MARKING SCHEME

Name: _____ Index No.: _____

Candidate's Signature: _____

Date: _____

232/2
PHYSICS
Paper 1
Sep 2021
Time: 2 hours

T. Copy: Final:

KASSU JET EXAMINATIONS – 2021

Kenya Certificate of Secondary Education

PHYSICS

Paper 1

2 hours

Instructions to Candidates

(a) *Write your name and index number in the spaces provided above.*
(b) *Sign and write the date of examination in the spaces provided above.*
(c) *This paper consists of **two** sections: **A** and **B**.*
(d) *Answer ALL the questions in sections A and B in the spaces provided.*
(e) *ALL working MUST be shown clearly*
(f) *Mathematical tables and silent electronic calculators may be used.*
(g) *This paper consists of **11** printed pages.*
(h) *Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.*

For Examiner's Use Only

SECTION	QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
A	1 – 12	25	
B	13	10	
	14	12	
	15	13	
	16	9	
	17	11	
TOTAL SCORE		80	

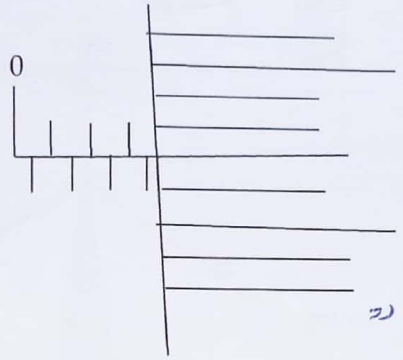
Answer ALL the questions in this section in the spaces provided

SECTION A (25 MARKS)

1. Thermodynamics is one of the branches of physics. What does it entail? (1mk)

It entails the study of transformation of heat to and from other forms of energy

2.(a) What is the reading in the following; (1mk)



⇒ Sleeve scale reading = 3.5mm

⇒ Thimble scale reading = 42 × 0.01 = 0.42mm

⇒ Actual Reading = 3.5 + 0.42 = 3.92mm ✓ (1)

(b) If the reading above was the diameter of a spherical ball; find it's volume. (2mks)

$V = \frac{4}{3}\pi r^3$

$\frac{4}{3} \times \frac{22}{7} \times \left(\frac{3.92}{2}\right)^2 = 16.098\ mm^3$ ✓ (2) S A

or $0.016098\ cm^3$

3. State two factors which affect the spring constant. (2mks)

- thickness of the wire used to make the spring any two
- Number of turns per unit length - the diameter of the spring
- the length of the spring - the nature of material

4. State the relationship between mass and weight. (1mk)

- Weight = mass × pull of gravity | $W = mg$ ✓ (1)

5.(a) State how the pressure in a moving fluid varies with speed of the fluid. (1 mk)

- An increase in velocity results to a corresponding decrease in pressure ✓ (1)

(b) Water flows along a horizontal pipe of cross sectional area 60 cm^2 which has a constriction of cross sectional area 24 cm^2 at one place. If the speed of water at the constriction is 5 m/s, calculate the speed in the wider section. (2 mks)

$A_1 = 60cm^2$ $A_2 = 24cm^2$

$V_1 = ?$ $V_2 = 5m/s$

$A_1V_1 = A_2V_2$

$V_1 = \frac{A_2V_2}{A_1}$ ✓ (2)

$= \frac{24 \times 5}{60} = 2m/s$ ✓

S ✓ A ✓

6. Explain why brakes fail in a hydraulic braking system when air gets into the system. (2mks)

Air is Compressible hence when used; pressure exerted won't be transmitted equally to the four wheels hence no uniform braking force ✓ (2)

2

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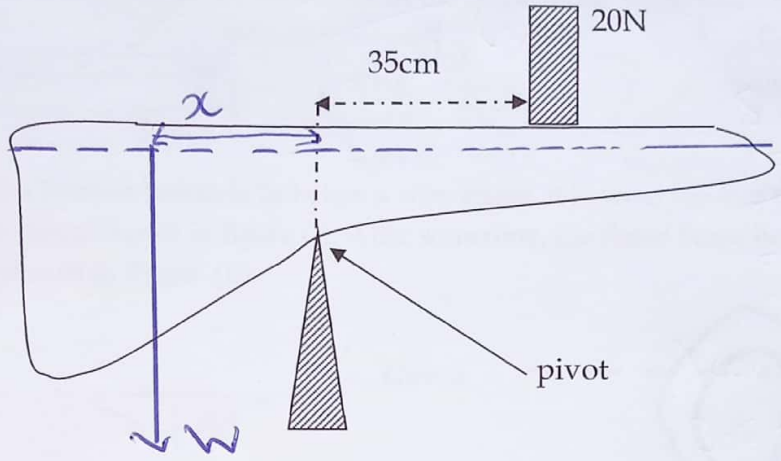
7.(i) State the principle of moments (1mk)

