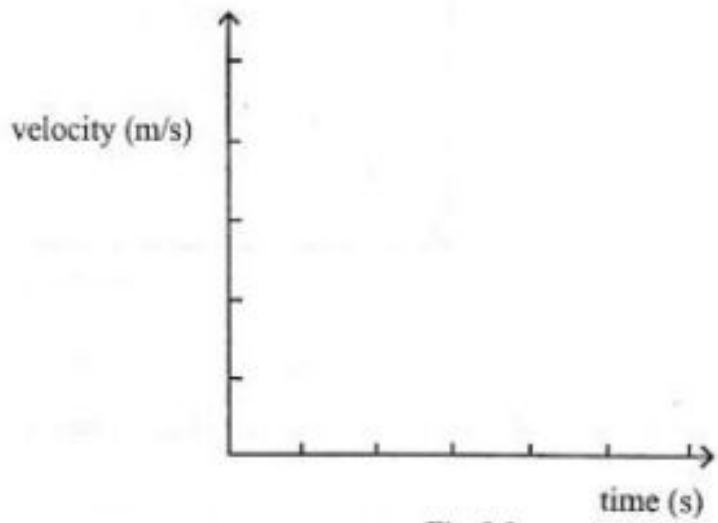

Fig. 2.2

[2]

3 (a) Define *moment of a force*.

[1]

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(b) **Fig. 3.1** shows a spanner being used to tighten a nut.

For Examiner's Use

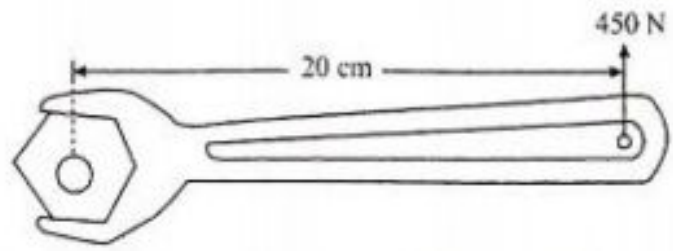

Fig. 3.1

Calculate the moment of the force shown in **Fig. 3.1**.

[2]

(c) State the principle of moments.

_____

_____ [2]

For Examiner's Use

4 (a) (i) State **two** laws of refraction.

_____

_____

(ii) The diagram shows a ray of light moving in different media.

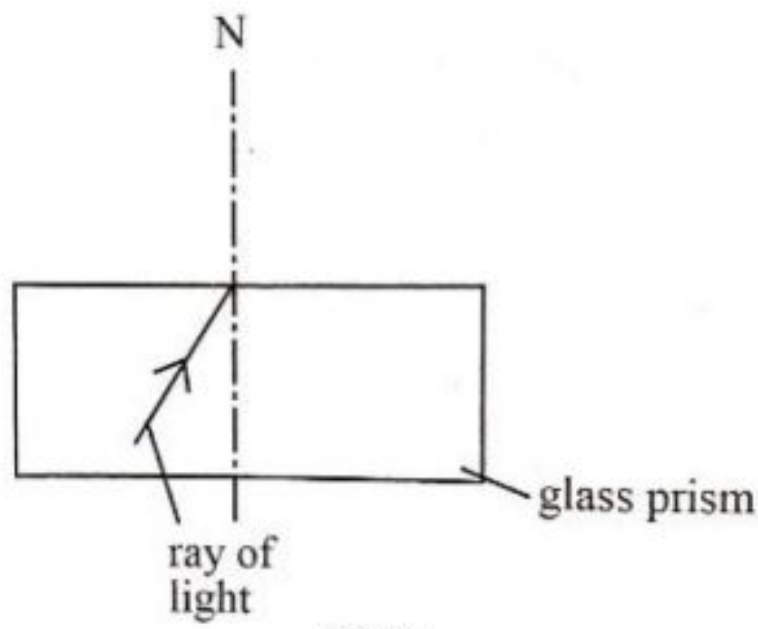

Fig. 4.1

Complete the path for the ray of light out of the glass prism in **Fig. 4.1**. [3]

(b) Explain why a straight drinking straw appears bent at the surface when partially immersed in water.

_____

_____

_____

_____ [2]

For Examiner's Use

5 (a) State the type of joint used in wooden roof trusses.

_____ [1]

(b) List **two** factors that affect the strength of joints in wooden roof trusses.

_____

_____ [2]

(c) Suggest **two** disadvantages of using wooden roof trusses.

_____

_____ [2]

6 (a) **Fig. 6.1** shows a system of pulleys used to lift a load of 500 N by an effort of 200 N.

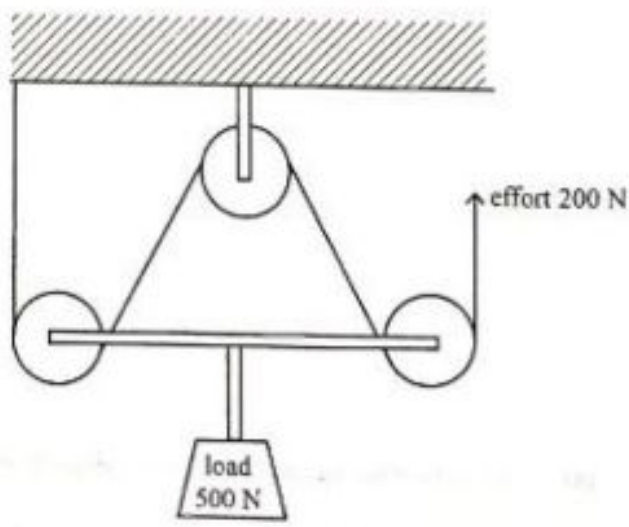

Fig. 6.1

For Examiner's Use

(i) Determine the velocity ratio of the pulley system.

(ii) Suggest any **two** ways of improving the efficiency of the pulley system.

(iii) Calculate the mechanical advantage of the pulley system.

[5]

7 (a) Explain what is meant by the term *magnification*.

[1]

(b) **Fig. 7.1** shows an object, O, placed in front of a human eye.

For Examiner's Use

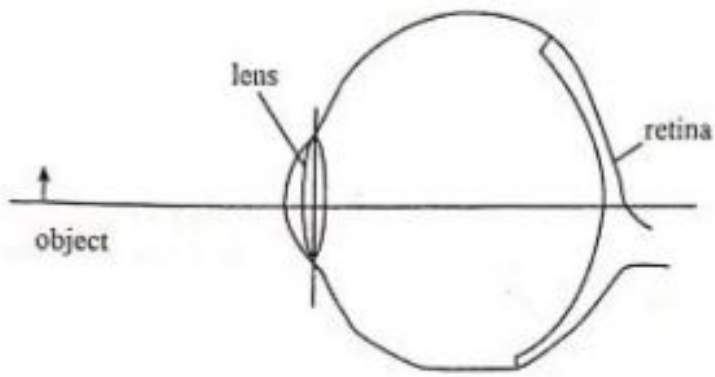

Fig. 7.1

(i) Complete **Fig. 7.1** to show how a real image is formed on the retina.

