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90183

NZQA
NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

For Supervisor's use only

Level 1 Physics, 2007

90183 Demonstrate understanding of mechanics in one dimension

Credits: Five
9.30 am Friday 30 November 2007

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should answer ALL the questions in this booklet.

For all numerical answers, full working must be shown. The answer should be given with an SI unit.

For all 'describe' or 'explain' questions, the answer should be in complete sentences.

Formulae you may find useful are given on page 2.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

For Assessor's use only	**Achievement Criteria**	
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Identify or describe aspects of phenomena, concepts or principles. ☐	Give descriptions or explanations in terms of phenomena, concepts, principles and / or relationships. ☐	Give concise explanations that show clear understanding in terms of phenomena, concepts, principles and / or relationships. ☐
Solve straightforward problems. ☐	Solve problems. ☐	Solve complex problems. ☐
Overall Level of Performance (all criteria within a column are met) ☐		

You are advised to spend 50 minutes answering the questions in this booklet.

Assessor's use only

You may find the following formulae useful.

$$v = \frac{\Delta d}{\Delta t} \qquad a = \frac{\Delta v}{\Delta t} \qquad F_{\text{net}} = ma \qquad P = \frac{F}{A}$$

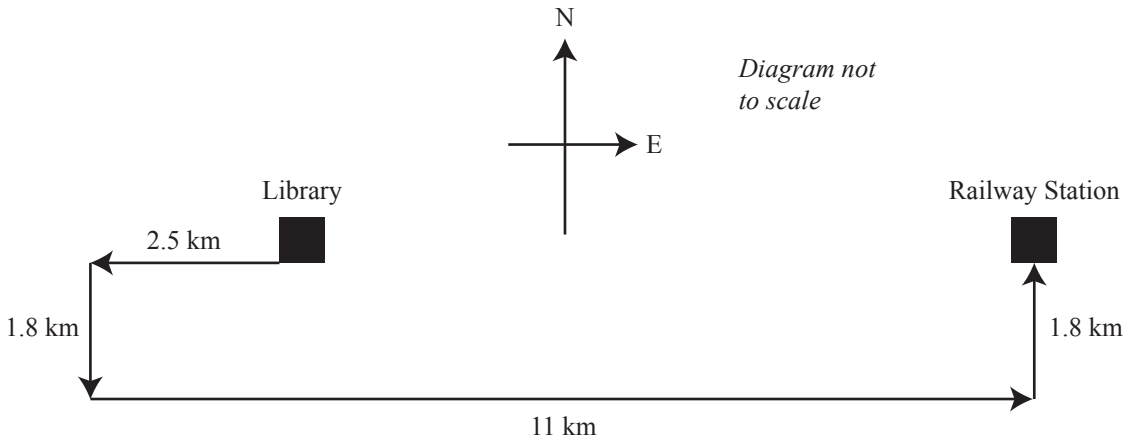
$$\Delta E_{\text{P}} = mg\Delta h \qquad E_{\text{K}} = \frac{1}{2}mv^2 \qquad W = Fd \qquad P = \frac{W}{t}$$

The value of g is given as 10 m s^{-2}.

QUESTION ONE: DELIVERY RUN

Assessor's use only

Mark is a courier van driver. During a delivery run, Mark starts from the city library, drives **2.5 km** west, **1.8 km** south, **11 km** east, **1.8 km** north to arrive at the railway station. The displacement vector diagram below shows Mark's journey.



(a) State Mark's final **displacement** from the city library.

displacement = _____

(b) The time taken for the delivery run is **18 min**. Calculate Mark's average **speed** in **km h^{-1}**.

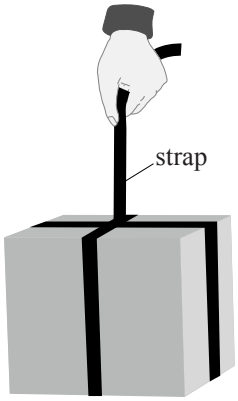
average speed = _____

(c) Calculate the size of Mark's average **velocity** in **m s^{-1}**.

average velocity = _____

Assessor's use only

Mark now holds a parcel at the railway station as shown in the diagram.
The mass of the parcel is **0.65 kg**.



(d) Calculate the **weight** of the parcel.

weight = _____

(e) Explain the difference between the terms "**mass**" and "**weight**" of the parcel.

(f) When Mark holds the parcel by its strap, the parcel remains motionless.

