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90940M

909405

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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

SUPERVISOR'S USE ONLY

Tohua tēnei pouaka mēnā kāore he tuhituhi i roto i tēnei pukapuka

Pūtaiao, Kaupae 1, 2020

90940M Te whakaatu māramatanga ki ngā āhuatanga o te pūhanga manawa

9.30 i te ata
Rāmere 27 Whiringa-ā-rangi 2020
Whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ngā āhuatanga o te pūhanga manawa.	Te whakaatu māramatanga hōhonu ki ngā āhuatanga o te pūhanga manawa.	Te whakaatu māramatanga matawhānui ki ngā āhuatanga o te pūhanga manawa.

Tirohia mēnā e rite ana te Tau Ākonga ā-Motu (NSN) kei runga i tō puka whakauru ki te tau kei runga i tēnei whārangi.

Me whakamātau koe i ngā tūmahi KATOA kei roto i tēnei pukapuka.

Mēnā ka hiahia whārangi atu anō koe mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka, ka āta tohu ai i te tau tūmahi.

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–23 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

ME HOATU RAWA KOE I TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE Ā TE MUTUNGA O TE WHAKAMĀTAUTAU.

TAPEKE

MĀ TE KAIMĀKA ANAKE

Tērā pea ka whai hua ēnei tātai ki a koe.

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

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

TŪMAHI TUATAHI

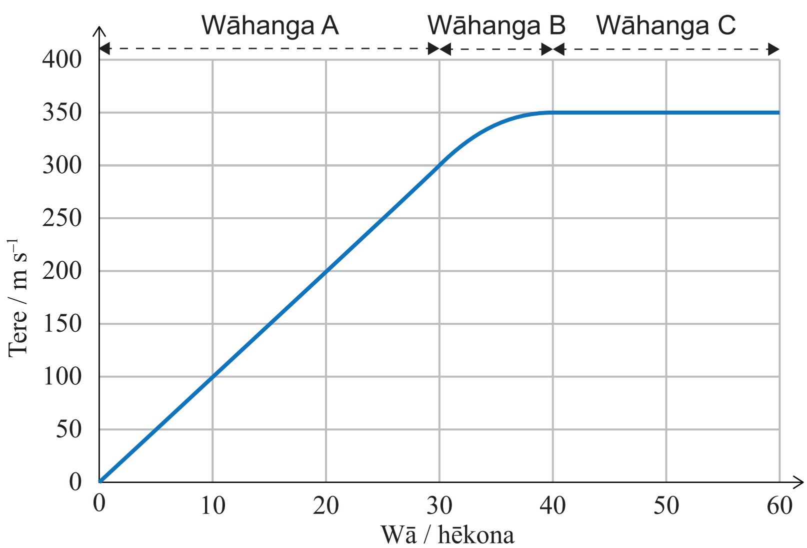
He tangata rongonui a Felix Baumgartner mō te peke mai i tētahi teitei o te 40 km i runga ake o Papatūānuku.

Neke atu i te 240 hēkona tana takahanga i mua i tana huaki i tana hekerangi.

https://cdn.mos.cms.futurecdn.net/9rhbQE95MYfAyRE3YhypCX-1024-80.jpg

Kei raro ko tētahi kauwhata o tana tere e ai ki te wā mō te 60 hēkona tuatahi o tana peke.

Kauwhata tere ki te wā mō te takahanga a Felix



You may find the following formulae useful.

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

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

QUESTION ONE

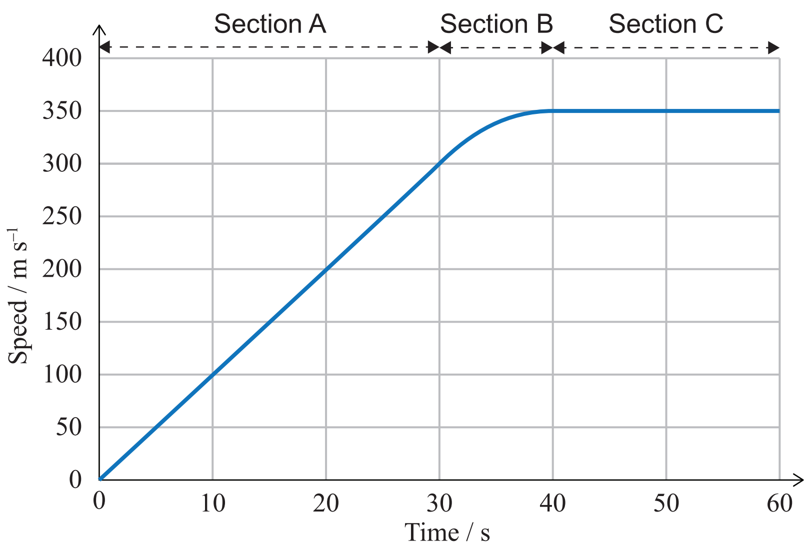
Felix Baumgartner is famous for jumping from a height of 40 km above the Earth.