(ii) The object is placed 4 cm from the eye lens and the image is found to be at 12 cm from the lens.
Calculate the magnification.

[5]

For Examiner's Use

8 (a) (i) State the unit for electromotive force.

_____

(ii) A learner is provided with three identical 1.5 V cells.
Draw an arrangement of the cells to show how the learner can produce a battery that supplies the

1. greatest e.m.f,

2. highest amount of current.

(iii) State **one** other advantage of arranging the cells as in **(ii) 1.**

_____ [5]

Section B

*Answer **any three** questions from this section.*

9 **(a)** **Fig. 9.1** shows an arrangement of how a certain form of energy is produced.

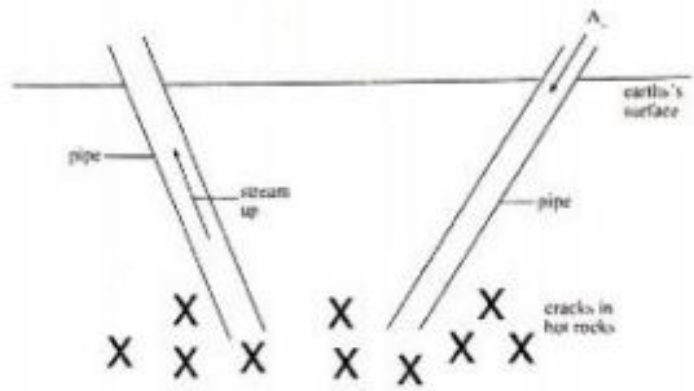

Fig. 9.1

(i) Name the form of energy produced in **Fig. 9.1.**

(ii) State a raw material being fed into the earth at A.

(iii) State any **two** uses of this form of energy.

(iv) Suggest, with a reason, a material used to make the pipes. [6]

(b) **(i)** Name the device used to store electrical energy from solar panels.

(ii) State a way of safely disposing the energy storing device in **b(i).**

(iii) Name another household gadget that makes use of solar energy.

(iv) Suggest any **two** factors that hinder wide usage of solar panels.

(v) Estimate the efficiency of solar panels. [6]

(c) **(i)** Define power and state its SI unit.

(ii) A car of mass 400 kg is going up an incline, moving at a constant speed of 10 ms^{-1} against a frictional force of 200 N as shown in **Fig 9.2.**

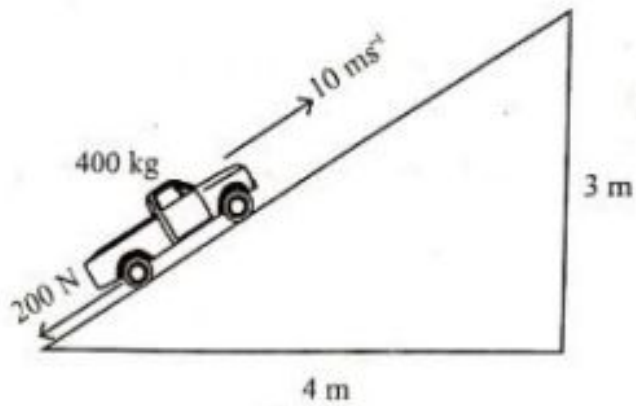

Fig. 9.2

When the car is at the top of the incline,

calculate the

(1) change in gravitational potential energy,

(2) work done against friction,

(3) power generated against friction. [8]

10 **(a)** **(i)** State any **two** properties of a gas.

(ii) Explain why the volume of a metal solid increases when heated.

(iii) Give any two reasons why solids have a definite shape. [6]

(b) **(i)** State a component of electromagnetic waves which is of use in a solar water heater.

(ii) Give any **two** reasons for using copper pipes in a solar water heater.

(iii) State a reason for covering the copper pipes with a glass plate in a solar water heater.

(iv) Suggest with a reason, the material used to make the storage tank of a water heating system. [6]

(c) **(i)** State any **two** practical situations which make use of the high specific heat capacity of water.

(ii) **Fig. 10.1** shows a set up used to determine the specific heat capacity of water.

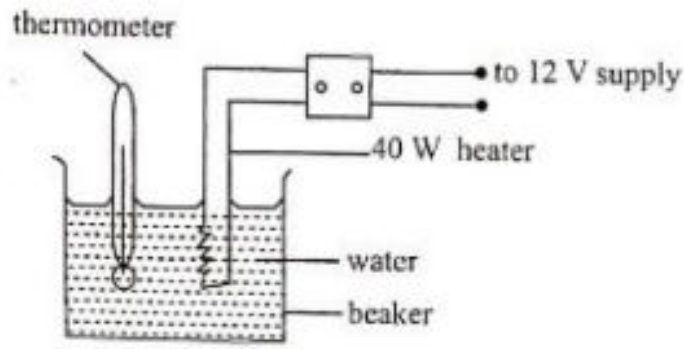

Fig. 10.1

Water of mass 1Kg at 20 °C is heated to 26 °C in 10 minutes.

1. Calculate the specific heat capacity of water.

2. State any **two** assumptions made in your calculation in (1).

3. Suggest **one** way of improving the experiment in **Fig. 10.1**. [8]

11 (a) (i) State the laws of reflection.

(ii) **Fig. 11.1** shows an arrangement used to investigate the law of reflection.

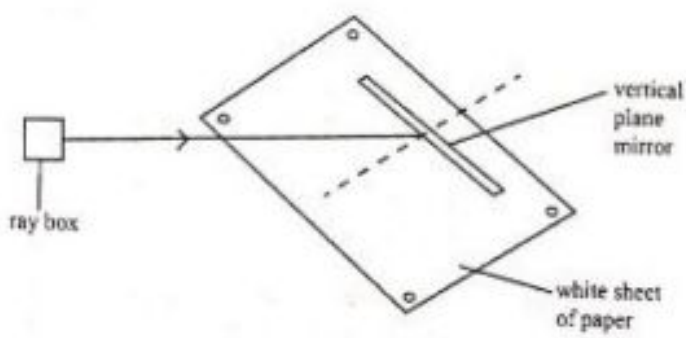

Fig. 11.1

On **Fig. 11.1** draw the reflected ray and mark the angle of reflection.

(iii) Fig 11.2 shows a periscope used to look through an object on the other side of a wall.