At equilibrium, the sum of clockwise moments about a point is equal to the sum of Anticlockwise moments about the same point. (1)

(ii)The figure below shows a non-uniform log of mass 1000g balanced on the pivot by a 20N weight as shown.



Determine the position of the centre of gravity from the pivot (2mks).

$m = 1000g = 1kg$

$W = mg = 1 \times 10 = 10N$

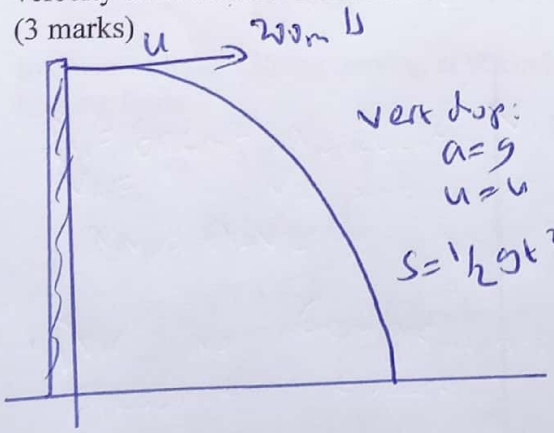
$10 \times x = 35 \times 20$ (1)

$x = \frac{35 \times 20}{10} = 70cm$ (1)

8.It is observed that a drop of milk carefully put into a cup of water turns the water white after sometime. Explain this observation (1mk)

This is because of diffusion. The drop diffused from a region of high concentration to a region of low concentration (1)

9.A bullet hits a stationary block at the edge of a cliff 100m high and moves with a common velocity of 200 m/s. Determine the maximum horizontal distance covered. (take g=10 m/s^2) (3 marks)



$100 = \frac{1}{2} \times 10 \times t^2$

$5t^2 = 100$

$t^2 = \frac{100}{5} = 20$ (3)

$t = \sqrt{20} = 4.472 sec$ (1)

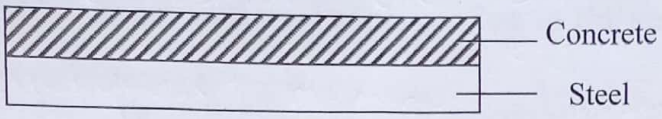
$R = ut$

$= 200 \times 4.472$ (1)

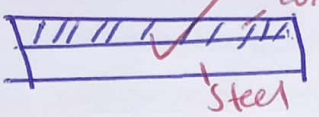
$= 894.4m$ (1)

7

10. The figure below shows a beam balance made out of concrete and reinforced with steel



Use a diagram to explain the behaviour of the shape of the beam when heated up (2mks)



The beam balance will remain the way it is. Concrete and steel have the same linear expansivity hence will expand at the same rate

11. When a Bunsen burner is lit below a wire gauze, it is observed that the flame initially burns below the gauze shown in figure (i). After sometime, the flame burns below as well as above the gauze as shown in figure (ii).

(i) (ii)

State the reason for this observation. (1 mk)

In (i) the gas above the gauze has not reached ignition point since the gauze conducts heat away
In (ii) the gas above & below has reached ignition point

12. a) State Newton's 2nd Law of Motion (1mk)

The rate of change of momentum is directly proportional to the resultant external force and takes place in the direction of the force

b) A car of mass 1200kg moving at 90km/h is brought to rest over a distance of 20m. Calculate the braking force . (3mks)

$m_{car} = 1200kg$

$u = 90km/h$

$= \frac{90 \times 1000}{3600} = 25m/s$

$v = 0m/s$

$a = \frac{v-u}{t}$

$\frac{0-25}{t}$ $v^2 = u^2 + 2as$

$0^2 = 25^2 + 2 \times a \times 20$

$40a + 625 = 0$

$40a = -625$

$a = \frac{-625}{40} =$

$-15.625 m/s^2$

$F = ma$

$= 1200 \times -15.625$

$= -18,750N$

Braking force

$= 18,750N$

7 (3)

