See back cover for an English translation of this cover

2

91171M

911715

SUPERVISOR'S USE ONLY

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Ahupūngao, Kaupae 2, 2014

91171M Te whakaatu māramatanga ki te pūnaha pūkahakaha

2.00 i te ahiahi Rātū 18 Whiringa-ā-rangi 2014
Whiwhinga: Ono

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki te pūnaha pūkahakaha.	Te whakaatu māramatanga hōhonu ki te pūnaha pūkahakaha.	Te whakaatu māramatanga matawhānui ki te pūnaha pūkahakaha.

Tirohia mehemea e ōrite ana te Tau Ākonga ā-Motu (NSN) kei tō pepa whakauru ki te tau kei runga ake nei.

Me whakautu e koe ngā pātai KATOA kei roto i te pukapuka nei.

Tirohia mēnā kei a koe te Rau Rauemi L2–PHYSMR.

Ki roto i ō whakautu, whakamahia ngā whiriwhiringa tohutau mārama, ngā kupu, ngā hoahoa hoki / rānei ki hea hiahiatia ai.

Me hoatu te wae tika o te Pūnaha o te Ao (SI) ki ngā whakautu tohutau.

Ki te hiahia koe ki ētahi atu wāhi hei tuhituhi whakautu, whakamahia te (ngā) whārangi kei muri i te pukapuka nei, ka āta tohu ai i ngā tau pātai.

Tirohia mehemea kei roto nei ngā whārangi 2–19 e raupapa tika ana, ā, kāore hoki he whārangi wātea.

HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.

TAPEKE

MĀ TE KAIMĀKA ANAKE

PĀTAI TUATAHI: POITŪKOHU

Kei te haere a Rachel ki te whakaharatau poitūkohu. Ko te papatipu o tana pōro he 0.60 kg.

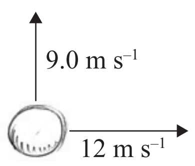
(a) Ka whakataka a Rachel i te pōro mai i te mahaurangi. He 1.2 hēkona te roa ka tae te pōro ki te whenua.

Tātaihia te rahinga o te **tōpana whakahāngai** kei te pōro i te wā e taka ana.

(b) Kei te pūmau te torohaki o te **pōro** i te wā e taka ana?

Whakamāramahia mai tō whakautu mā te kōrero i ngā āhuatanga e hiahiatia ana mō te pūmau o te torohaki.

(c) Ka whiua e Rachel te pōro kia eke ai te wāhanga **poutū** o tana tere ki te 9.0 m s^{-1} me te wāhanga **huapae** o te tere ki te 12 m s^{-1}, e ai ki te hoahoa i raro.



ASSESSOR'S USE ONLY

QUESTION ONE: BASKETBALL

Rachel is on her way to basketball practice. Her ball has a mass of 0.60 kg.

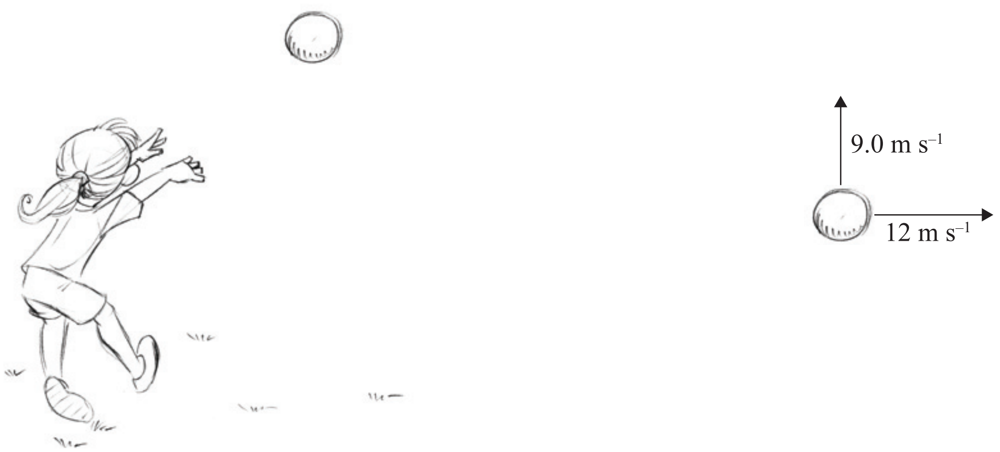
(a) Rachel drops the ball from a balcony. It takes the ball 1.2 seconds to reach the ground.