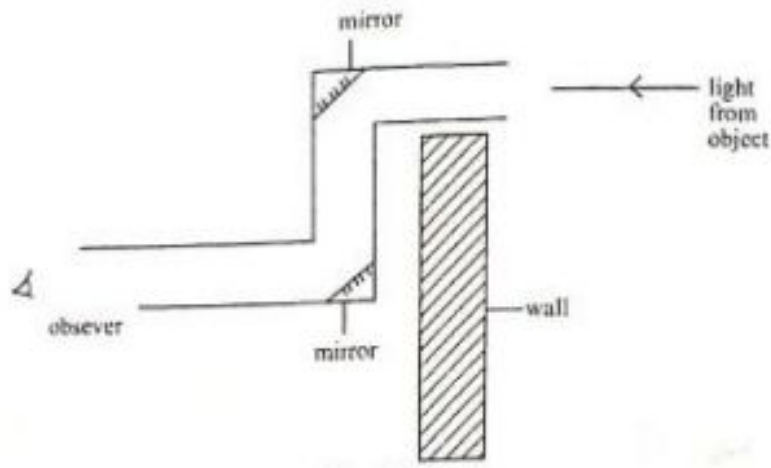

Fig. 11.2

On **fig 11.2**, complete the path taken by the ray of light from the object to the observer. [6]

(b) **Fig. 11.3** shows a camera.

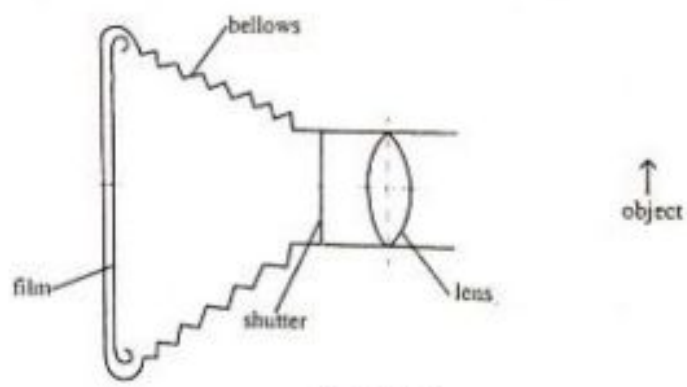

Fig. 11.3

(i) Draw **two** rays from the top of the object to show how the image is formed on the film mark and label the image on the film.

(ii) Apart from its size, state one other property of the image formed by the lens.

(iii) Explain why, when taking photographs of distant objects, it may be necessary to move the lens towards the film. [6]

(c) **(i)** Complete **Fig. 11.4** for the path taken by the ray of light incident on a glass prism.

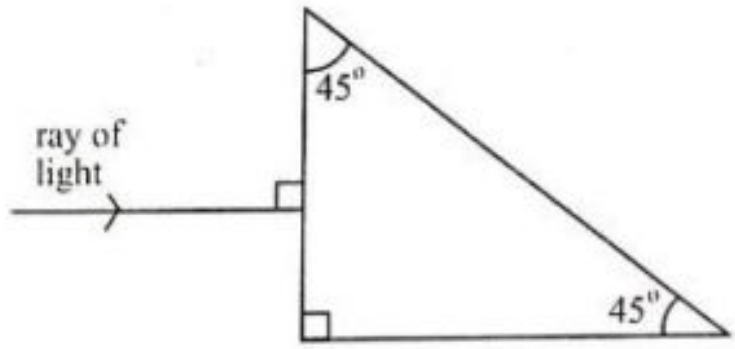

Fig. 11.4.

(ii) State **one** device that makes use of such a prism as in **Fig. 11.4**.

(iii) A driver may see a "pool of water" on the road before him on a hot sunny day.
Describe briefly how the "pool of water" is formed on the road. **[8]**

12 (a) **Fig. 12.1** shows a current carrying conductor.

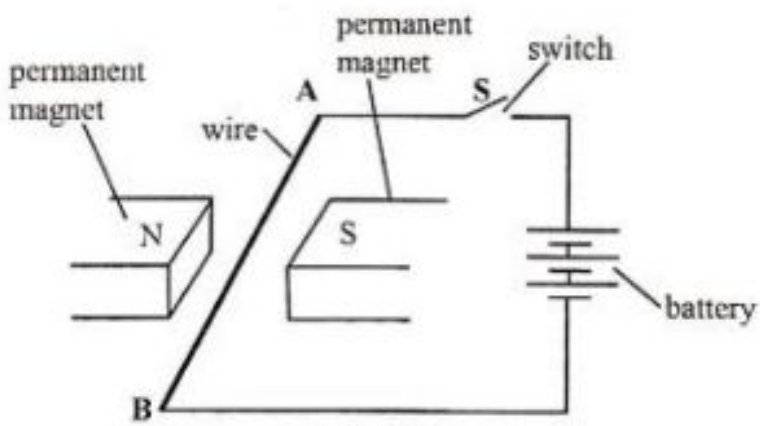

Fig. 12.1

(i) State the direction of current along the wire.
(ii) Explain what happens to the wire when switch, S, is closed.
(iii) State and explain what will happen when the battery is replaced by an AC current. **[6]**

(b) (i) State any **two** factors that affect the magnitude of induced e.m.f.

For Examiner's Use

(ii) **Fig. 12.2** shows an electromagnet.

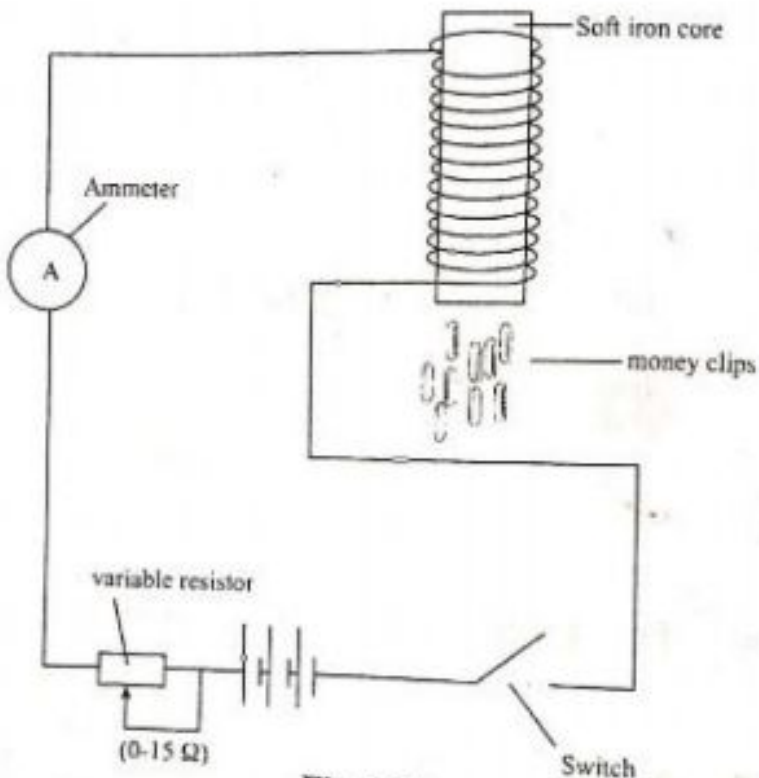

Fig. 12.2

Using **Fig. 12.2**,

1. suggest two ways of increasing the number of money clips attracted to the soft iron core,

2. suggest any material used to make money clips used in **Fig. 12.2**.

(iii) State any **three** uses of an electromagnet. [8]

(c) (i) Define *half-life*.

(ii) State any **three** uses of radioactive isotopes.