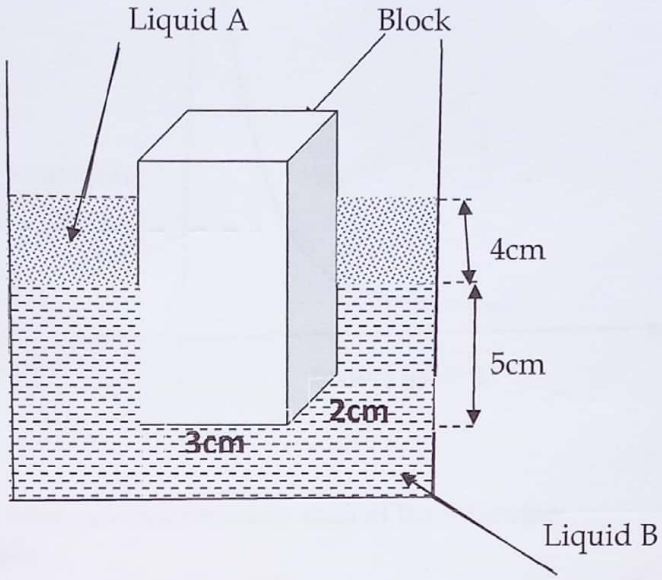
SECTION II(55mks)

Attempt ALL the questions in this section in the spaces provided.

13. (a) State Archimedes Principle. (1mk)

When a body is partially or fully immersed in a fluid; it will experience an upthrust equal to the weight of the fluid displaced. ✓1

(b)The figure below shows a rectangular block of height 10cm floating vertically in a beaker containing two immiscible liquids A and B. The densities of the liquids are $0.8g/cm^3$ and $1.2g/cm^3$ respectively. The block is of dimensions 2cm by 3cm 10cm.



Determine;

(i)the weight of liquid A displaced by the block. (2mks)

⇒ Vol of liquid A displaced = Vol of block in liquid A = 3cm × 2cm × 4cm = 24cm³ ✓1

⇒ mass of liquid A displaced = ρ × V = 0.8 × 24 = 19.2g ✓2

⇒ weight of liquid A displaced = mg = 19.2/1000 × 10 = 0.192N ✓1

(ii)weight of liquid B displaced by the block. (2mks)

- Vol of block in liquid B = 3cm × 2cm × 5cm = 30cm³ = Vol of liquid B displaced.

- mass of liquid B displaced = ρV = 1.2 × 30 = 36g ✓2

- weight of liquid B displaced = 36/1000 × 10 = 0.36N ✓1

(iii)mass of the block. (2mks)

⇒ Law of floatation:

- A floating object displaces its own weight in the fluid it floats

⇒ Total weight of liquid displaced = weight of the block

= 0.192N + 0.36N = 0.552N ✓1

W = mg

m = W/g = 0.552/10 = ✓2

0.0552kg or 55.2g

7

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(c) A hydrometer is one of the applications of Archimedes Principle and relative density. State the functions of the following parts of a hydrometer;

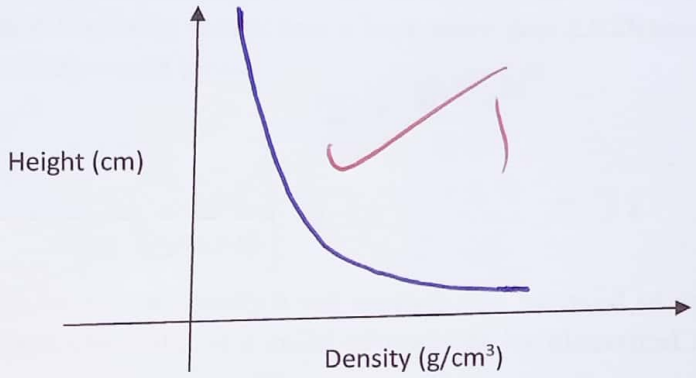
(i) wide bulb (1mk)

- To displace large volume of liquid Sufficient upthrust to keep it afloat.

(ii) lead shots (1mk)

⇒ Make the hydrometer float upright

(d) Sketch a graph of depth of immersion of a hydrometer against the density of a fluid. (1mk)



14. (a)Explain what you understand by each of the following;

(i)Angular velocity (1mk)

Rate of change of angular displacement

(ii) Centripetal force. (1mk)

Force which constrains a body to move in uniform circular motion

(b) A car is moving in an unbanked circular path. State what provides the centripetal force. (1mk)

The frictional force between the tyres and the road's surface.