Calculate the size of the **impulse** on the ball during the time it takes to fall.

(b) Is the momentum of the **ball** conserved as it falls?

Explain your answer with reference to the conditions required for momentum conservation.

(c) Rachel throws the ball so it has a **vertical** component of velocity of 9.0 m s^{-1} and a **horizontal** component of velocity of 12 m s^{-1}, as shown in the diagram below.



MĀ TE KAIMĀKA ANAKE

Tuhia te rahinga o te wāhanga **poutū** o te tere ME te wāhanga **huapae** o te tere ina eke te pōro ki tōna pūwāhi teitei rawa.

Whakamāramahia tō whakautu.

Kei a koe mō te kore e aro ake ki te parehau.

Wāhanga poutū =

Whakamāramatanga:

Wāhanga huapae =

Whakamāramatanga:

(d) Ina kōpeketia[1] te pōro, ka **rite** ki te pūniko me te aumou whana o te 1200 N m^{-1}.

Ina whiua e Rachel te pōro ki te pātū, ka kōpeke te pōro ki te 9.0 mm te tawhiti.

Ko te papatipu o te pōro he 0.60 kg.

- Tātaihia te pūngao moe kūtorotoro kei roto i te pōro i te wā noho noa iho ana ki te pātū mō te wā poto.
- Tātaihia te tere mōrahi ka taea i te wā e turapa mai te pōro.
- Tuhia ngā whakapae ka mahia e koe.

Te pūngao moe kūtorotoro:

Te tere mōrahi o te turapa ka taea:

Ngā whakapae:

[1] hīnohi

State the size of the **vertical** component of velocity AND the **horizontal** component of velocity when the ball reaches the highest point.

Explain your answer.

You may ignore air resistance.

Vertical component =

Explanation:

Horizontal component =

Explanation:

(d) When the ball is compressed, it **acts** like a spring with a spring constant of 1200 N m^{-1}.

When Rachel throws the ball at the wall, the ball compresses a distance of 9.0 mm.

The ball has a mass of 0.60 kg.

- Calculate the elastic potential energy stored in the ball when it is momentarily stationary against the wall.
- Calculate the maximum possible speed at which the ball rebounds.
- State any assumptions you make.

Elastic potential energy stored:

Maximum possible rebound speed:

Assumptions made:

ASSESSOR'S USE ONLY

PĀTAI TUARUA: KEI TE WHARE WHAKAPAKARI TINANA

Kei te whakapakari tinana a Jamie. Kei te whakamahi tauteka ia me ngā maitai taumaha i runga. Ko te papatipu tapeke o te tauteka me ngā maitai taumaha i runga he 120 kg.

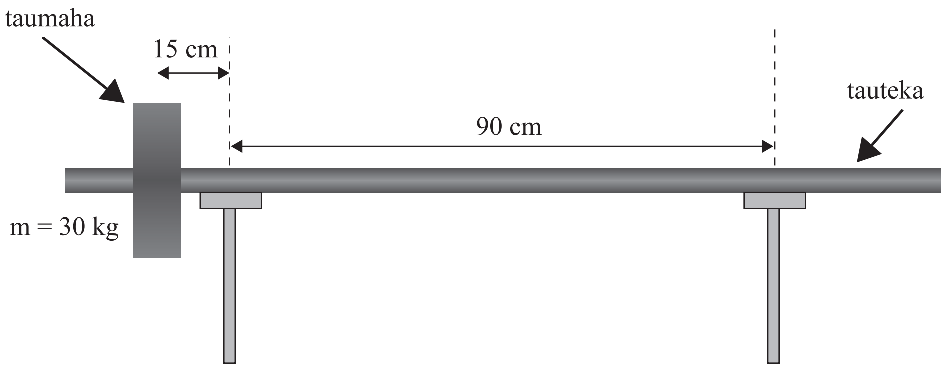
He tapu tēnei rauemi. E kore taea te tuku atu. Aata tirohia ki ngā kupu kei raro iho i te pouaka nei.

http://www.makeoverfitness.com/images/stories/standing-barbell-tricep-extension.jpg

(a) Tātaihia te mahi ka oti i te tauteka mēnā ka hīkina poutūhia e Jamie ki te 0.55 m ki te tere aumou.