(iii) The initial mass of Uranium-236 is 300 g.
Calculate the number of half-lives in 72 days. [6]

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ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2020

12 (a) (i) AB [1]

(ii) Wire moves upwards

- A current carrying, conductor induces magnetic field around
- The induced magnetic field interacts with the magnetic field of a permanent magnet; an upward force is created

max [3]

(iii) - the wire oscillates with a frequency equal to the frequency of a.c, current
- when current changes direction the force also changes direction; [2]

(b) (i) strength of magnet
relative motion
number of
area of coil max [2]

(ii) 1. increase current by reducing the resistance of a variable resistor [1]
- reducing the distance between money clips and the soft iron core [1]

2. Iron [1]

(iii) - security locks in doors [1]
- relay switches [1]
- electric bell [1]
- reed switch [1]
- speakers [1]

max [3]

(c) (i) - the time taken for half the number of particles to decay, [1]

(ii) - tracers
- treatment of cancer
- sterilisation
- carbon dating

max [3]

(iii) $t = nT_{\frac{1}{2}}$

72 days = n (24 days) [1]

$$n = \frac{72\ days}{24\ days}$$

n = 3 [1]

∴ there are 3 half-lives.

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3. - lagging the beaker
   - putting lid on beaker;
   - heater in the middle of beaker;

max [1]

11 (a) (i) - the incident ray, reflected ray and the normal at the point of incidence, all lie on the same plane;
- the angle of incidence is equal to the angle of reflection; [2]

(ii) - correct ray at 30° to the normal
- correct value for angle [2]

(iii) - ray reflected at 90° at first mirror
- ray reflected at 90° at second mirror [2]

(b) (i) - ray passing through the optic centre unrefracted
- ray refracted by the this to the film
- correct position and nature of image (inverted) [3]

(ii) - image is inverted
- image is real
max 1 [1]

(iii) - to focus a clear and sharp image of the object
- otherwise a blurred image is formed in front of the film [2]

(c) (i) - ray through the first face unrefracted
- ray incident on second surface
- ray totally internally reflected [3]

(ii) - periscope
- binoculars;
max 1

(iii) - atmosphere made up of layers of air of different densities
- rays of light coming from the sun is continuously refracted away from the normal
- ray of light may not reach the earth's surface
- total internal reflection occurs

[4]

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(c) (i) - rate of doing work
- unit watt
[2]

(ii) 1. $\Delta EP = mgh$
$= 400 \times 10 \times 3$ [1]
$= 12\,000\ J$ [1]

2. $W = Fd$
$= 200 \times 5$ [1]
$= 1\,000\ J$ [1]

3. $P = FV$
$= 200 \times 10$ [1]
$= 2\,000$ watts [1]

10 (a) (i) - very weak forces of attraction between molecules;
- have most/highest kinetic energy;
- have no definite shape or volume;
max 2 [2]

(i) - heated particles gain more energy;
vibrate with higher amplitude/AW; [2]

(iii) - solid particles closely packed/no space between particles;
- particles kept in position by strong attractive forces; [2]

(b) (i) - infra-red; [1]

(ii) - good **thermal** conductivity;
- resists corrosion; [2]

(iii) - to prevent heat loss through **radiation**; [1]

(iv) - plastic/expanded polystyrene/glass fibre/any plausible insulator;
- poor conductor of heat; [2]

(c) (i) - car radiators/car cooling systems;
- heating rooms;
- hot water bottles;
max 2 [2]

(ii) 1. - Heat supplied = Heat gained/
$40 \times 10 \times 60 = 1 \times c \times 6$; [1]
$24\,000 = 6\ c$; [1]
$c = 4\,000\ J/kg\ ^{\circ}C$; [1]

2. - beaker has negligible specific heat capacity; [1]
- no heat is lost to the environment; [1]

7 (a) - a measure of how many times the object increases or decreases in size when it appears as an image
- ratio of image height to the object's height [1]

(b) (i) - correct rays
- correct nature of image (inverted) [2]

(ii) magnification = $\frac{distance\ of\ image}{distance\ of\ object}$ / $\frac{12\ cm}{4\ cm}$ [1]

= 3 [2]

8 (a) (i) - volt (v)
- Joule per coulomb (J/c) [1]

(ii) - correct symbol for cell [1]
- correct arrangement (cells in series) [1]
- correct arrangement (cells in parallel) [1] [3]

(iii) Cells last longer. [1]

9 (a) (i) Geothermal [1]

(ii) Cold water [1]

(iii) - power stations
- warming homes in cold countries
- tourist attractions
max [2]

(iv) - copper/aluminium
- resists
[2]

(b) (i) Accumulator/lead-acid battery
Reject battery [1]

(ii) Recycling/burying [1]

(iii) Solar water heaters/solar lights/boreholes [1]

(iv) - expensive to install
- no equal sunlight distribution
- expensive to maintain [2]

(v) 15 - 30% [1]

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4 (a) (i) 1. The incident ray, the refracted ray and the normal at the point of incidence all lie on the same

2. The ratio of the sine of the angle of incidence to the sine of the angle Of refraction is a constant / $\frac{\sin i}{\sin r}$ = constant

[2]

(ii) correct path [1]

(b) - light from bottom part of the straw is refracted at the water-air boundary
- ray bend away from the normal
- (this happens for all other parts on the straw under water) [2]

5 (a) Nailing/bolting [1]

(b) - length of joints /area of overlap
- number and distribution of nails /bolts
- size of nails
max 2 [2]

(c) - susceptable to fires
- attacked by termites
- rotting
- not durable
max 2 [2]

6 (a) (i) 4 [1]

(ii) - greasing movable parts
- using light weight pulleys
- using a light inextensible string

max 2 [2]

(iii) $MA = \frac{Load}{Effort}$

$= \frac{500\ N}{200\ N}$

= 2.5 [1]

[2]

1 (a) Kilogram
s
Temperature [3]

(b) Volume = $(7 \times 6 \times 6)\,cm^3$

$= 252\ cm^3$

Density = $\frac{mass}{volume}$

$= \frac{500\ g}{252\ cm^3}$

$= 1.984\ g/cm^3$

$\approx 1.98\ g/cm^3$

[2]

2 (a) (i) Acceleration [1]

(ii) Finding the area under the graph [1]

(iii) positive [1]

(b)

Asset required

Graph of correct shape and correct intervals is expected.

[2]

3 (a) Product of force and perpendicular distance in line of force. [1]

(b) Moment of force = force × distance
= 450 N × 0.2m
= 90.0 Nm
= 90 Nm

[2]

(c) For a body in equilibrium the clockwise moments equal the anticlockwise moments equal the anticlockwise moments.

[2]

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

PHYSICS 4023/2

PAPER 2 Theory

NOVEMBER 2021 SESSION 2 hours 15 minutes

Additional materials:
Electronic calculator
Answer paper

Time 2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page and on any separate answer paper used.

Section A

Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B

Answer any **three** questions.
Write your answers on the separate answer paper provided.
At the end of the examination fasten the answer paper used securely to the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question.
Candidates are reminded that **all** quantitative answers should include appropriate units.

