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90191

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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

Level 1 Science, 2005

90191 Describe aspects of physics

Credits: Five
9.30 am Friday 18 November 2005

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 2–10 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.

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

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

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

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

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

resistor *lamp* *battery* *switch*

voltmeter *ammeter*

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

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QUESTION ONE: TANDEM SKYDIVING

Ariana wins a competition for a Tandem Skydive.

The plane flies to a height of 5 000 m above sea level.

Ariana is strapped to her jumpmaster.

Ariana and the jumpmaster have a combined mass of 150 kg.

[For copyright reasons, this resource cannot be reproduced here. See below.]

http://www.skydivenagambie.com/photos/gallery2

(a) Using the equation $F_{\text{gravity}} = mg$ find the combined weight of Ariana and the jumpmaster.

Weight = _____ N

(b) Calculate the amount of gravitational potential energy Ariana and the jumpmaster have just before they jump out of the plane at 5 000 m.

Gravitational Potential Energy = _____ J

Ariana and the jumpmaster jump out of the plane.

(c) One force acting on Ariana and the jumpmaster is **gravity**. Name the other force acting on them, and state the direction in which it acts.

Force _____

Direction _____

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http://www.skydivenagambie.com/photos/gallery2

During the first 10 seconds the net force acting on Ariana and the jumpmaster is 825 N.

(d) Calculate the net acceleration of Ariana and the jumpmaster. Include an appropriate unit.

Net acceleration = _____ _____ (unit)

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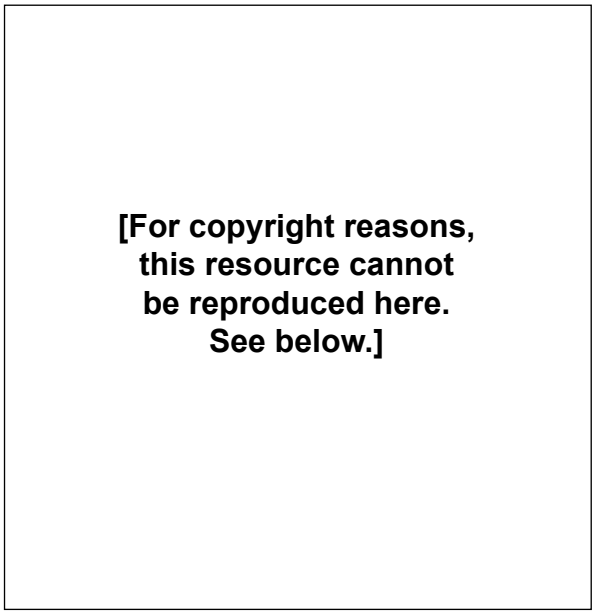
After 60 seconds the jumpmaster pulls the cord and releases the parachute.



http://www.skydivezion.com/bramtandem.jpg

(e) Discuss how the parachute **reduces** the speed of Ariana and the jumpmaster.

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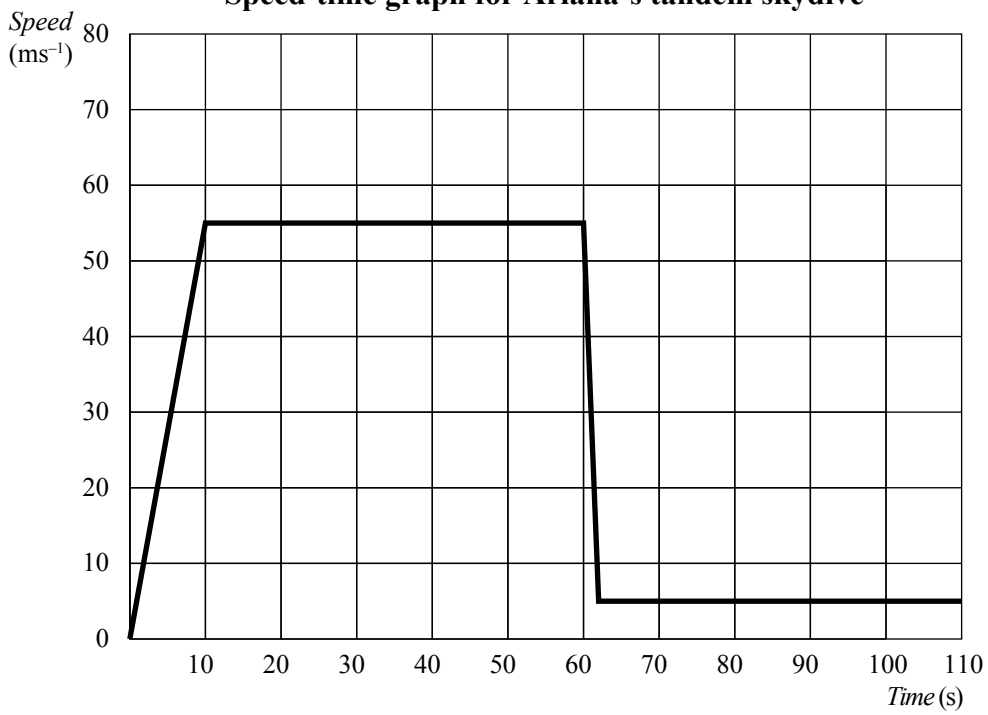
The speed-time graph below shows the motion of Ariana and the jumpmaster from when they leave the plane until after the parachute is released.