(b) Ka utaina e Jamie te tauteka ki ngā poutoko e rua ka whakarerekē i ngā maitai taumaha o te tauteka. Kāore he maitai taumaha i tētahi pito, ā, he maitai taumaha 30 kg kei tētahi pito, ko te tōpana tautoko o te poutoko taha matau he kore.

- Tātuhia ngā pere whai tapanga ki te hoahoa e whakaatu ana i ngā tōpana ki te tauteka.
- Whakamahia te ariā tōpana whakahuri hei tātai i te taumaha kei te tauteka. Ko te whakapae he tauteka hangarite.

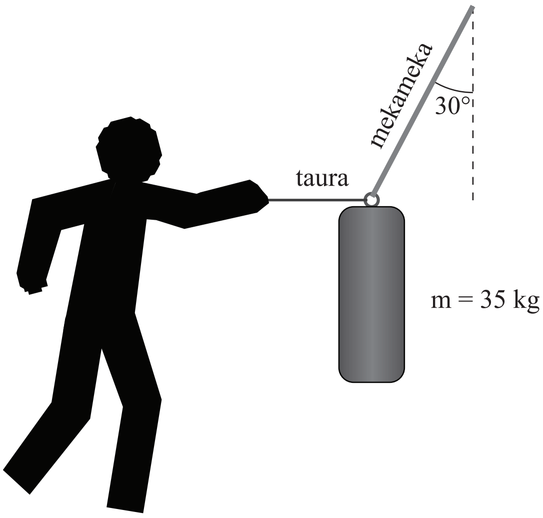


Ki te hiahia koe ki te tuhi anō i ngā tapanga, whakamahia te hoahoa wātea ki te whārangi 16.

(c) I muri i te hikihiki maitai taumaha, ka haere atu a Jamie ki te pēke mekemeke, ā, he pēke nui tēnei e tāiri ana mai i tētahi mekameka. Ko te papatipu o te pēke he 35 kg. Ka kumea huapaetia e Jamie te pēke, mā te whakamahi i te taura e here ana ki tētahi rīngi kei runga o te pēke, kia tae te mekameka ki te koki o te 30^{o} ki te poutū, e ai ki te hoahoa kei tērā taha.

(i) Tātuhia ngā tōpana e toru e pā ana ki te rīngi i runga o te pēke.

(ii) Mā te tātuhi i tētahi hoahoa tāpiri pere o ngā tōpana e toru e pā ana ki te rīngi i runga o te pēke, whakatauhia te rahinga o te tōpana renarena kei te mekameka.



Hoahoa pere

Ki te hiahia koe ki te tuhi anō i tō hoahoa, whakamahia te hoahoa wātea i te whārangi 16.

MĀ TE KAIMĀKA ANAKE

(d) Ka mekea huapaetia e Jamie te pēke. Kātahi ka whakamaua e ia tētahi karapu whai parepare mātotoru ka meke anō ia i te pēke ki taua tere ōrite anō.

Matapakitia te rerekētanga i waenga i ngā meke e rua e ai ki:

- te wā tū o tana meke
- te tōpana ki te pēke.

Tuhia ngā whakapae ka mahia e koe.

QUESTION TWO: AT THE GYM

ASSESSOR'S USE ONLY

Jamie is doing a workout. He is using a barbell with weights on it. The total mass of the bar with the weights on it is 120 kg.