This question paper consists of 16 printed pages.

Section A

Answer all questions.

1 (a) **Fig. 1.1** shows how the measurement of length can be used to find the thickness of a wire.

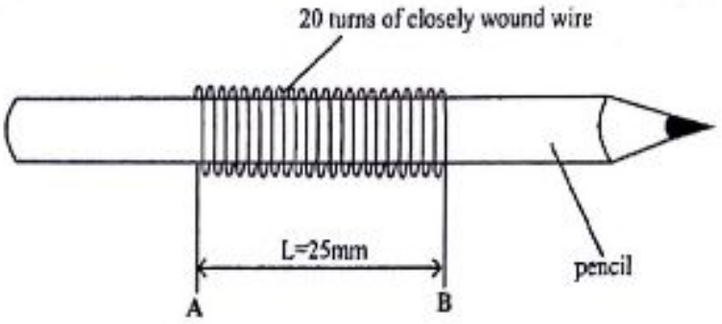


Fig. 1.1

Name the instrument used to measure length **AB**.

_____ [1]

(b) Calculate the thickness of the wire in **Fig. 1.1**.

[2]

(c) State the precaution to be taken when winding the wire over the pencil.

_____

_____ [1]

(d) Name the most suitable instrument for measuring the diameter of the wire.

For Examiner's Use

_____ [1]

2 (a) Explain what is meant by *transverse wave*.

_____

_____ [1]

(b) State any **two** other similarities of electromagnetic waves.

_____

_____

_____

_____ [2]

(c) A radio wave has a speed of 3×10^8 m/s in air and its wavelength is 150 m. Calculate its frequency.

[2]

For Examiner's Use

3 (a) (i) State a base quantity that is measured to determine the strength of a beam.

_____ [1]

(ii) Name a property of beams that is used to name them.

_____ [1]

(b) **Fig. 3.1** shows a beam made by piling layers of wood.

Fig. 3.1

(i) Explain why the beam is easily sheared by a horizontal force.

_____ [1]

(ii) Add on **Fig. 3.1** a beam that will make it resist shear. [1]

(iii) Explain why wood snaps when loaded.

_____ [1]

4 (a) State the value of the upper fixed point on a Celsius scale.

_____ [1]

(b) State any **two** physical properties which can be used for temperature measurement.

_____

_____ [2]

For Examiner's Use

(c) State with a reason, a suitable thermometer for measuring the melting point of iron.

Type of Thermometer _____

Reason _____ [2]

5 (a) (i) State the effect, on the resistance of a metallic conductor, of

doubling the length,

_____

doubling the cross-sectional area,

_____

increasing the temperature.

_____ [3]

For Examiner's Use

(ii) A copper cable of length 50 m and uniform cross-sectional area 1.26×10^{-5} m^2 is used during transmission of electricity.

Calculate the resistance of the cable given that the resistivity for copper is $1.68 \times 10^{-8} \Omega$m.

[2]

6 (a) **Fig. 6.1** shows a conductor carrying a current into the paper.

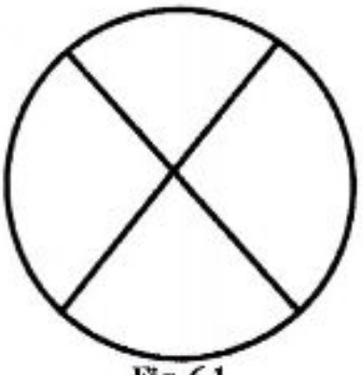


Fig. 6.1

On Fig. 6.1 draw the magnetic field around the wire. [2]

(b) **Fig. 6.2** shows two hollow cylindrical tubes placed next to each other with insulated copper wires passing through the hollow tubes.

For Examiner's Use

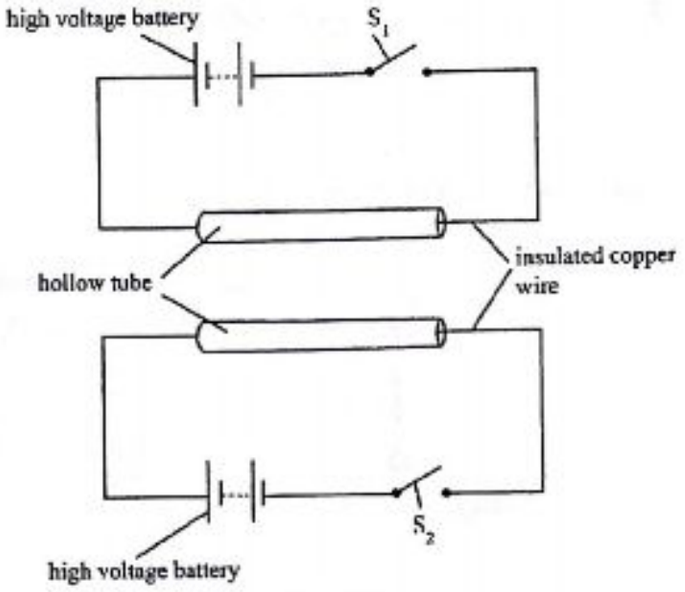


Fig. 6.2

(i) State what is observed when switches S_1 and S_2 are closed.

_____

_____ [1]

(ii) Explain your observations in **b (i)**.

_____

_____

_____

_____ [2]

For Examiner's Use

7 (a) (i) State the function of a capacitor.

_____ [1]

(ii) **Fig. 7.1** shows an RC circuit.

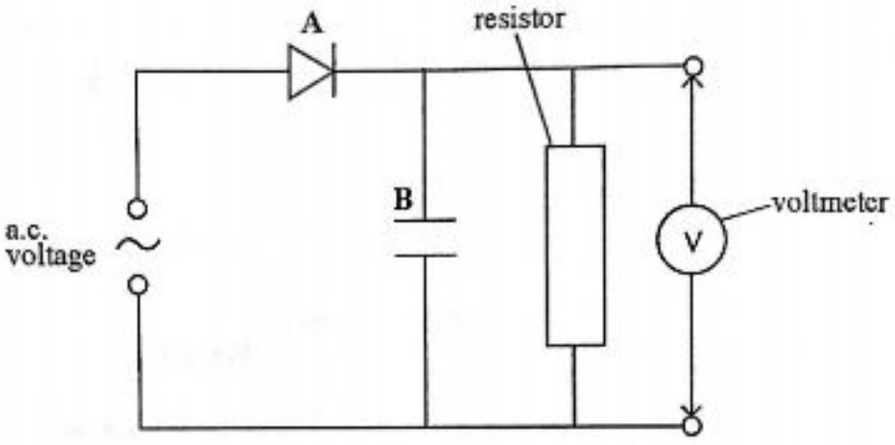


Fig. 7.1

Name the components

A, _____

B. _____ [2]

For Examiner's Use

(b) Sketch a voltage-time graph of the output voltage across the resistor in **Fig. 7.1** for two cycles.