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(c) A bicycle wheel with radius 0.30m moves with a linear velocity of 9m/s. Determine;

(i) the angular velocity of the wheel. (3mks)

$V = r\omega$ $\omega = \frac{V}{r} = \frac{9}{0.3} = 30\ rad/s$ F S A (3)

(ii) the centripetal acceleration at a point on the rim of the wheel. (3mks)

$a = \frac{V^2}{r} = \frac{9^2}{0.3} = 270\ rad/s$ (3) F S A

or $a = r\omega^2 = 0.3 \times 30^2 = 270\ rad/s$

(d) A marble of mass 50g attached to a light string of length 0.8m is rotated in a vertical plane. The string cannot bear a load more than 2.5 Determine the velocity at which the string would break. (3mks)

$T = \frac{mv^2}{r} + mg$

$2.5 = \frac{0.05}{0.8}v^2 + 0.05 \times 10$

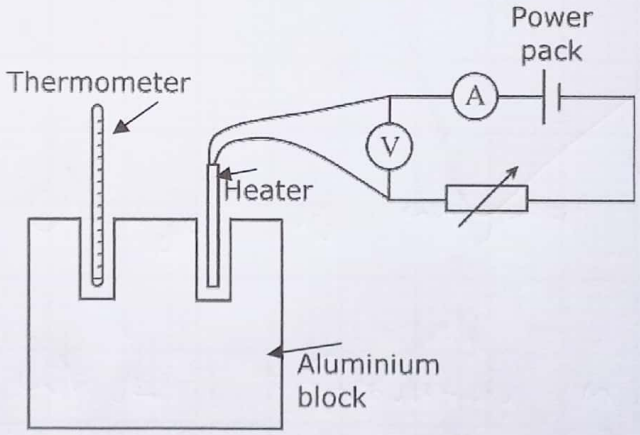
$2 = \frac{0.05}{0.8}v^2$

$v^2 = \frac{2 \times 0.8}{0.05} = 32$

$V = \sqrt{32}$

$= 5.657\ m/s$ F S A (3)

15 (a) The Figure below shows a set up that can be used in an experiment to determine the specific heat capacity of a solid of mass **m** by electrical method.



(i) Why are the two holes for the heater and thermometer filled with light oil? (1mk)

To improve thermal contact with the heater and the thermometer. (1)

(ii) State the measurements that should be taken from the above setup. (2 mks)

⇒ Ammeter reading; I

⇒ Voltmeter reading; V (2)

