



# AITEL EXAMINATIONS BUREAU LIMITED

UGANDA CERTIFICATE OF LOWER CURRICULUM EDUCATION

END OF YEAR 2023

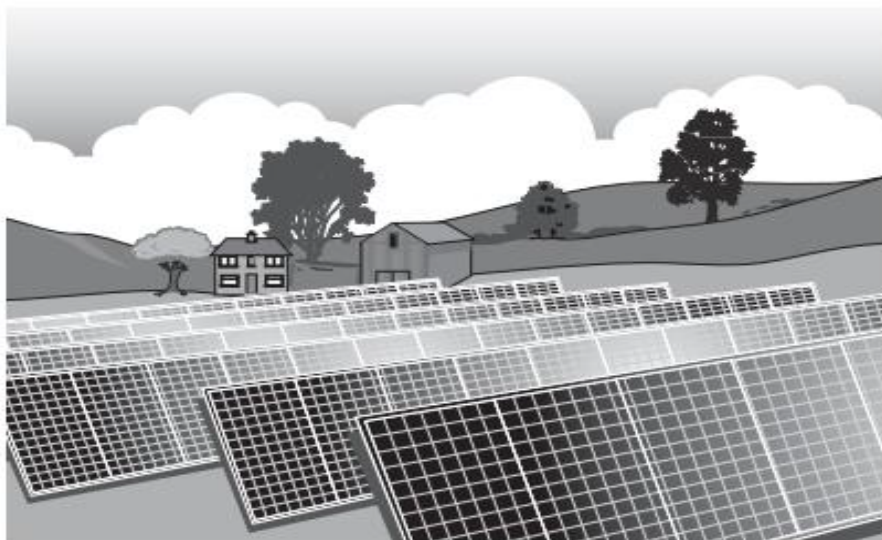
SENIOR TWO PHYSICS

TIME: 2 hours

## Instructions

- *Attempt all the questions.*
- *Where necessary, assume*  
✓ *Acceleration due to gravity,  $g = 10\text{ms}^{-2}$*

1. **Figure 1.1** shows solar cells used to generate electrical energy.



**Figure 1.1**

(a) State the main form of energy transferred from the Sun to the solar cells for the generation of electrical energy. **(01mark)**

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(b) Consider the generation of electrical energy by a large number of solar cells, as shown in **Figure. 1.1**.

(i) State **one** environmental advantage and **one** environmental disadvantage.

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.....**(01 mark)**

**disadvantage**

.....

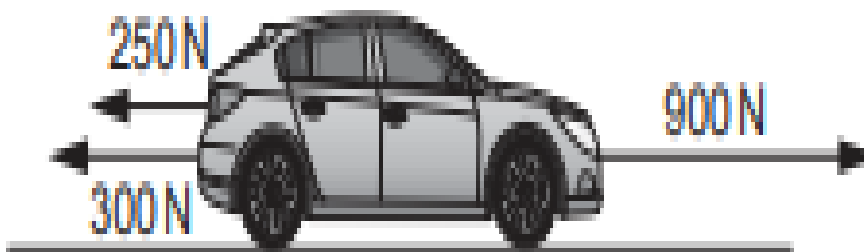
.....**(01 mark)**

(ii) State and explain whether this source of electrical energy is **renewable** or **non-renewable**. **(02 marks)**

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- 2 **Figure 2.1** below shows three horizontal forces acting on a car as it moves along a straight road. The horizontal forces act along the same straight line.



**Figure 2.1**

- (a) (i) Calculate the size of the resultant horizontal force on the car and state its direction. **(04 marks)**

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$\therefore$  **size of resultant force** = ..... **N**

**direction of resultant force** .....

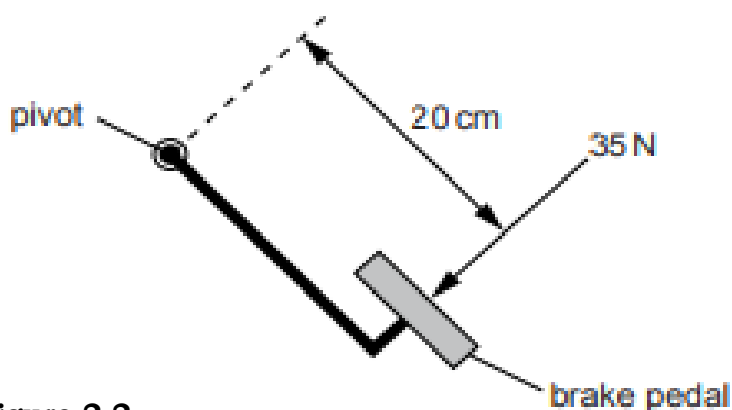
- (ii) The driver presses the brake pedal and the car slows down.

