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WORKSHEETS
ATTEMPT | CHECK | CORRECT | IMPROVE

OCR A A Level Physics | Work done worksheet

35-40 minutes independent practice + 15-20 minutes review | 35 marks

Specification points covered

- 3.3.1(a) Define work done by a force and the unit joule.
- 3.3.1(b) Use W = F x cos θ for work done by a force.
- 3.3.1(c) State and apply the principle of conservation of energy.
- 3.3.1(d) Describe energy in different forms, its transfer and conservation.
- 3.3.1(e) Explain that transfer of energy is equal to work done.

How to use this worksheet
Attempt every question independently. Show numerical working in the blank spaces and use the ruled lines for precise written explanations. Give work done a sign where direction matters.

1. Starting with the definition [3 marks]

The installation team begins by checking the language and units used in its planning notes.

(a) Define work done by a force and state what it means for one joule of work to be done. **[2 marks]**

(b) A stage light is pushed horizontally with a force of 75 N through 3.20 m. Calculate the work done by the force. **[1 mark]**

2. Direction matters [4 marks]

A technician moves equipment along the level tunnel floor.

(a) The technician walks 25 m while supporting a load with an upward force of 180 N. Calculate the work done by this upward force. **[1 mark]**

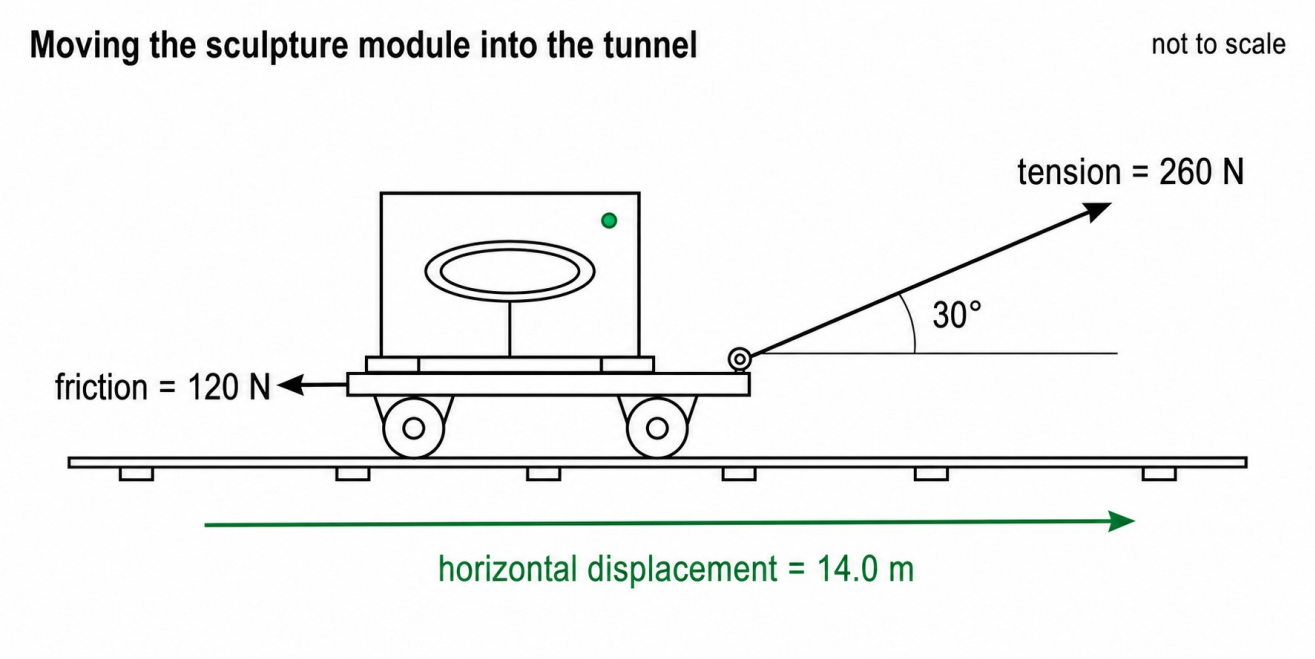
(b) A trolley is pulled 6.00 m by a horizontal force of 42 N. Calculate the work done. **[1 mark]**

(c) The same 42 N force is now directed at 55° to the trolley's horizontal displacement of 6.00 m. Calculate the work done. **[2 marks]**

Scenario: installing The Lumen Line
A team is installing a moving light sculpture in a former railway tunnel. Treat each stated force as constant over the displacement.