[2]

8 **(a)** **Fig. 8.1** shows a transformer.

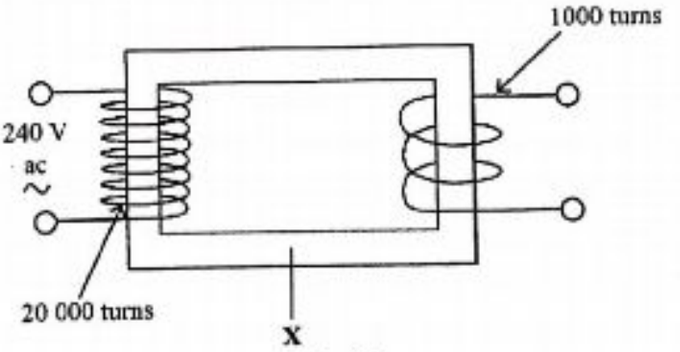


Fig. 8.1

(i) Identify part X.

_____ [1]

(ii) State, giving a reason, the type of transformer in **Fig. 8.1**.

_____

_____

_____

_____ [2]

For Examiner's Use

(b) Calculate the output voltage of the transformer in **Fig. 8.1.**

[2]

Section B

*Answer **any three** questions from this section.*

For Examiner's Use

9 **(a)** **Fig. 9.1** shows the moon orbiting the earth.

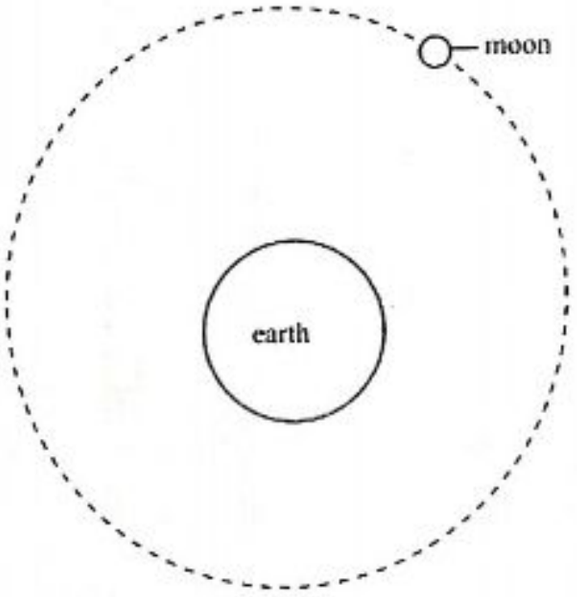


Fig. 9.1

(i) On **Fig. 9.1** draw an arrow that shows the direction of the force that keeps the moon in orbit.

(ii) State the name of the force in **a (i).**

(iii) Explain why the force in **a (i)** does not do any work.

(iv) Predict what will happen to the moon, if the force was to do work. [6]

For Examiner's Use

(b) **Fig. 9.2** shows an electric motor rated 6 500 W used to operate a lift of mass 500 kg that rises 11 m in 15 seconds.

[g = 10 ms^{-2}].

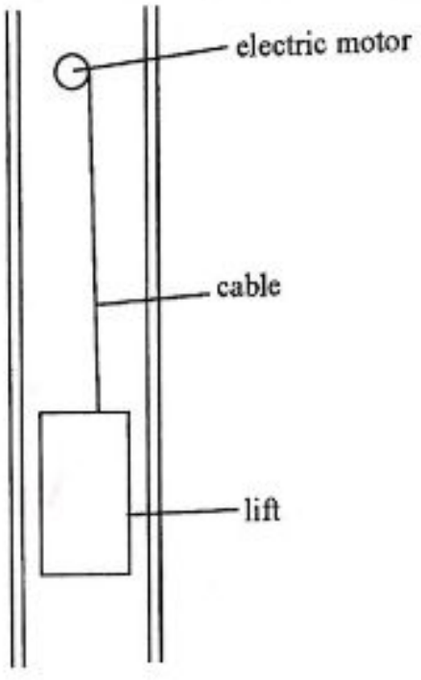


Fig. 9.2

(i) Calculate the tension in the cable.

(ii) Determine the power out of the electric motor.

(iii) Calculate the efficiency of the electric motor.

(iv) Justify the efficiency found in **b (iii)**.

[6]

(c) **(i)** Name **two** processes that gives out nuclear energy.

(ii) State any **two** uses of nuclear energy.

(iii) Suggest **two** dangers associated with nuclear energy.

(iv) Explain, giving **two** reasons, why most countries in the world are failing to make use of nuclear energy.

[8]

For Examiner's Use

10 (a) (i) State any **two** reasons why acroplane bodies are made of aluminium alloy.

(ii) Table **10.1** shows information about beams **A, B** and **C** produced which sags after being loaded.

Table 10.1

Beam	A	B	C
Sag	0.5 cm	2.0 cm	3.0 cm

From **table 10.1,** suggest with a reason, the strongest beam.

(iii) State **two** factors that should be kept constant for the comparison of the beams to be fair.

[6]

(b) Wind is blowing towards a wind turbine at $8\ ms^{-1}$. The mass of air passing through the area covered by wind turbine blades is $5000\ kgs^{-1}$.

(i) State the useful energy conversions during operation of a wind turbine.

(ii) Determine the kinetic energy of the air flowing in one second.

(iii) If the turbine is 15% efficient, calculate the electrical energy output.

(iv) State the reason why the turbine is not 100% efficient.

(v) Suggest an environmental hazard passed by wind turbines.

[6]

For Examiner's Use

(c) (i) State any **two** factors which determine the type of bridge to be constructed across a river.

(ii) Suggest why suspension bridges have a limited life span.

(iii) **Fig.10.1** show an incomplete suspension bridge.

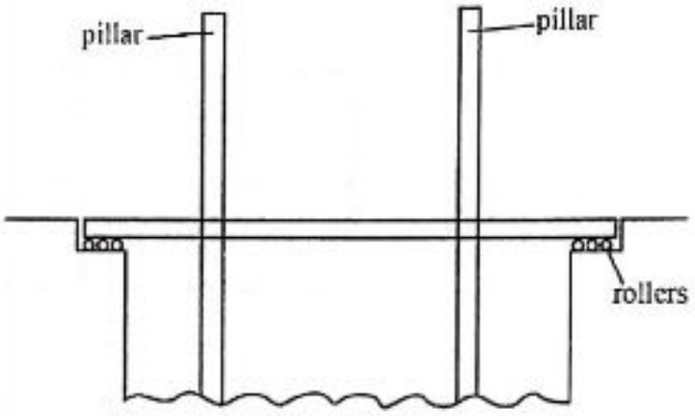


Fig. 10.1

On **Fig. 10.1** make additions that will complete and strengthen the bridge.

Using arrows, show the type of forces acting on pillars when the bridge is loaded.

(iv) State the function of rollers.

[8]

11 (a) **Fig. 11.1** shows a component on a car engine.