He fell for over 240 seconds before opening his parachute.

https://cdn.mos.cms.futurecdn.net/9rhbQE95MYfAyRE3YhypCX-1024-80.jpg

Below is a graph of his speed vs time for the first 60 seconds of his jump.

Speed vs time graph for Felix's fall



MĀ TE KAIMĀKA ANAKE

(a) Whakaahuatia te nekehanga a Felix i ngā Wāhanga A me C o tēnei kauwhata.

Wāhanga A: ______________________________

Wāhanga C: ______________________________

(b) Tuhia te tere mōrahi i taea e Felix.

______________ $m\ s^{-1}$

(c) Mā te whakamahi i te kauwhata, tātaihia te whakaterenga o Felix i te 30 hēkona tuatahi.

______________ $m\ s^{-2}$

(d) Mā te whakamahi i te kauwhata, tātaihia te tawhiti i taka a Felix i te 30 hēkona tuatahi.

______________ m

ASSESSOR'S USE ONLY

(a) Describe Felix's motion in Sections A and C of this graph.

Section A: ____________________

Section C: ____________________

(b) State the maximum speed reached by Felix.

____________ $m\ s^{-1}$

(c) Use the graph to calculate Felix's acceleration in the first 30 seconds.

____________ $m\ s^{-2}$

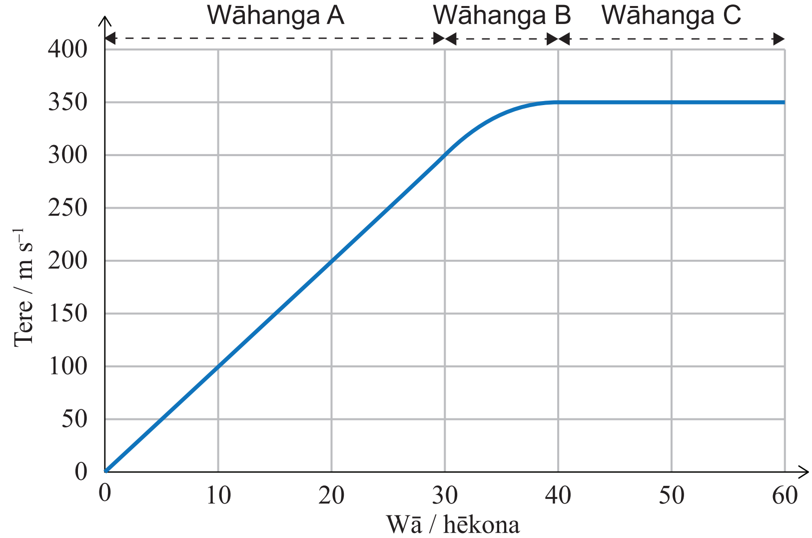
(d) Use the graph to calculate how far Felix fell in the first 30 seconds.

____________ m

MĀ TE KAIMĀKA ANAKE

Kua tāruatia te kauwhata i raro mai i te whārangi 2.

Kauwhata tere ki te wā mō te takahanga a Felix



(e) (i) Tātuhi me te tapa i ngā pere ki ngā hoahoa i raro hei whakaatu i te nui me te ahunga o ngā tōpana poutū e pā ana ki a Felix i te **Wāhanga A** me te **Wāhanga C** o te kauwhata.

