NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

Level 1 Science, 2017

90940 Demonstrate understanding of aspects of mechanics

9.30 a.m. Wednesday 15 November 2017
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of aspects of mechanics.	Demonstrate in-depth understanding of aspects of mechanics.	Demonstrate comprehensive understanding of aspects of mechanics.

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 attempt ALL the questions in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–12 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.

TOTAL

ASSESSOR'S USE ONLY

You may find the following formulae useful.

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

$$E_k = \frac{1}{2}mv^2 \qquad W = Fd \qquad g = 10 \text{ N kg}^{-1} \qquad P = \frac{W}{t}$$
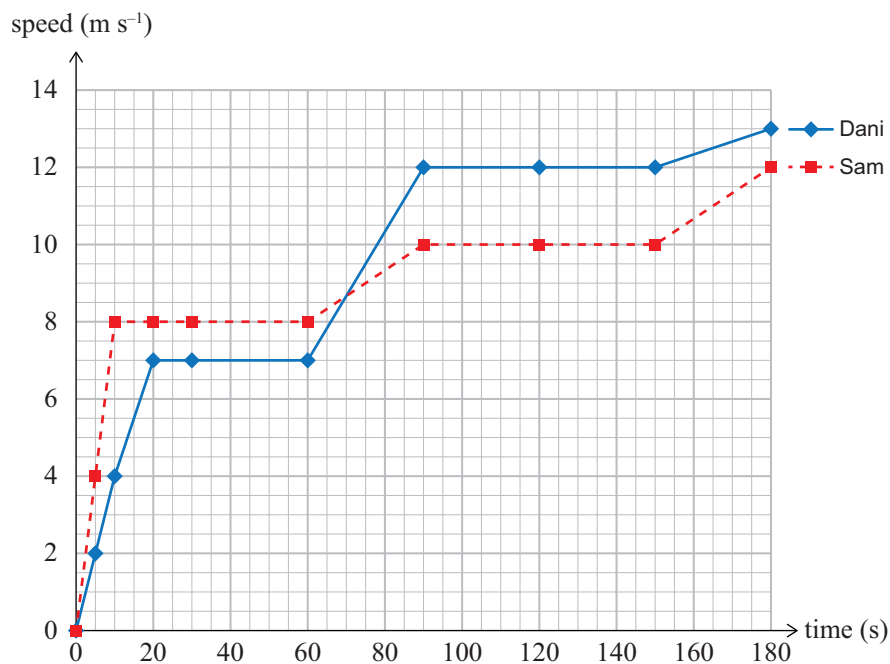
QUESTION ONE

Two horses, ridden by Dani and Sam, are racing against each other.

www.cambridgejockeyclub.co.nz

The speed-time graph of their two horses is shown below.

(a) Use the information in the graph to compare the speed AND acceleration of Dani and Sam in the **first 60 seconds**.

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Sam's horse accelerates for the first 10 s of the race AND covers a distance of 40 m. Sam and his horse have a total mass 308 kg.

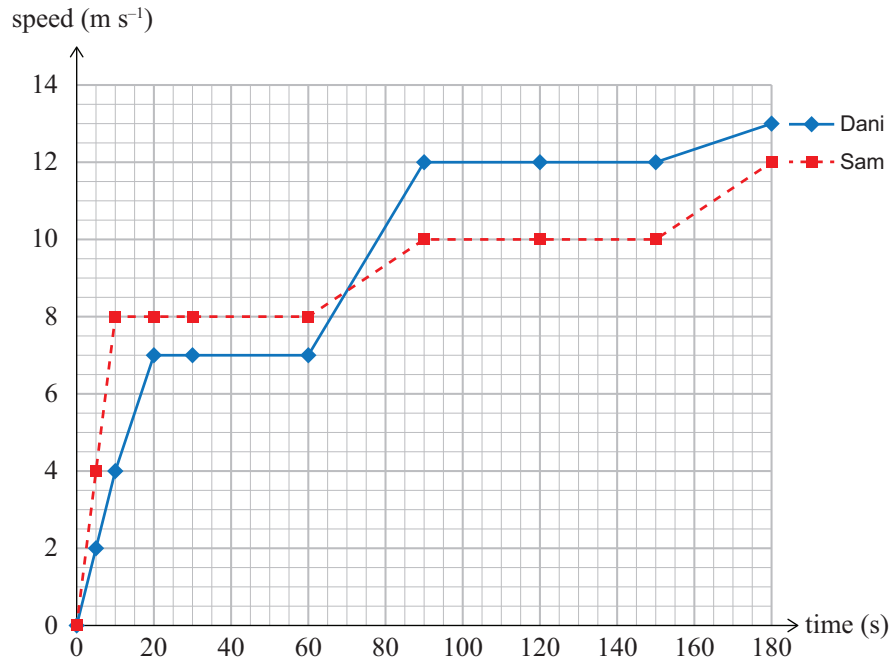(b)   Use the acceleration to calculate the work that Sam and his horse have done in the first 40 m.