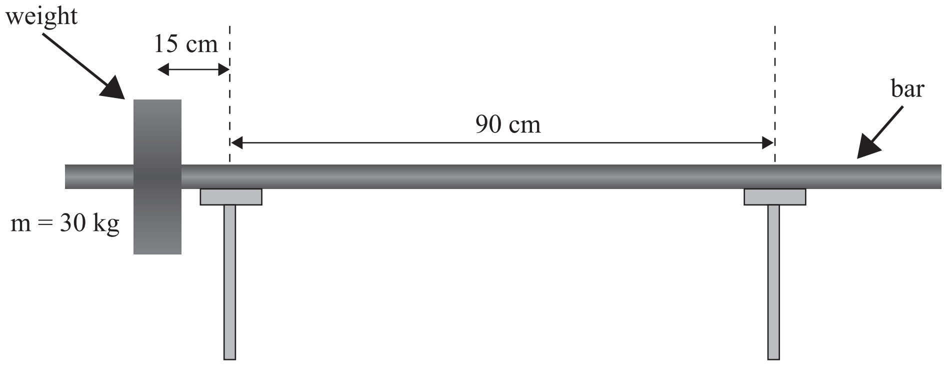
For copyright reasons, this resource cannot be reproduced here.

http://www.makeoverfitness.com/images/stories/standing-barbell-tricep-extension.jpg

(a) Calculate the work done on the bar if Jamie lifts it 0.55 m vertically at constant speed.

(b) Jamie puts the barbell on two supports and changes the weights on the bar. With no weights on one end and a 30 kg weight on the other end, the support force provided by the right-hand support is zero.

- Draw labelled arrows on the diagram showing the forces on the bar.
- Use the concept of torque to calculate the weight of the bar. Assume it is a uniform bar.

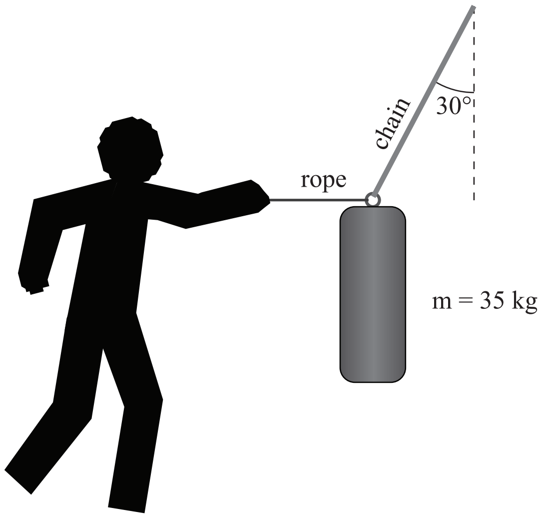


If you need to redraw your labels, use the spare diagram on page 17.

(c) After doing some weights, Jamie goes across to the punch-bag, which is a large bag hanging from a chain. The bag has a mass of 35 kg. Jamie pulls the bag horizontally, using the rope tied to a ring at the top of the bag, until the chain is at an angle of 30° to the vertical, as shown in the diagram opposite.

(i) Draw the three forces acting on the ring at the top of the bag.

(ii) By drawing a vector addition diagram of the three forces acting on the ring at the top of the bag, determine the size of the tension force on the chain.



Vector diagram

If you need to redraw your diagram, use the spare diagram on page 17.

ASSESSOR'S USE ONLY

(d) Jamie punches the bag horizontally. He then puts on a glove with thick padding and punches the bag again with the same velocity.

Discuss the difference between the two punches in terms of:

- the stopping time of his fist
- the force on the bag.

State any assumptions you make.

MĀ TE KAIMĀKA ANAKE

PĀTAI TUATORU: KA TARAIWA A SHAMILLA KI TE WHARE WHAKAPAKARI TINANA

Ko te papatipu tōpū o Shamilla me tōna waka he 1100 kg. Kei te taraiwa ia ki te **tere aumou**.

(a) Tātaihia te rahi o te tōpana poutū ki te waka e puta ana i te rori.

(b) Ko te kī a Shamilla 'ahakoa kei te neke te waka, kei te taurite'.

Whakamārama mai he aha te tikanga o tēnei kīanga.

(c) Kāore i roa i muri mai ka whakaterehia te waka o Shamilla mai i te tere o te 2.0 m s^{-1} ki te tere o te 22.0 m s^{-1}, e kapi ana te tawhiti o te 72 m.