As the car slows down, the kinetic energy of the car decreases by 100 kJ.

Describe and explain what happens to this 100 kJ of energy. **(02 marks)**

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- (b) **Figure 2.2** shows the force applied to the brake pedal by the driver's foot.

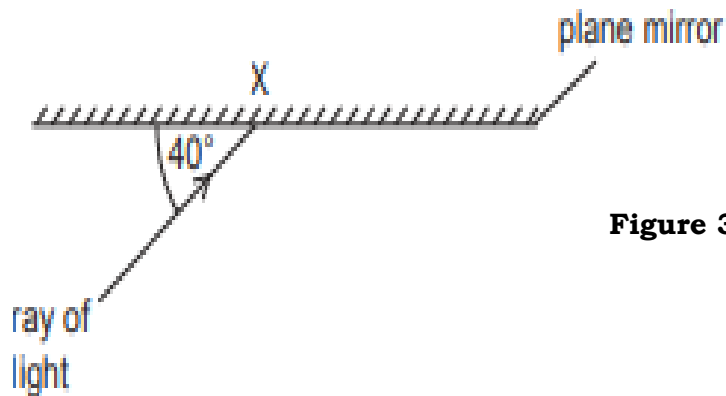


**Figure 2.2**

Calculate the moment of the force about the pivot. Include the unit. **(03ks)**

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- 3 (a) **Figure. 3.1** shows a ray of light incident on a plane mirror at point X.



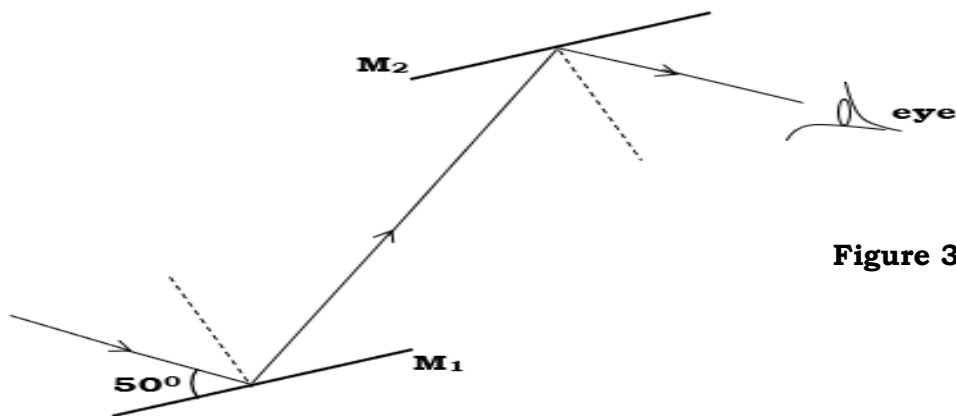
**Figure 3.1**

- (i) Determine the value of the angle of reflection for the ray of light at point X. **(02 marks)**

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- (ii) On **Figure 3.1**:
- draw the **normal** at point X and label the normal with the letter **N**.
  - draw the ray **reflected** from point X and name it as R. **(02 marks)**

- (b) A ray of light is reflected by two parallel mirrors  $M_1$  and  $M_2$  as shown in **figure 3.2**.



**Figure 3.2**

- (i) Find the angle of incidence at mirror  $M_1$  . **(02 marks)**

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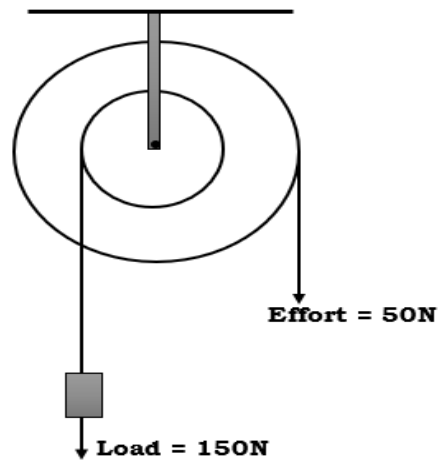
- (ii) Find the angle of reflection at mirror  $M_2$ . **(02 marks)**

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- (iii) State **one** optical device which uses the arrangement in **figure 3.2**. **(01 mark)**

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- 4 (a) The figure below shows the cross – section of a wheel and axle machine of radius 6.5cm and 1.5cm respectively used to lift a load.