⇒ Time taken to heat the metal block; t

⇒ Initial temp. of the metal block; θ_1

⇒ Final temp of metal block; θ_2

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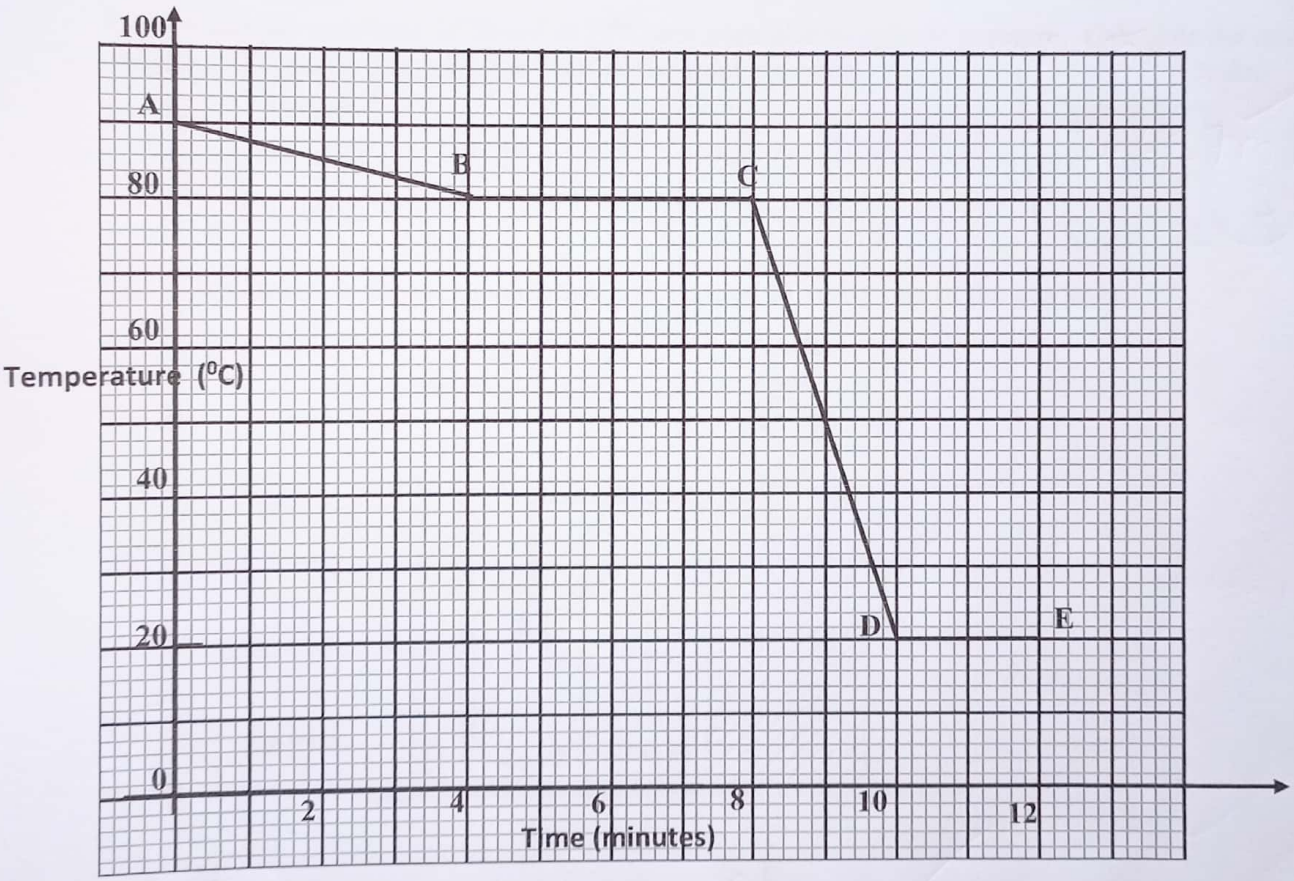
(iii)If the change in temperature of the block was recorded as θ. Write an expression that can be used to determine the specific heat capacity of the solid. (1 mk)

$VIt = mc\theta$ $\quad c = \frac{VIt}{m\theta}$ ✓ 1

(iv) From the above expression, state the assumption made. (1mk)

Heat Supplied by the heater = Heat gained by the block
No heat lost to the Surrounding ✓ 1

(b) The graph below shows a cooling curve for 50g of Naphthalene which was heated until it melted into a liquid then allowed to cool.



Explain the shape of the graph between the points:

(i)AB. Liquid Naphthalene is cooling as it's loosing heat ✓ 1 (1mk)

(ii)BC. (1mk)

Change of State of Naphthalene i.e from liquid to solid. ✓ 1
[solidification of Naphthalene]

8

4

(iii)Given that the specific latent heat of fusion for Naphthalene is 19097.3J/kg. Calculate the heat evolved between the region BC of the 50g of Naphthalene. (3mks).

$Q = mL_f$ $\frac{50}{1000} \times 19097.3 = 954.865\ J$ f s a 3

(iv) How much heat energy would be released by the 50g.of Naphthalene in region CD, if the specific heat capacity of Naphthalene is 1720J/kgK. (2mks)

$Q = mc\Delta\theta$

$\frac{50}{1000} \times 1720 \times (80-20) = \frac{50}{1000} \times 1720 \times 60$

$= 5160J$ s a 2

16.(a)A gas has a volume of 20cm^3 at 27^{0}C and normal atmospheric pressure. Calculate the new volume of the gas if it is heated to 54^{0}C at the same pressure. (3mks)