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(c)   Explain the effect on **work** AND **power** if a new, heavier jockey was on Sam's horse, which had the same speed and acceleration over the race.

Calculations are not required.

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(The speed-time graph from page 2 is repeated below.)

speed (m s⁻¹)

(d) After 90 s, Sam and his horse had travelled 710 m.

How much further had they travelled compared to Dani and her horse at this stage in the race?

Use the information in the graph and any necessary calculations to answer.
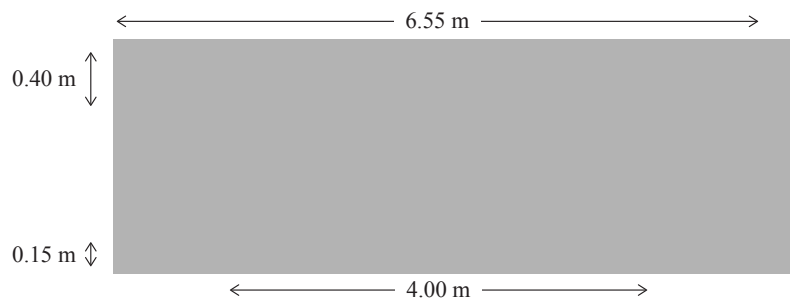
QUESTION TWO

A lightweight waka ama (outrigger canoe) has a mass of 9.90 kg.

(a)   What is the difference between **mass** and **weight**?

Use the waka ama as an example, and include a calculation for weight.

A sketch of the waka ama hulls is shown below right.

http://www.tangaroa.school.nz/
small-gallery-article/waka-ama-
nationals/134766/324377/

6.55 m

0.40 m

0.15 m

4.00 m

www.selway-fisher.com/Opcan17.htm

(b)   Calculate the pressure exerted by the waka ama (both hulls) on the water.

Your answer should include:

• an area calculation (assume both waka ama hulls are rectangular in shape, and the measurements above show the area in contact with the water)

• a calculation of the pressure.

(c) The waka ama sinks further into the water when a 67 kg paddler sits in it.

Explain why the waka ama sinks further into the water when the paddler sits in it.
Use calculations to support your answer.

QUESTION THREE

www.turbosquid.com/3d-models/3d-model-port-container-crane-industrial/689347

(a)   The crane shown above lifted a container 30 m in 15 s. The weight of the container is 60 000 N.

(i)   Calculate the work done by the crane in lifting the container 30 m.

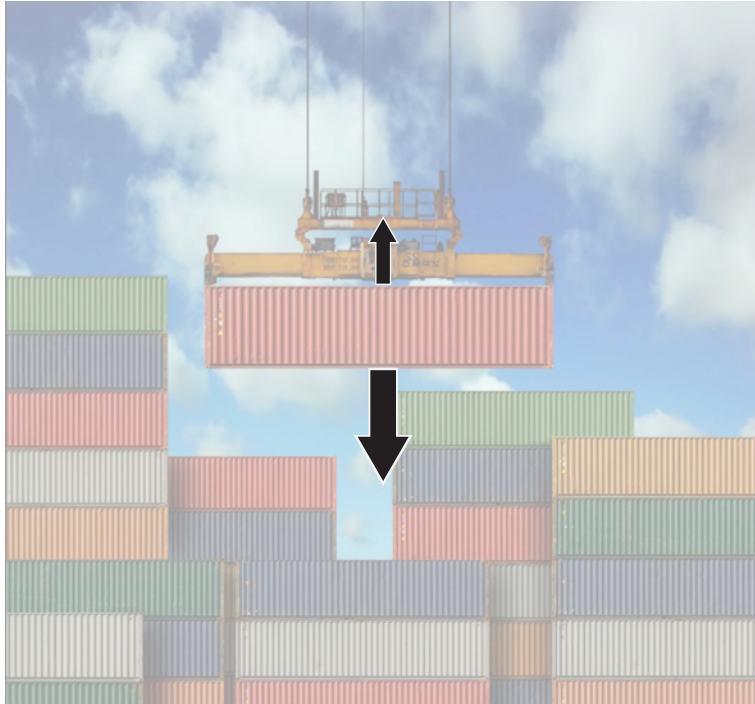(ii)   Calculate the power of the crane while lifting the container 30 m in 15 s.

(b)   Explain what work is being done on the container when it is hanging in the air without moving.

(c) Referring to the force diagram below, explain the link between the vertical net force acting on the container, and the type of motion produced, while the container is **being lowered**.

In your answer, you should:

- describe what is meant by net force
- explain the link between the direction of the vertical net force and motion.

Force diagram

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**Question Three continues
on the following page.**

(d) The crane was lifting another container and the cable broke. The 6500 kg container fell 15 m to the ground below. The container had 970 000 J of kinetic energy just before it hit the ground.

Calculate the energy the container had before the cable broke.

AND

Explain why there is a difference in the energy of the container when it was hanging from the crane compared to just before it hit the ground.

Extra paper if required.
Write the question number(s) if applicable.

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