For Supervisor's use only

1

90191

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Level 1 Science, 2006

90191 Describe aspects of physics

Credits: Five
9.30 am Tuesday 28 November 2006

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.

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**
Describe aspects of physics.	Explain aspects of physics.	Discuss aspects of physics.
Overall Level of Performance		

The following may be useful.

$$v_{\text{average}} = \frac{d}{t} \qquad F = ma \qquad a = \frac{\text{change in speed}}{\text{change in time}}$$

$$E_{\text{p}} = mgh \qquad F_{\text{gravity}} = mg \qquad E_{\text{k}} = \frac{1}{2}mv^2$$

$$Work = Fd \qquad P = \frac{E}{t} \qquad V = IR \qquad P = IV$$

$$g = 10 \text{ m s}^{-2}$$

$$g = 10 \text{ N kg}^{-1}$$

resistor *lamp* *battery* *switch*

voltmeter *ammeter*

You are advised to spend 40 minutes answering the questions in this booklet.

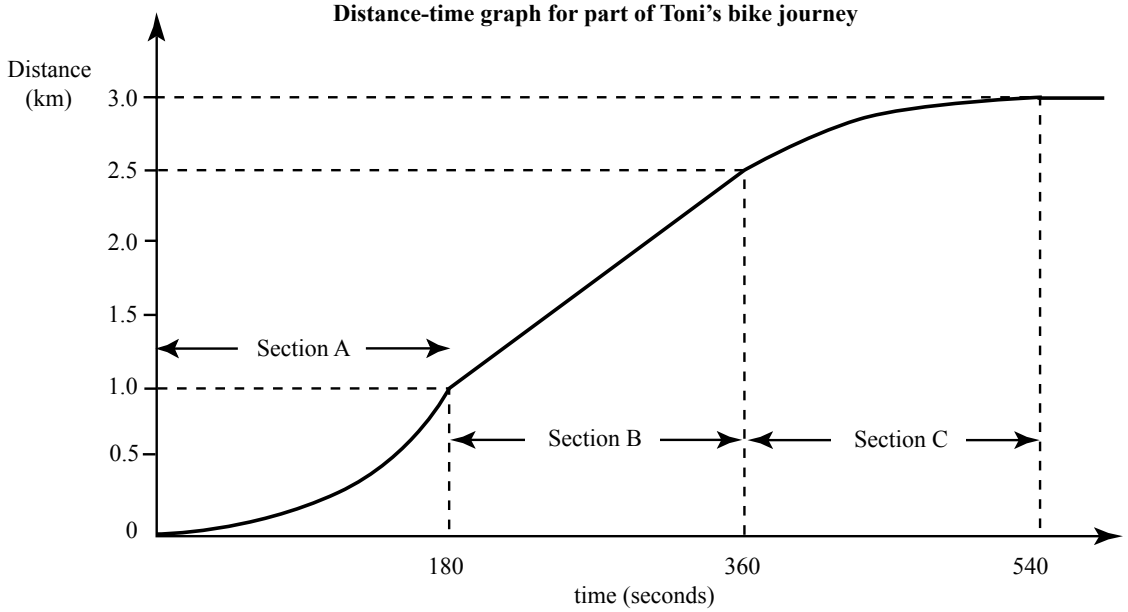
Assessor's use only

QUESTION ONE: CYCLING

Toni cycles each day on her mountain bike.

The distance-time graph below shows part of her journey on one day.

Distance-time graph for part of Toni's bike journey



(a) How far, in **metres**, does Toni travel in the first 360 seconds?

_____

(b) Calculate Toni's average speed over the 540-second bike journey.

_____

_____

_____

_____ Average Speed = _____ $m\,s^{-1}$

(c) Describe the motion of Toni and the bike during **Section A**.

_____

(d) Using the graph above, show that the speed of Toni and the bike during **Section B** is 8.3 $m\,s^{-1}$.

_____

_____

_____

_____

Assessor's use only

The **combined** mass of Toni and the bike is 70 kg.

(e) Using the speed given in Question 1(d), calculate the kinetic energy of Toni and the bike as she travels at that constant speed.

Kinetic Energy = _____ J

Four forces act on Toni and the bike while she rides: weight, support, friction and push.

(f) On the diagram below, draw in arrows to show the **directions** of ALL FOUR forces acting on Toni and the bike. **Label** the forces.

The four forces in the above diagram add together to give a net force of zero.

(g) Explain why a net force of zero would result in Toni and the bike moving at a **constant speed**.