$V_1 = 20\ cm^3$

$T_1 = 27 + 273 = 300K$

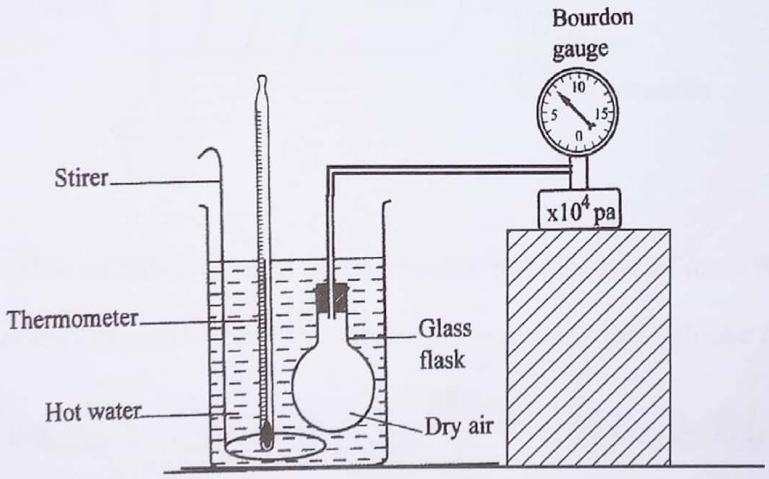
$T_2 = 273 + 54 = 327K$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $V_2T_1 = V_1T_2$

$V_2 = \frac{V_1T_2}{T_1} = \frac{20 \times 327}{300}$

$V_2 = 21.8cm^3$ 3

(b)The figure below shows a set up that may be used to verify one of the gas laws.



(i) State the law being investigated pressure law. (1 mark)

- Pressure of a fixed mass of a gas varies directly with absolute temperature provided volume is kept constant. 1

(ii) State the measurements that may be taken in the experiment. (2 marks)

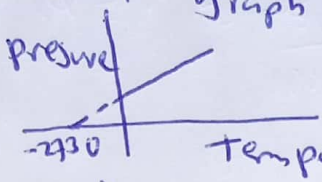
=) Temperature

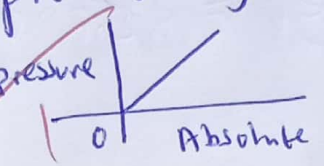
=) pressure. 2

11

(iii) Explain how the measurement in (i) above may be used to verify the above law (4 marks)

⇒ Record temperature and corresponding pressure values
⇒ plot a graph of pressure against temperature





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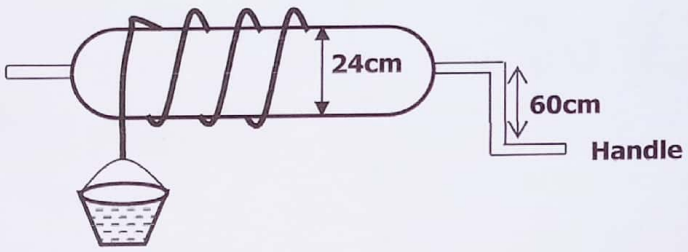
Observations:
- A straight line is obtained passing through origin. This shows that pressure vs absolute temp.
Pressure varies directly with absolute temperature.

17. The figure below shows a windlass. An effort is applied on the handle which is turned on a radius of **60 cm**. As the handle turns, a rope is wound around the drum of diameter **24 cm**, thus raising a bucket of water out of the well



a) If an effort of **20N** is needed to lift a bucket full of water of mass **8kg**, Calculate:

(i) The energy gained by the mass when the drum turns through one revolution (3mks)

$W_{output} = L \times D_L$ ✓1 $= 60.3264\,J$ ✓1

$= L \times 2\pi r$

$= 8 \times 10 \times 2 \times 3.142 \times \frac{12}{100}$ ✓1 $\simeq 60.33\,J$

3

(ii) The work done by the effort during this revolution. (3mks)

$W_{input} = E \times D_E$

$= E \times 2\pi R$ ✓1

$20 \times 2 \times 3.142 \times \frac{60}{100}$ 3

$= 75.408\,J$ ✓1

10

10

b) Suggest a reason why the two quantities in a(i) and (ii) are not equal (1mk)

Work output is less than work input because of;
⇒ Friction between moving parts or
⇒ work done in lifting useless load [moving parts of the windlass].

c) Calculate:

(i) The velocity ratio of the machine (2mks)

$$VR = \frac{2\pi R}{2\pi r} = \frac{R}{r} = \frac{60}{12} = 5$$ 1 s/a 2

(ii) The efficiency of the windlass (2mks)

$$MA = \frac{L}{E} = \frac{80}{20} = 4$$

$$\eta = \frac{MA}{VR} \times 100\%$$

$$= \frac{4}{5} \times 100\% = 80\%$$ 1/2 s/a 1

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