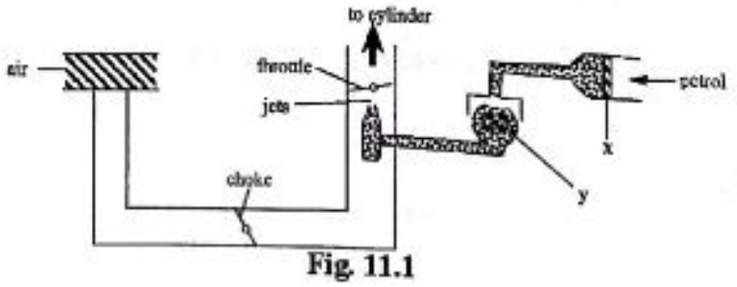


Fig. 11.1

For Examiner's Use

(i) Identify the component in **Fig. 11.1**.

(ii) State the functions of parts labelled X and Y.

(iii) Name a substance used in blending petrol in Zimbabwe.

(iv) Suggest any **two** reasons why countries are shifting from fossil fuels to solar energy. [6]

(b) (i) State what causes boiling point of water to vary with altitude.

(ii) Explain why sea water has a higher boiling point than pure water.

(iii) Describe how sound is produced when water boils. [6]

(c) (i) Define *heat capacity*.

(ii) State **two** factors that determine the heat capacity of a substance.

(iii) An aluminium cup of mass 0.2 kg contains 0.4 kg of water at 90 °C. Calculate the total amount of heat lost when the water and cup are cooled to 15 °C.
[specific heat capacity of water = 4 200 J/kg °C]
[specific heat capacity of aluminium = 900 J/kg °C]

(iv) Explain why different materials have different heat capacities. [8]

12 (a) (i) Arrange x-rays, radio waves and micro waves in order of increasing frequency.

(ii) State one use of
1. X-rays,
2. micro-waves,
3. infra-red,
4. ultraviolet. [6]

For Examiner's Use

(b) **(i)** Name any **two** household devices that make use of thermostats in temperature control.

(ii) **Fig. 12.1** shows a fire alarm circuit.

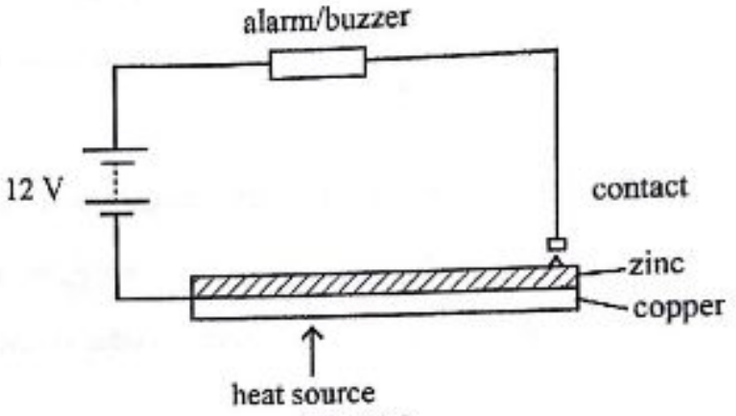


Fig. 12.1

Describe how the circuit in **Fig. 12.1** works.

(iii) Explain what would happen if railway lines had no gaps along them.

[6]

(c) **(i)** Give any **two** differences between *boiling* and *evaporation.*

(ii) State Boyle's law.

(iii) A gas occupies 100 cm^3 at a pressure of 20 kPa and a temperature of 25°C.
Calculate the volume of gas when pressure of 20 kPa and temperature are changed to 15 kPa and 15°C respectively.

(iv) Explain why island heat faster than the sea.

[8]

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2021 SESSION

PHYSICS

4023/2

1 (a) Metre rule/vernier calipers/measuring tape/ruler [1]

(b) Length Ab = 25 mm
Number of turns from A to B = 20 turns
∴ thickness of wire = $\frac{\text{Length AB}}{\text{Number of turns}}$

$\frac{25\text{mm}}{20\text{ turns}}$

= 1.25 mm accept other units [1]
- reject answer with no units

(c) There should be no spaces between the turns when winding the wire.
= no kinks in the wire
- avoid stretching wire [1]

(d) Micrometer screw gauge. [1]

2 (a) One in which the direction of vibration of particles in the medium is perpendicular to the direction of wave propagation; [1]
- accept diagram

(b) - they travel at the speed of light/travel at 3×10^8 m/s in a vacuum;
- they travel in straight lines in a vacuum;
- they can be reflected or refracted; polarised, diffracted, interfer
- they are not affected by electric fields or magnetic fields;
max 2
- they have equation v=fλ
- are all transverse waves
- transmit energy [1]
max [2]
+ max 2 for 2 reasons

(c) $f = \frac{v}{\lambda} = \frac{3\times10^8}{150}$

f = 2 000 000/2 MHz; [1]
Hz
- reject answer without correct unit max [1]

3 (a) (i) Mass [1]

(ii) Cross sectional area — cross-sec. shape [1]

(b) (i) Layers easily slide over another / there is no triangulation / not bonded or joined. [1]
slip
(more)

(ii) Beam showing a triangle [1]


single diagonal beam

(iii) Wood is weak in tension / brittle. [1]

4 (a) 100 °C; (award zero for no units;) [1]

(b) - length of liquid (column);
- resistance (of a wire);
- electromotive force/emf set up at a junction;
max 2 [2]

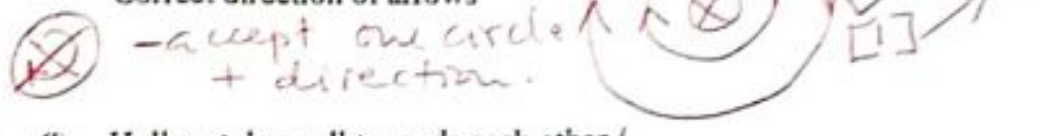
(c) thermocouple; [1]
has wider temperature range (-200 °C to 1 700 °C); [1]
[2]

5 (a) (i) 1. resistance doubles [1]
2. resistance halves [1]
3. resistance increases [1]
[3]

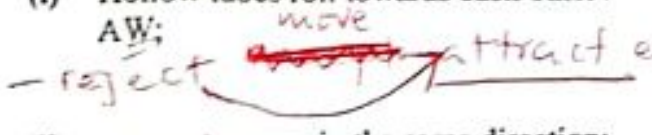
(ii) $R = \rho \frac{l}{A} = \frac{1.68 \times 10^{-8} \times 50}{1.26 \times 10^{-5}}$ [1]

= 0.067 Ω [1]
[2]

6 (a) Concentric circles B1
Correct direction of arrows B1



(b) (i) Hollow tubes roll towards each other / AW; B1



(ii) - currents move in the same direction; B1
- using (Flemmings left hand rule) a force of attraction is created B1

7 (a) (i) A device which stores charge. B1

(ii) Component A - diode B1
Component B - capacitor B1

(b) correct graph B1
labels B1

8 (a) (i) Soft iron core / iron core / core / soft magnetic core B1
- reject hard magnetic material