Speed-time graph for Ariana's tandem skydive



(f) Describe the motion of Ariana and the jumpmaster during the first 10 seconds.

(g) Between 10 and 60 seconds Ariana and the jumpmaster's speed remains constant. Explain what the constant speed tells us about the two forces acting on them as they fall.

(h) Calculate how far Ariana and the jumpmaster fell during the first 60 seconds.

Distance travelled = _____ metres

QUESTION TWO: AN ELECTRIC JUG

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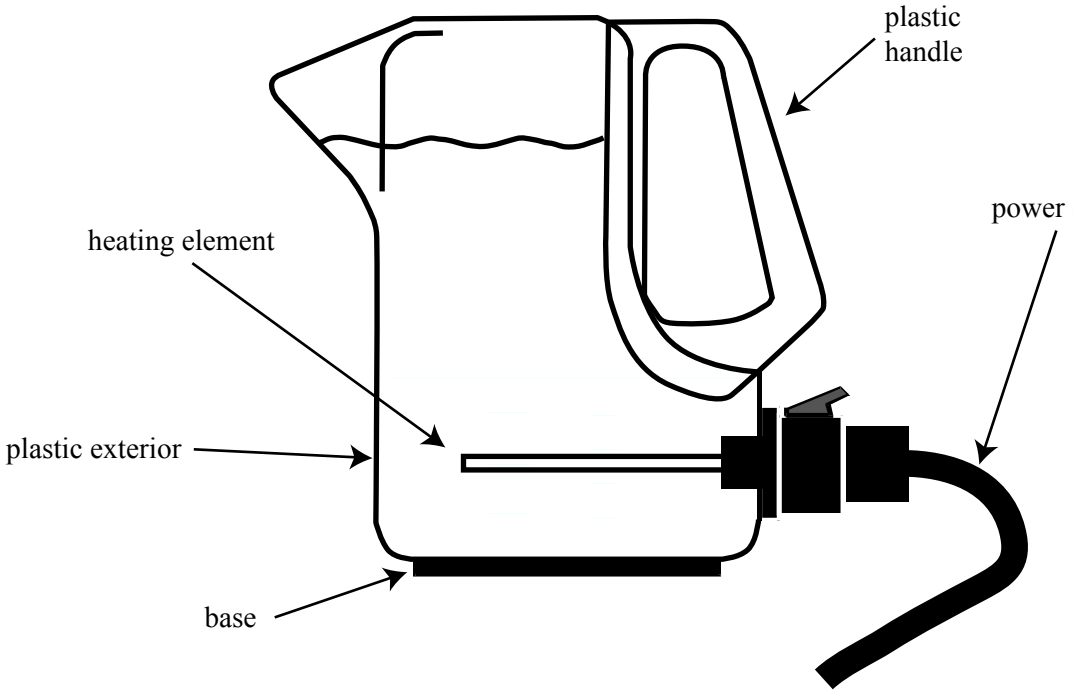
The diagram below shows the parts of an electric jug.