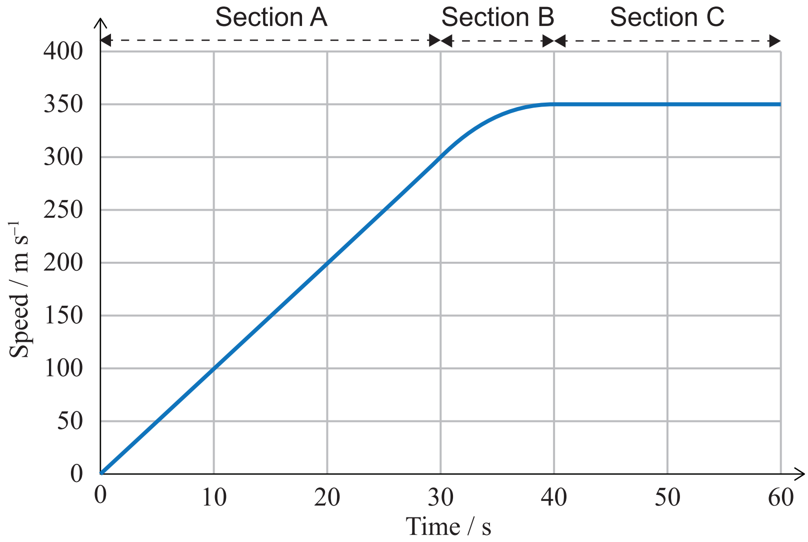
Wāhanga A **Wāhanga C**

https://o.aolcdn.com/images/dims?quality=85&image_uri=http%3A%2F%2Fwww.blogcdn.com%2Fwww.engadget.com%2Fmedia%2F2012%2F10%2Fstratosfeathedjt1.jpg&client=amp-blogside-v2&signature=2ef362f5e712a85af9aea67599d2991003b162bf

ASSESSOR'S USE ONLY

The graph below is repeated from page 3.

Speed vs time graph for Felix's fall



(e) (i) Draw and label arrows on the diagrams below to show the size and direction of the vertical forces acting on Felix in **Section A** and **Section C** of the graph.

Section A **Section C**

https://o.aolcdn.com/images/dims?quality=85&image_uri=http%3A%2F%2Fwww.blogcdn.com%2Fwww.engadget.com%2Fmedia%2F2012%2F10%2Fstratosfeathedjt1.jpg&client=amp-blogside-v2&signature=2ef362f5e712a85af9aea67599d2991003b162bf

(ii) Whakamāramatia te nekehanga i **Wāhanga A** me te **Wāhanga C** mā te whakataurite i **ngā tōpana poutū** e pā ana ki a Felix.

MĀ TE KAIMĀKA ANAKE

(ii) Explain the motion in **Section A** and **Section C** by comparing the **vertical forces** acting on Felix.

ASSESSOR'S USE ONLY

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUARUA

Oma ai ngā kaipatu ahi ki runga o te Sky Tower i ia tau.

Kei te whakarite a Lynley mō tēnei kaupapa mā te omaoma i ngā arapiki i tōna whare.

Ka piki ia ki te 25 m teitei i ia rā. Kei raro ko ngā raraunga mai i ngā rā e rua o ēnei rā.

https://therecord.co.nz/2018/05/09/firefighters-challenge/

	Rā 1	**Rā 2**
Papatipu o Lynley me ngā utauta (kg)	80	80
Teitei (m)	25	25
Wā (s) hei piki 25 m	50	30

(a) Whakatauritea ngā **mahi kua oti** me te **kaha** ka puta i a Lynley i ia rā.

I tō tuhinga, me:

- tātai te mahi ka oti i ia rā
- tātai te kaha i whakamahia i ia rā.

QUESTION TWO

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Each year firefighters run up the Sky Tower.

Lynley is preparing for this event by running up the stairs in her building.

Each day she climbs to a height of 25 m. Below is data from two of these days.

	Day 1	**Day 2**
Mass of Lynley and equipment (kg)	80	80
Height (m)	25	25
Time (s) to climb 25 m	50	30

https://therecord.co.nz/2018/05/09/firefighters-challenge/

(a) Compare the **work done** and **power** produced by Lynley on each of these days.

In your answer you should:

- calculate the work done on each day
- calculate the power used on each day.

MĀ TE KAIMĀKA ANAKE

(b) Ka tirotiro atu a Lynley ki te pikitanga, ā, ka taka mai tōna pōtae mārō. Ka taka iho te pōtae mārō ki waenga i ngā arapiki me te kore pā atu.

http://stairstar.ca/the-6-most-common-questions-asked-about-circular-stairs/

Ko tana whakatau tata ka tau te pōtae mārō ki te papa i te 20 m s^{-1}.

Whakamahia te pūmau o te pūngao, ā, me kī kāore he āhuatanga ā-waho atu anō, tātaitia te teitei i taka mai ai te pōtae mārō.