(ii) Step down transformer B1
Primary coil has more number of turns than secondary coil / AW B1
$N_s < N_p$

(b) $\frac{V_p}{V_s} = \frac{N_p}{N_s}$ /

$\frac{240V}{V_s} = \frac{20\,000 \text{ turns}}{100 \text{ turns}}$ C1

[1]

$V_s = \frac{240}{20}$;

$V_s = 12V$ A1

[1]

9 (a) (i) Arrow pointing towards earth B1

(ii) Centripetal force / Gravitational force. B1

(iii) - force perpendicular displacement B1
- no displacement in direction of force / B1
- work is force × displacement in direction of force B1
W = 0 since displ. = 0 ~~max = B2~~

(iv) - moon moves towards earth / speeds up towards the earth B1
- moon earth collide B1

(b) $T = mg = 500 \times 10$
5 000 N. Accept answer only A1

(ii) $Pout = \frac{W}{t} = \frac{5\,000 \times 11}{15}$ C1

= 3 660 watts / 3 700 watts A1

(iii) $E = \frac{Pout}{Pin} = \frac{3\,660}{6\,500}$ $\frac{3700}{6500}$ or $\frac{3660}{6500}$ C1

= ~~55.4~~ %. = 56.4 % ≡ 0.564 accept A1

(iv) Energy losses / power losses or E.C.F (from ii). B1
- W.d against friction / cable weight
- Sound / production — Heat Losses B1

(c) (i) -(nuclear fission / radioactive decay B1
-(nuclear fussion B1

(ii) power stations / industrial boilers B1
nuclear ships B1
nuclear submarines B1
nuclear cells B1
max B2
- radiotherapy
- sterilisation
* - leak detection
- nuclear weapons / war heads

(c) (iii)
- nuclear weapons
- radiation harmful
- environmental pollution
- radiation causes cancer / leukemia
- mutation / genetic alteration
- eye cataracts
- sterility. - burns - kills

B1 B1 B1 B1 max B2

(iv)
- nuclear plants expensive build / expensive
- high safety standards are needed / not safe / risky
- requires expertise/technical know how
- nuclear plants expensive to decommission / disposal of wastes
- raw materials not readily available,

B1 B1 B1 B1 max B2

10 (a) (i) - lighter / less dense / low density B1
- high strength to mass ratio B1
- does not rust B1
- easy to cast & shape into machine parts. max B 2

(ii) 1. A B A1
2. produced the least sag B M1

(iii) - same length
- same weight of load / mass of load B1
- same depth B1
B1
max B2

(b) (i) Kinetic (air) → Kinetic (blades) → electrical B1
KE → ELECTRICAL ✓

(ii) $Ek = \frac{1}{2}mv^2$ /

$= \frac{1}{2} \times 1 \times 5\,000 \times 8^2$; C1

$= 160\,000$ J A1

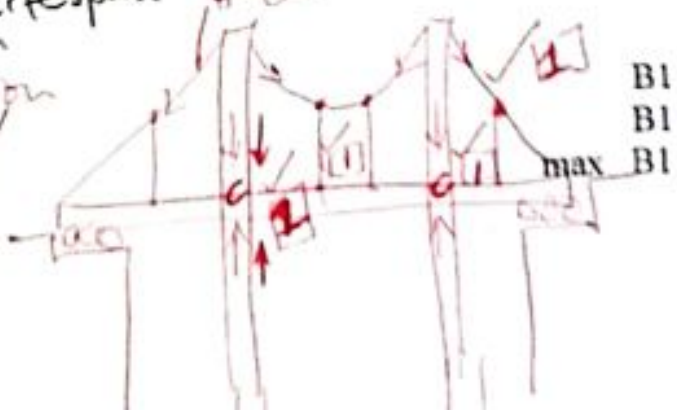
(iii) Energy output = 15% × 160 000 / *E.C.F (from ii)
= 24 000 J A1

(iv) Energy lost heat, sound / B1
Energy lost against friction B1
~~Max B1~~

(b) (v) - Cause harm to birds / destruction of ecosystem B1
- clearing of land / degradation
- ~~decompost~~ - decommissioned plants pose a threat to land pollution -

(c) (i) - Span / length of span B1
- use of bridge / load B1
- availability of materials / type of material B1
- cost of material
- proposed lifespan max B2

(ii) - rusting / corrosion B1
- fatigue of metals / cables break B1
max B1



(iii) Correct complete arrows; B2
Correct forces B2

(iv) reduce friction during expansion and contraction B1

11 (a) (i) Carburettor B1

(ii) X - cleans fuel/removes dirty from petrol; B1
Y - prevents flooding; B1

(iii) Ethanol; B1

(iv) - fossils cause pollution/affect environment/solar is clean; B1
- cheaper/lower running costs for solar; B1

(b) (i) - (change/variation) in atmospheric pressure; B1

(ii) - sea water has/contains impurities/salts; B1
(which raise the boiling point); B1

(iii) - particles gain more energy; B1
- energetic particles (forcefully) break away from strong bond; B1
- sound produced when bonds break; B1

(c) (i) - amount of heat energy required to raise temperature of a body; B1
by 1 K or 1 °C; B1

(ii) - amount of substance/mass; B1
- nature/type of substance; B1

(iii) Qlost = heat lost by Aluminium + heat lost by water; B1
= (0.2 × 900 × 75) + (0.4 × 4 200 × 75) C1
= 13500 + 126000 C1
= 139500 J / 139.5KJ; C1

(iv) Raising the temperature of a substance means changing the average kinetic energy, substances are made from different particles. B1

12 (a) (i) radio waves → microwave → x-rays; B2

(ii) 1. - internal imaging; B1
- cancer treatment; B1
- flaw detection in machines; B1
max B1

2. - ovens; B1
- telecommunications / data transmission; B1
max B1

3. (tv) remote ; B1

4. sterilise products B1

(b) (i) - electric stoves; B1
- electric irons; B1
- microwave ovens; B1
max B2

(ii) - when heated, strip bends towards zinc and makes contact; B1
- circuit completes and alarm goes/rings/walls; B1

(iii) - if temperature rises, the rail will expand; B1
and buckle since there is no room for expansion; B1

(c) (i)

Evaporation	Boiling
- occurs on surface only	- occurs throughout
liquid;	
- slow	- fast;
- occurs at any temperature	- occurs at specific
temperature;	

max B2

(ii) For a fixed mass of gas at **constant temperature**; B1
pressure is **inversely proportional** to the volume; B1

(iii) $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ C1

$\frac{20\,000\times100}{(273+25)} = \frac{15\,000V_2}{(16+273)} \Rightarrow \frac{2\times10^6}{298} = \frac{15\times10^3V_2}{288}$ C1

$V_2 = 1067cm^3$; $129\ cm^3$ accept $128.9\ cm^3$ (4 s.f.) A1

(iv) - water has a higher specific heat capacity than soil; B1

accept correct answer in m^3.

accept heat capacity in place of spec. heat capacity.