Calculate the efficiency of the machine.

**(05 mark)**

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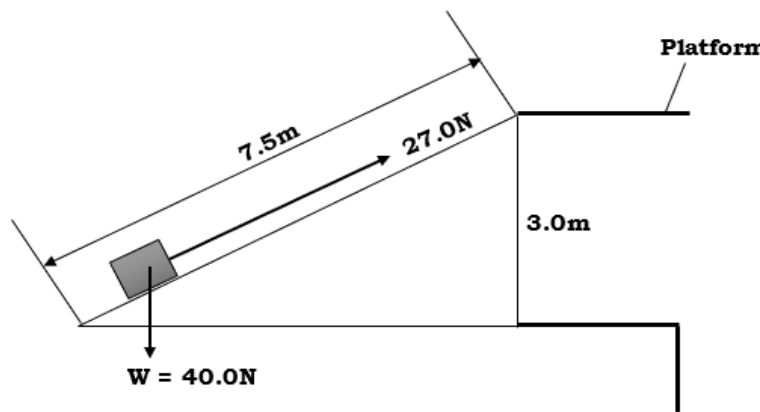
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- (b) A student wanted to put boxes of salt at the top of the platform using an inclined plane.



If the total weight of the boxes of salt is 40.0N and the student uses a pulling force of 27.0N along the plane, determine;

- (i) the Mechanical advantage of the plane.

**(02 marks)**

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- (ii) the velocity ratio of the plane.

**(02 marks)**

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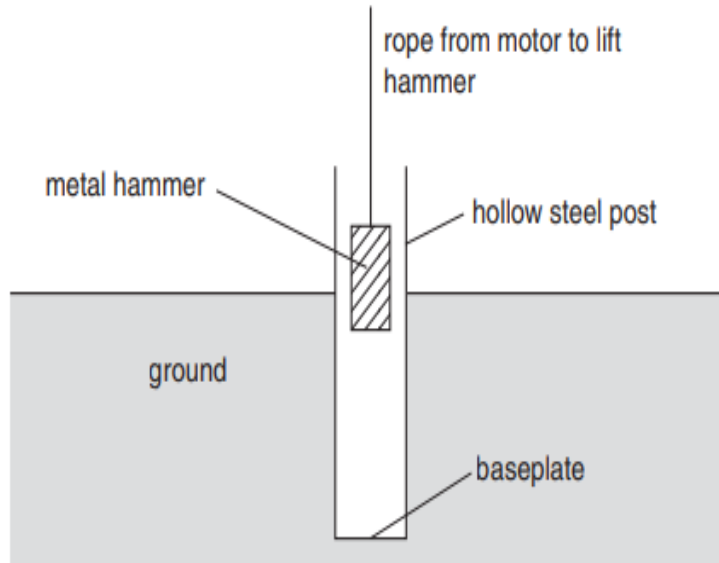
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(iii) the efficiency of the inclined plane.

**(04 marks)**

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- 5** A falling metal hammer is used to drive a hollow steel post into the ground, as shown in **Figure. 5.1**. The hammer is lifted by an electric motor and then falls freely to hit the baseplate.



**Figure 5.1**

- (i) State the law of conservation of energy.

**(01 mark)**

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- (ii) State the energy conversions that take place as the hammer falls, starting from the initial potential energy of the hammer before it is dropped.

**(03 marks)**

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- (b) The metal hammer has a mass of 1500 kg and it hits the baseplate with a speed of 8.0 m/s.

- (i) Calculate the kinetic energy of the hammer as it hits the baseplate.