Tātaihia te rahi o te tōpana more toharite ka pā ki te waka i te wā ka whakaterehia.

QUESTION THREE: SHAMILLA DRIVES TO THE GYM

ASSESSOR'S USE ONLY

Shamilla and her car have a combined mass of 1100 kg. She is driving at **constant velocity**.

(a) Calculate the size of the vertical force the road produces on the car.

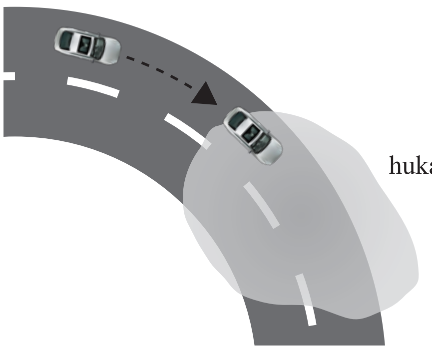
(b) Shamilla says that 'even though the car is moving, it is in equilibrium'.

Explain what this statement means.

(c) A short time later, Shamilla's car accelerates from a speed of 2.0 m s^{-1} to a speed of 22.0 m s^{-1}, covering a distance of 72 m.

Calculate the size of the average net force on the car while it accelerates.

(d) Ka taraiwahia e Shamilla tōna waka i te kokonga ki te tere aumou, kātahi ka taraiwa ia i runga hukapapa, e ai ki te hoahoa i raro. Ko te whakapae kāore he waku i waenga i te hukapapa me ngā wīra.

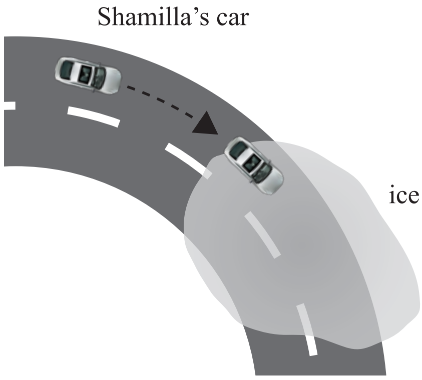


- Whakaahuatia te tōpana more ki te waka (mēnā kei reira he tōpana) i mua me muri o tana taenga atu ki te hukapapa.
- Whakamāramahia he pēhea te pānga o te tōpana more (mēnā kei reira he tōpana) ki te nekehanga o te waka i mua me muri o tana taenga atu ki te hukapapa.

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(d) Shamilla drives her car at constant speed around a corner, and then drives over some ice, as shown in the diagram below. You can assume there is no friction between the ice and the tyres.



- Describe the net force on the car (if any) before and after she reaches the ice.
- Explain how the net force (if any) affects the motion of the car before and after she reaches the ice.

PĀTAI TUAWHĀ: KA TARAIWA A SHAMILLA KI TE KĀINGA

MĀ TE KAIMĀKA ANAKE

Ko te papatipu tōpū o Shamilla me tōna waka he 1100 kg.

(a) Tātaihia te torohaki tapeke o te waka me Shamilla ina eke te tere o te waka ki te 18 m s^{-1}.

Whakaurua te wae tika ki tō whakautu.

(b) Tātaihia te rahi me te ahunga o te huringa torohaki o te waka i te wā ka āta haere mai i te tere o te 18 m s^{-1} ki te tere o te 11 m s^{-1}.

(c) Ka pēhia te pereki e te waewae o Shamilla, ka āta haere te waka.

Whakamāramahia te mātāpono o te pūmau o te pūngao i roto i tēnei āhuatanga, ā, ka tautohu i te whakawhiti o te pūngao ka puta i te mahi pereki.

(d) Tātaihia te pāpātanga toharite e whakawhiti pūngao ai ngā pereki i te wā ka āta haere te waka mai i te tere o te 18 m s^{-1} ki te tere o te 11 m s^{-1} i roto i te 6.0 s te roa.

QUESTION FOUR: SHAMILLA DRIVES HOME

ASSESSOR'S USE ONLY

Shamilla and her car have a combined mass of 1100 kg.

(a) Calculate the total momentum of the car and Shamilla when the car has a velocity of 18 m s^{-1}.