Ko te papatipu o te pōtae mārō ko te 1.5 kg.

I tō tuhinga, me:

- tātai te pūngao neke o te pōtae mārō i mua tonu i te taunga ki te papa
- whakaahua i huri mai tēnei pūngao neke i tēhea momo pūngao.

ASSESSOR'S USE ONLY

(b) Lynley looks into the stairwell and her helmet falls off. The helmet falls between the stairs without touching them.

http://stairstar.ca/the-6-most-common-questions-asked-about-circular-stairs/

She estimates that the helmet would hit the ground at 20 m s^{-1}.

Using conservation of energy, and assuming no other external factors, calculate the height from which the helmet fell.

The mass of the helmet is 1.5 kg.

In your answer you should:

- calculate the kinetic energy of the helmet just before it hits the ground
- describe from which form this kinetic energy has transformed.

(c) Whakamārama mai he aha e kore ai e eke te pōtae mārō ki te tere o te 20 m s^{-1}.

MĀ TE KAIMĀKA ANAKE

(c) Explain why the helmet will not reach a speed of 20 m s^{-1}.

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MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATORU

Kua whakaaturia e NASA tētahi waka pea hei haere i runga i te mata o Matawhero. He aorangi tino puehu a Matawhero e tino iti iho te tō-ā-papa ki tō tātau. Ko te tō-ā-papa i Matawhero he 3.7 N kg^{-1}; i Papatūānuku he 10 N kg^{-1}.

https://boygeniusreport.files.wordpress.com/2017/06/rover.jpg?quality=98&strip=all&w=1564

(a) Whakamāramatia te kupu te “papatipu” me te “taumaha”.

(b) Whakamāramatia mai he aha te tikanga o te 10 N kg^{-1}.

QUESTION THREE

NASA has revealed a possible vehicle to travel over the Martian surface. Mars is a very dusty planet with much lower gravity than ours. Gravity on Mars is 3.7 N kg^{-1}; on Earth it is 10 N kg^{-1}.

https://boygeniusreport.files.wordpress.com/2017/06/rover.jpg?quality=98&strip=all&w=1564

(a) Define mass and weight.

(b) Explain what 10 N kg^{-1} means.

MĀ TE KAIMĀKA ANAKE

(c) Tātaihia te tōpana taumaha o te waka i runga o Papatūānuku me Matawhero.

Ko te papatipu o te waka he 2500 kg.

(i) Te taumaha o te waka i runga o Papatūānuku, ina ko $g = 10\ \text{N kg}^{-1}$.

(ii) Te taumaha o te waka i runga o Matawhero, ina ko $g = 3.7\ \text{N kg}^{-1}$.

(d) E 6 ngā wīra o tēnei waka, ā, ko te horahanga mata he $0.25\ \text{m}^2$ **mō ia wīra**.

Tātaihia te pēhanga tapeke ka puta i tēnei waka **i Papatūānuku.**

ASSESSOR'S USE ONLY

(c) Calculate the weight force of the Mars vehicle when it is on Earth and when it is on Mars. The mass of the Mars vehicle is 2500 kg.

(i) Weight of vehicle on Earth, where $g = 10\ \text{N kg}^{-1}$.

(ii) Weight of vehicle on Mars, where $g = 3.7\ \text{N kg}^{-1}$.

(d) There are 6 wheels on this vehicle, with a surface area of $0.25\ \text{m}^2$ **per wheel**.

Calculate the total pressure that this vehicle would exert **on Earth.**

(e) Kei runga te waka i **ngā oneone ōrite** i Papatūānuku me Matawhero.

Whakamāramatia he aha te take ka totohu te waka ki ngā hōhonu rerekē i tēnā aorangi, i tēnā aorangi.

Whakamahia he tātaitanga hei tautoko i tō tuhinga.

MĀ TE KAIMĀKA ANAKE

(e) The Mars vehicle is placed on **similar soils** on Earth and on Mars.

Explain why the Mars vehicle will sink to different depths on each planet.

You should support your answer with a calculation.

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He whārangi anō ki te hiahiatia.
Tuhia te (ngā) tau tūmahi mēnā e tika ana.

TAU TŪMAHI

MĀ TE KAIMĀKA ANAKE

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

QUESTION NUMBER

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English translation of the wording on the front cover

Level 1 Science 2020

90940 Demonstrate understanding of aspects of mechanics

9.30 a.m. Friday 27 November 2020
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 2–23 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.

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