3. Moving the sculpture module [6 marks]

The Lumen Line is a kinetic light sculpture being installed inside a disused railway tunnel. Its main module is carried on a rail trolley.



(a) Calculate the work done on the trolley by the tension in the cable. **[2 marks]**

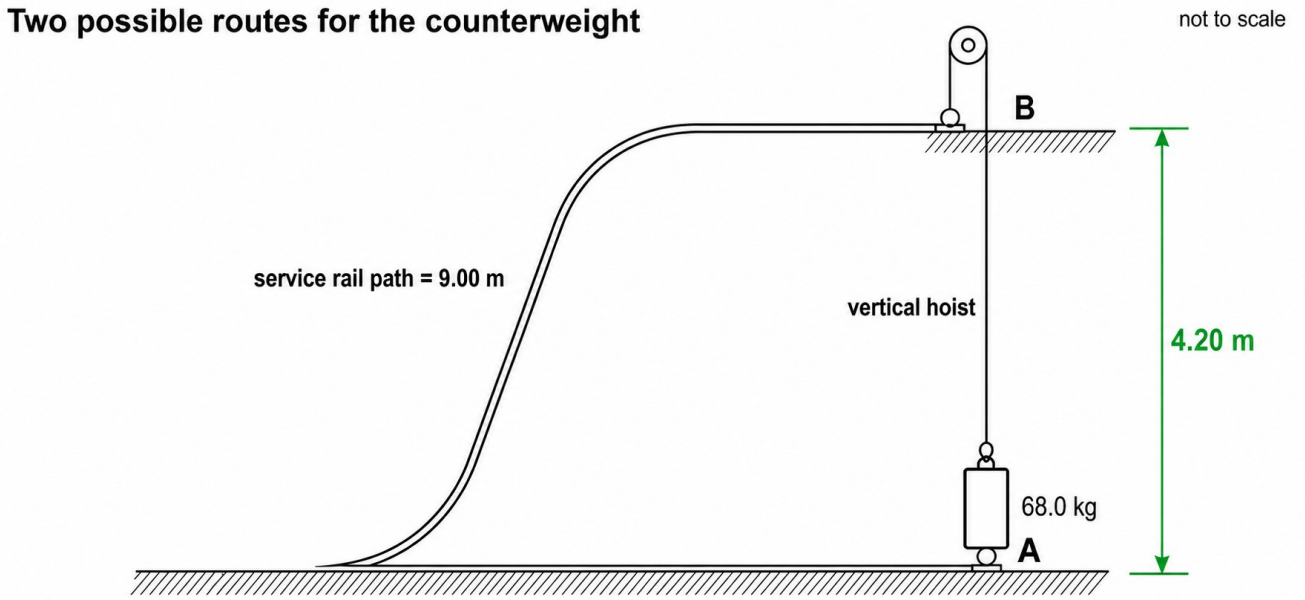
(b) Calculate the work done on the trolley by friction. Include the correct sign. **[1 mark]**

(c) Calculate the net work done on the trolley by all the forces. **[1 mark]**

(d) State the energy store that increases. Explain why the weight and normal contact force do no work on the trolley during this movement. **[2 marks]**

4. Moving the counterweight [7 marks]

A 68.0 kg counterweight must be moved from A to B. It could be lifted vertically or moved along a longer service rail. Use g = 9.81 N/kg.



(a) State the distance that must be used to calculate the work done against the counterweight's weight. **[1 mark]**

(b) Calculate the work done against the weight in moving the counterweight from A to B. **[2 marks]**

(c) During the vertical lift, the hoist exerts a constant upward force of 760 N through 4.20 m. Calculate the energy transferred to thermal stores. **[2 marks]**

(d) Explain why, if resistive forces are ignored, the work done against the weight is the same for the vertical route and the service-rail route. **[2 marks]**

5. Checking a cable angle [3 marks]

During alignment, the direction of a cable cannot be measured directly.