State the size of the **net force** acting on the box. Use Newton's Law to explain your answer.

Size _____

Explanation _____

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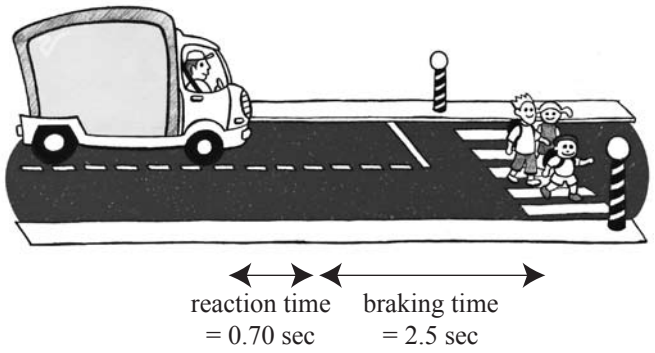
QUESTION TWO: RETURN JOURNEY

Assessor's use only

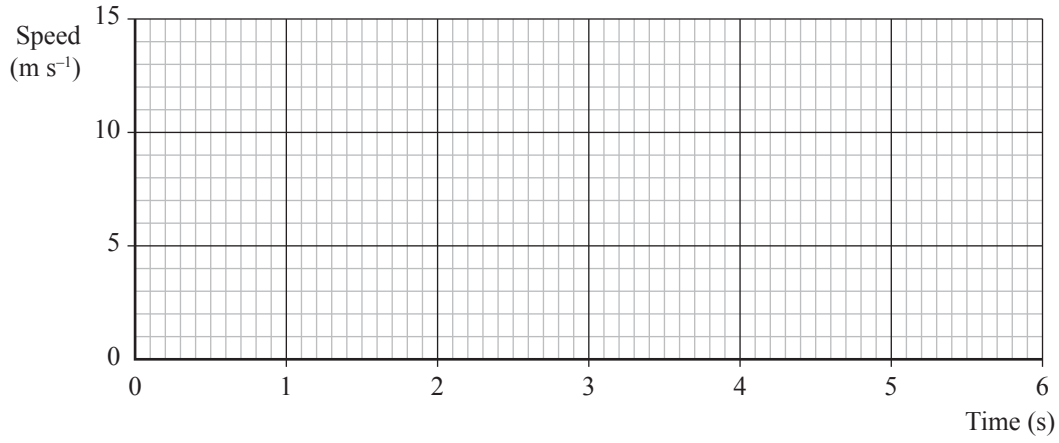
On the way back to the warehouse, Mark is travelling at a constant speed of **12 m s^{-1}** along a straight road when he sees children walking across a pedestrian crossing ahead of him. It takes him **0.70 s** to react before he applies the brakes as hard as he can. It takes a **further 2.5 s** for the van to come to a stop.



(a) Calculate the **distance** Mark travels during the **0.70 s** reaction time.

distance = _____

(b) In the space given below, **draw** a speed-time graph for the motion of Mark and his van, from the time he sees the children on the pedestrian crossing, until the van stops.



(c) State how you would use your graph to calculate the **total distance** travelled by Mark and his van, from the time he sees the children on the pedestrian crossing, until the van stops.

Assessor's use only

(d) On the same axes, **sketch** another graph to show how the motion of Mark and his van will change if the road is wet and slippery. Label this graph as "**W**".

(e) Use physics ideas to explain why the **shape** of the graph changes if the road is wet and slippery.

(f) The van is travelling at **12 m s^{-1}** when Mark applies the brakes. The van travels **27 m** before it stops. The combined mass of Mark and his van is **2100 kg**.

Use this information to calculate the average braking **force** required to stop Mark and his van.

average force = _____

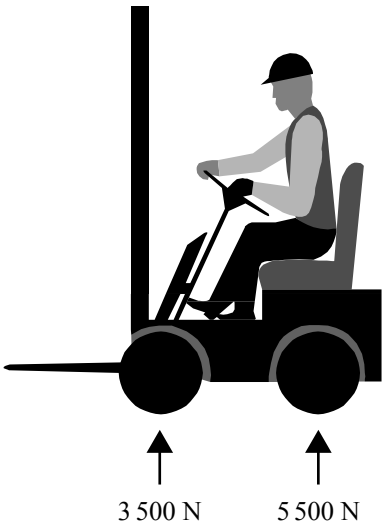
(g) On another occasion the van was travelling at **24 m s^{-1}** instead of 12 m s^{-1}.