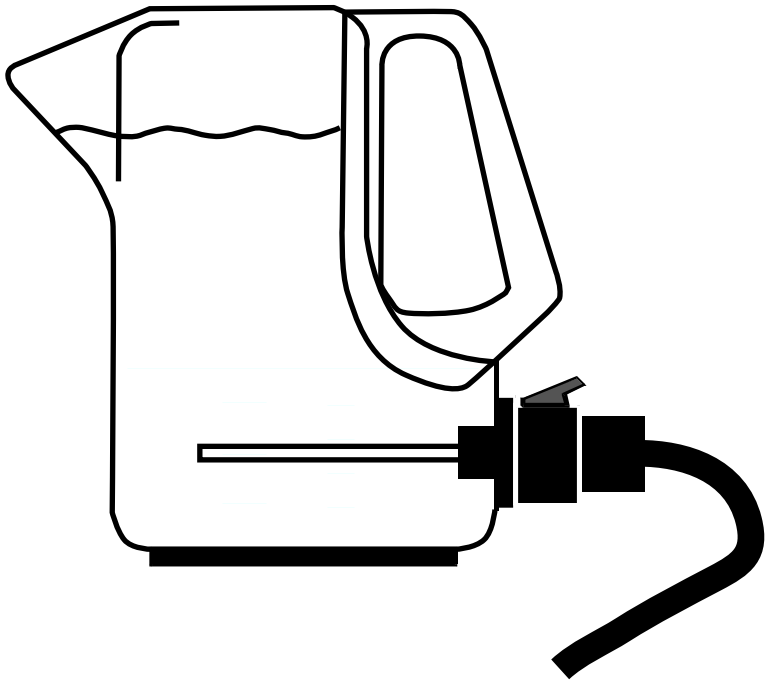


(a) Name the process by which heat energy is **transferred** from the heating element to the water.

_____

Heat energy is then spread through the rest of the water by the process of **convection**.

(b) Draw in arrows on the diagram below to show the convection currents occurring.



(c) Discuss, in terms of water particles, how the process of convection heats the water in the electric jug.

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(d) Explain, in terms of heat transfer, why the outside of the jug is made from plastic.

QUESTION THREE: DC ELECTRICITY

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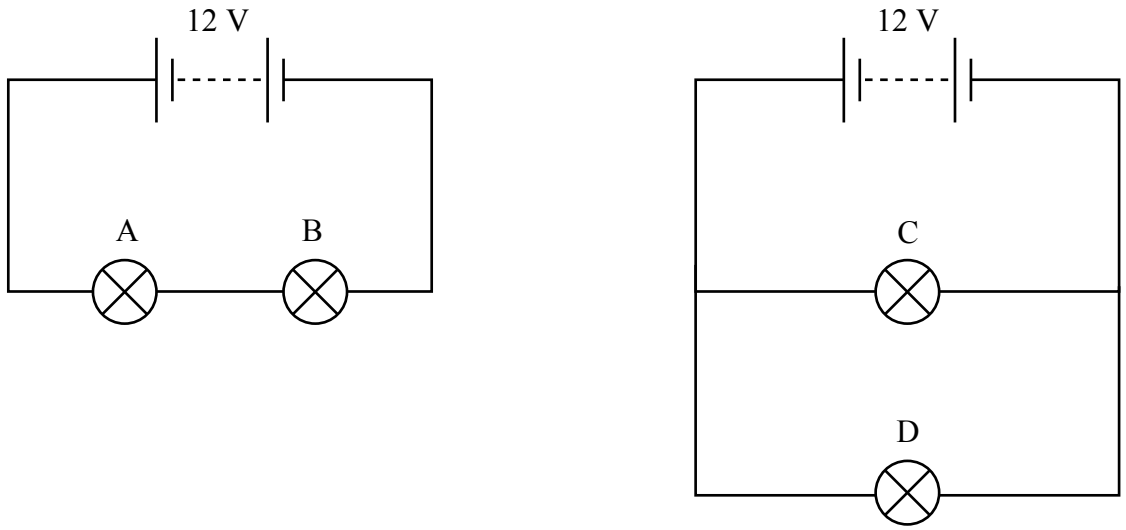
Refer to the following electrical circuits. **All light bulbs are identical**.



Circuit A **Circuit B**

(a) Draw an ammeter in **Circuit A** to find the overall current.

(b) Given that the bulbs are identical, determine the voltage across bulb A.

Voltage = _____ V

The resistance of each bulb is 15 **Ω**.

(c) Use $V = IR$ to calculate the current in bulb A.

Current = _____ A

(d) Calculate the power output of bulb A. Include an appropriate unit.

Power = _____ _____ (unit)

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(e) Referring to **Circuit B**, state the voltage across bulb C.

Voltage = _____ V

The current is measured in bulb C's branch of the circuit and found to be 0.8 A.

(f) Determine the **total** current provided by the battery in circuit B.

_____

Current = _____ A

(g) Explain why this reading differs from the total current reading in circuit A.

_____

_____

_____

_____

(h) Calculate the **total** resistance of Circuit B.

_____

_____

_____

Resistance = _____ Ω

(i) If bulb C is left on for 10 minutes, calculate the amount of energy used by the bulb in this time.

_____

_____

_____

_____

_____

_____

_____

_____

Energy = _____ _____ (unit)

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

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Question number	