(a) A cable force of 190 N does 870 J of work while the module moves 8.50 m. Determine the angle between the force and the displacement. **[2 marks]**

(b) A 95 N braking force then acts exactly opposite to the motion over 2.60 m. Calculate the work done by the braking force. **[1 mark]**

6. A regenerative descent [4 marks]

During a test descent, the counterweight's gravitational energy store decreases by 5.60 kJ. The generator transfers 4.10 kJ to the battery's chemical energy store.

(a) Calculate the energy transferred to thermal stores. **[1 mark]**

(b) Explain how this example demonstrates conservation of energy and why it is inaccurate to say that the remaining energy has been 'lost'. **[3 marks]**

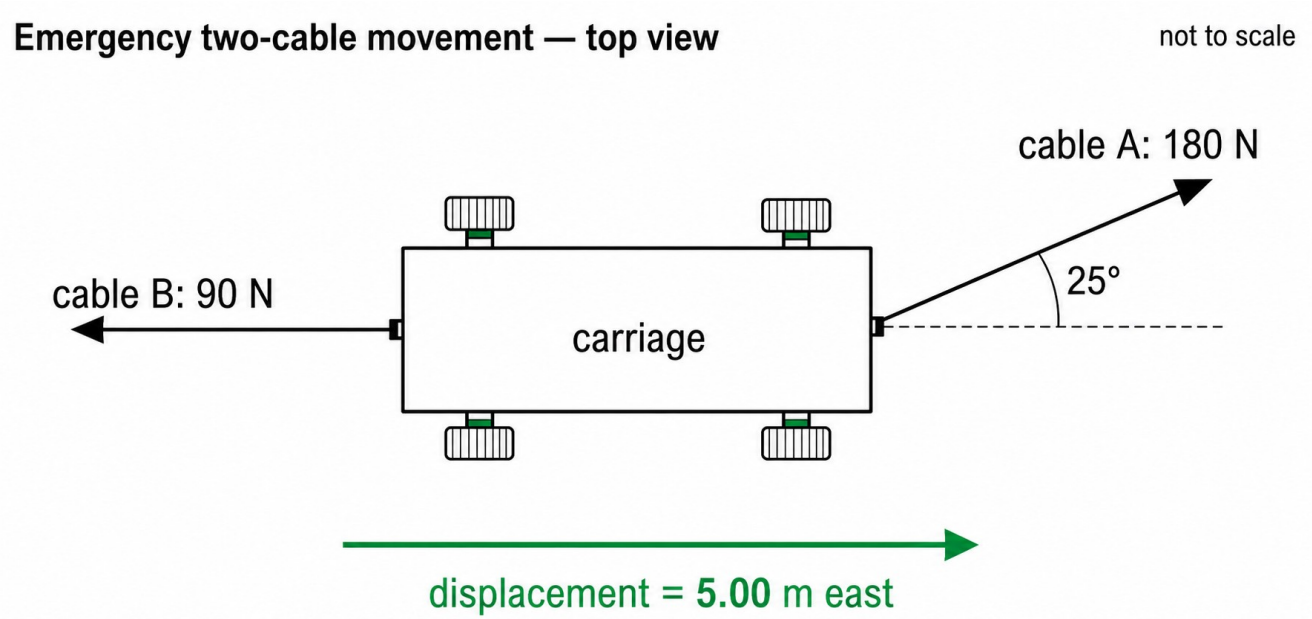
7. Choosing the towing arrangement [3 marks]

Two cable arrangements are proposed for moving a display carriage through the same horizontal distance of 16.0 m.

(a) Arrangement A uses 310 N at 20° to the motion. Arrangement B uses 360 N at 42° to the motion. Calculate the work done by each arrangement and determine which transfers more energy to the carriage. **[3 marks]**

8. Emergency two-cable movement [5 marks]

In an emergency test, two cables act on the carriage while it moves 5.00 m east.



(a) Calculate the total work done on the carriage by cable A and cable B. **[3 marks]**

(b) A technician says, 'Both cables transfer energy to the carriage because both exert a force on it.' Evaluate this statement using precise physics language. **[2 marks]**

Review and improve

- ☐ I can identify the component of a force in the direction of motion.
- ☐ I can use the sign of work done to describe the direction of energy transfer.
- ☐ I can account for all energy transfers without saying energy is destroyed.