Explain how the distance travelled by the van **changes** before it comes to a stop. Assume the braking force, the reaction time and road conditions remain unchanged.

QUESTION THREE: FORKLIFTS

Assessor's use only

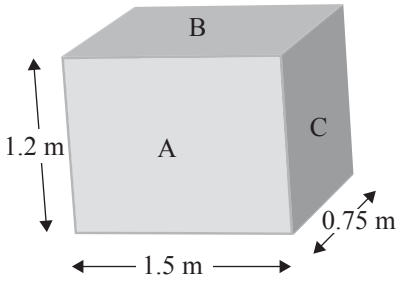
In the warehouse, forklifts are used to shift large crates. The combined support force on both front wheels of a forklift is **3500 N** and the combined support force on both back wheels is **5500 N**, as shown in the diagram.



(a) Calculate the **mass** of the forklift.

mass = _____

A crate has dimensions **1.5 m × 0.75 m × 1.2 m**, and its weight is **1150 N.**



(b) State which of the sides, **A, B** or **C**, should be placed on the floor to exert the **maximum pressure**.

_____

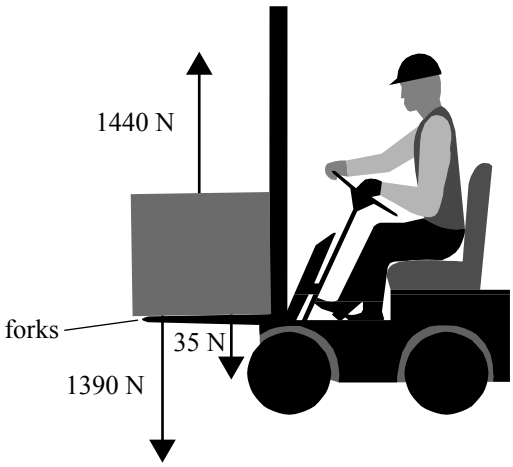
(c) Calculate the size of the **maximum pressure**. Give the correct unit with your answer.

maximum pressure = _____

Assessor's use only

Mark now uses the forklift to lift the crate onto a loading bay. The forks slide upwards along a vertical track as they lift the crate up.

The combined weight of the crate and the forks is **1390 N**. The initial lifting force is **1440 N**.
The initial frictional force on the lifting mechanism is **35 N**, as shown in the diagram.



(d) Calculate the initial **resultant force** acting on the crate and the forks.

resultant force = _____

(e) The combined mass of the forks and the crate is **139 kg**. Calculate the initial **acceleration** of the forks and the crate.

acceleration = _____

(f) After the initial lift, the crate moves up at a constant velocity of **0.28 m s^{-1}**. The mass of the crate is **115 kg**. Calculate the **kinetic energy** of the crate.

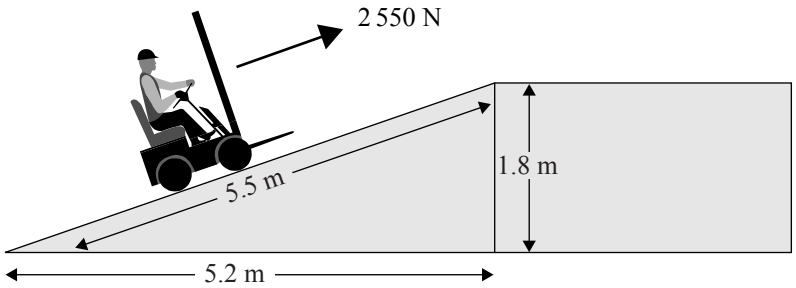
kinetic energy = _____

(g) The mass of the crate is **115 kg** and it is being lifted onto a loading bay through a vertical height of **190 cm** in **9.0 s**. Calculate the **power** required to lift the crate onto the loading bay.

power = _____

Assessor's use only

Mark now drives a smaller forklift onto the loading bay along a ramp, as shown in the diagram below. The combined mass of Mark and the forklift is **750 kg**. The driving force required to climb up the ramp is **2 550 N**. The dimensions of the ramp are shown in the diagram.



(h) During the climb up the ramp, some energy is converted to heat, due to friction.

Calculate the amount of **energy** converted to heat during the climb.

energy = _____

Extra paper for continuation of answers if required.
Clearly number the question.

Assessor's use only

Question number	

90183