Assessor's use only

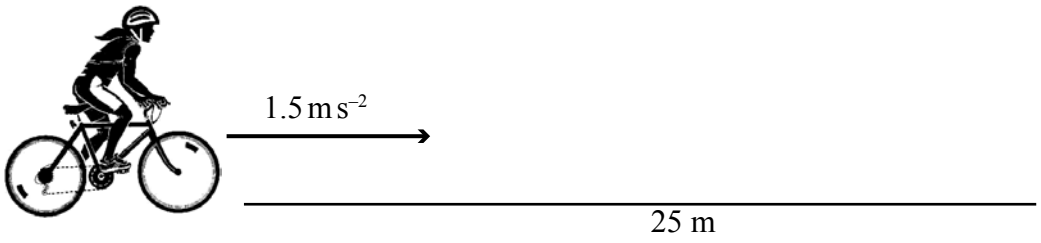
As shown on **Section C** of the graph, Toni reduces her speed from 8.3 $m\,s^{-1}$ to 0 $m\,s^{-1}$ in 180 seconds to come to a stop.

(h) Calculate the deceleration of Toni during these 180 seconds.

Deceleration = _____ $m\,s^{-2}$

(i) Explain what must happen to the forces involved, to reduce Toni's speed.

While travelling home, the bike accelerates at 1.5 $m\,s^{-2}$ over a distance of 25 m as shown in the diagram (not to scale).



Toni and the bike have a mass of 70 kg.

(j) Using the equation $F = ma$, calculate the net force acting on the bike when it is accelerating.

Net force = _____ N

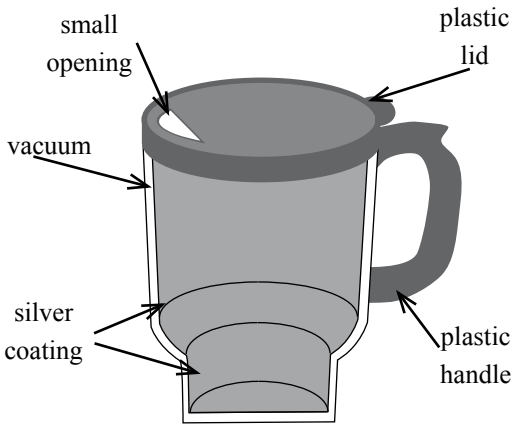
(k) If it takes 5 seconds to cover the distance of 25 m, calculate the power output of the bike during this time.

Power = _____ W

QUESTION TWO: COFFEE TO GO!

Assessor's use only

The photo and diagram below show a travel mug used to keep coffee warm for up to an hour.



(a) A vacuum exists between the outer layers. Describe the term vacuum.

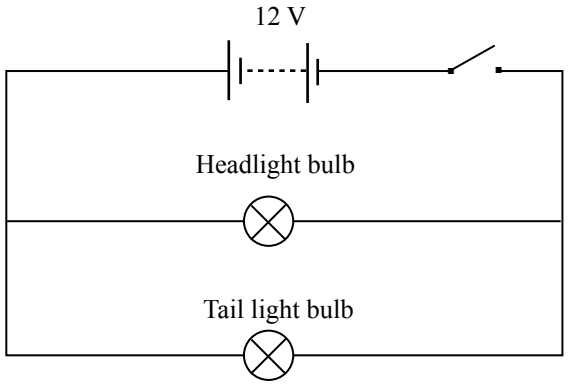
(b) Discuss, in terms of heat transfer, TWO features of the travel mug that would help to keep the coffee warm.

QUESTION THREE: TEO'S MOTORBIKE LIGHTS

Assessor's use only

Teo has bought a second-hand motorbike.

The circuit diagram below represents the lighting circuit for the motorbike.



(a) What is the name given to this arrangement of bulbs in a circuit?

_____

(b) Explain ONE reason why the bulbs would be arranged this way on a motorbike.

_____

_____

_____

_____

(c) State the voltage across the tail light when the switch is closed.

_____

A current of 0.5 A was measured through the tail light bulb.

(d) Using $P = IV$ calculate the power output of the tail light.

_____

_____ Power = _____W

Assessor's use only

Teo discovers that the headlight bulb is broken.

(e) Describe the effect of the broken headlight bulb on the tail light.

Teo finds a spare bulb marked 12 V, 30 W, in his garage.

(f) Calculate the resistance of this bulb, and give an appropriate unit.

Resistance = _____ (_____) unit

Teo also finds a 12 V, 45 W headlight bulb. He tries both bulbs and notices that the 45 W bulb is brighter.

(g) Discuss how the higher wattage bulb would produce a greater brightness. Consider the electrical properties of the bulb as well as the effect on the circuit.

(h) Calculate the amount of energy used by the 45 W bulb when it is turned on for 120 seconds.

Assessor's use only

Energy = _____ J

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

Assessor's use only

Question number	

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

Assessor's use only

Question number	