**(04 marks)**

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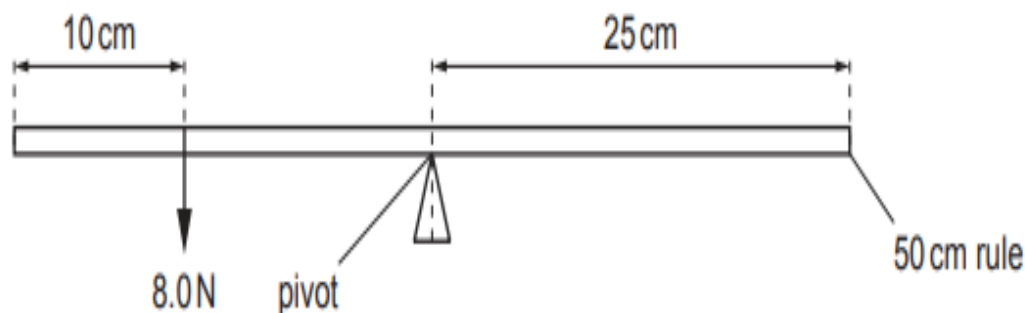
- (ii) State the **initial potential energy** of the hammer.

**(01 mark)**

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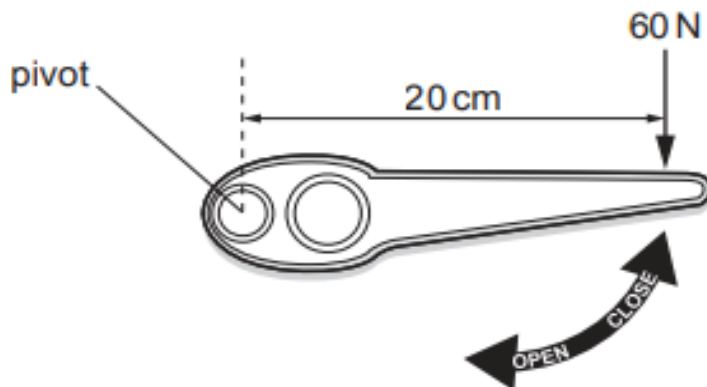
- (iii) Calculate the height above the baseplate from which the hammer is dropped. (**Take  $g$  as  $10 \text{ ms}^{-2}$** ). **(04 marks)**

6. (a) A 50 cm rule is balanced at its mid-point. A force of 8.0 N acts at a distance of 10 cm from one end of the rule. **Figure 6.1** shows the arrangement.



**Figure 6.1**

- (i) Calculate the moment of the 8.0 N force about the pivot. Give the unit. **(04 marks)**
- .....
- .....
- (ii) Another force acts at a point 10 cm from the pivot and to the right of the pivot. It makes the rule balance. On **Figure 6.1**, draw an arrow to show the position and direction of this force. **(01 mark)**
- (b) **Figure 6.2** shows the handle used to open and close a cupboard door on the aeroplane.



**Figure 6.2**

- A force of 60 N acts at a distance of 20 cm from the pivot of the handle. Calculate the moment of the 60 N force about the pivot. **(04 mark)**

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7. **Figure. 7.1** shows a fork-lift truck lifting a box.



**Figure 7.1**

The electric motor that drives the lifting mechanism is powered by batteries.

(a) State the **form of the energy** stored in the batteries. **(01 mark)**

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(b) The lifting mechanism raises a box of mass **32 kg** through a vertical distance of **2.5 m** in **5.4 s**.

(i) Calculate the gravitational potential energy gained by the box.

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**gravitational potential energy = .....(03 mark)**

(ii) The **power developed** on lifting the box through the vertical distance

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(iii) The efficiency of the lifting mechanism is 65%. Calculate the **input**

**power** to the lifting mechanism. **(04 marks)**

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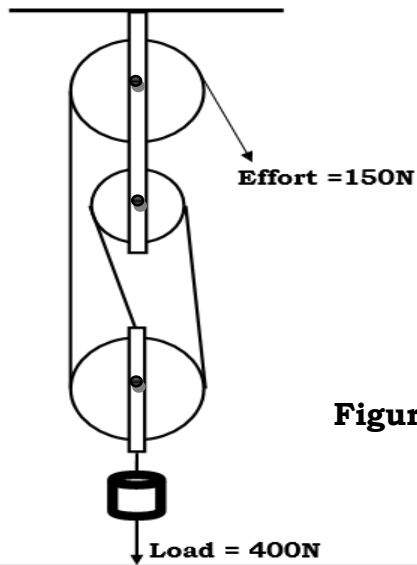
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**input power = .....**

8. **Figure 8.1** shows a pulley system.



**Figure 8.1**

(a) What is the **velocity ratio** of the system? **(01 mark)**

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(b) Calculate the efficiency of the system. **(05 marks)**

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(c) On **figure 8.1**, show the direction of the force on the string. **(01 mark)**

(d) State any **three** uses of pulleys. **(03 marks)**

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**THE END**