Include the correct unit with your answer.

(b) Calculate the size and the direction of the momentum change of the car as it slows from a velocity of 18 m s^{-1} to a velocity of 11 m s^{-1}.

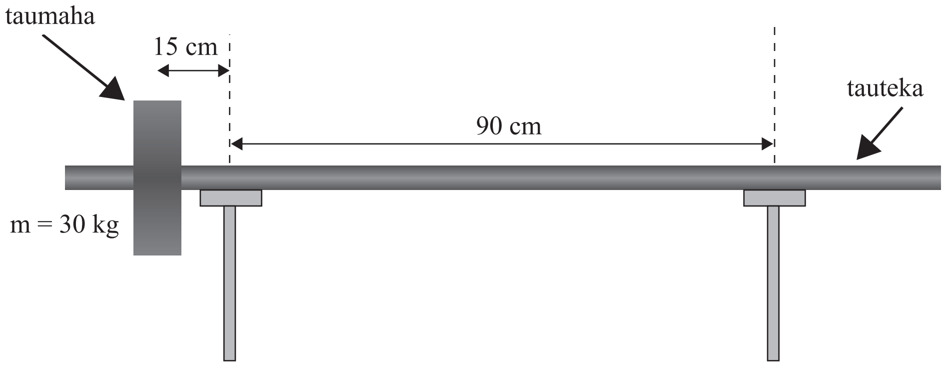
(c) Shamilla puts her foot on the brake, and the car slows down.

Explain the principle of energy conservation in this situation, and identify the transfer of energy caused by braking.

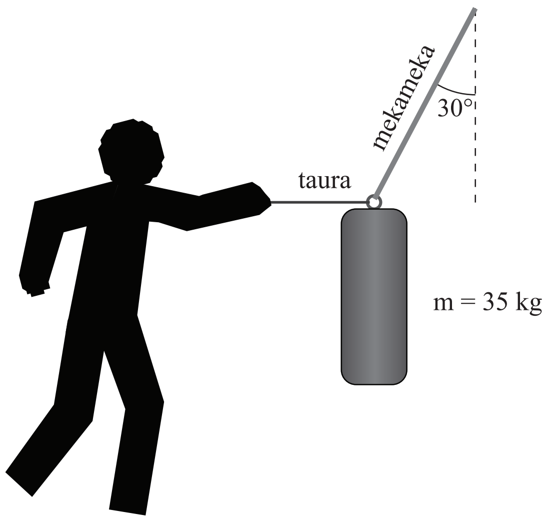
(d) Calculate the average rate at which the brakes transfer energy as the car slows from a velocity of 18 m s^{-1} to a velocity of 11 m s^{-1} in a time of 6.0 s.

Ki te hiahia koe kia tuhia anō ō hoahoa ki te Pātai Tuarua, tuhia ki raro nei. Kia mārama te tohu ko tēhea te hoahoa ka hiahia koe kia mākahia.

(b)



(c)

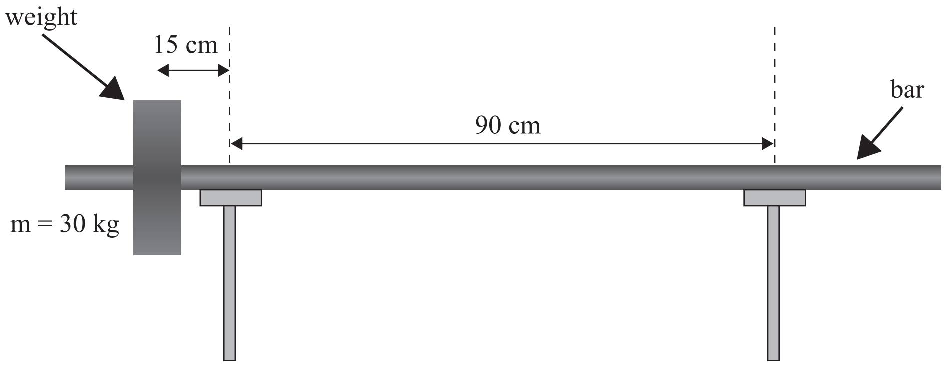


Hoahoa pere

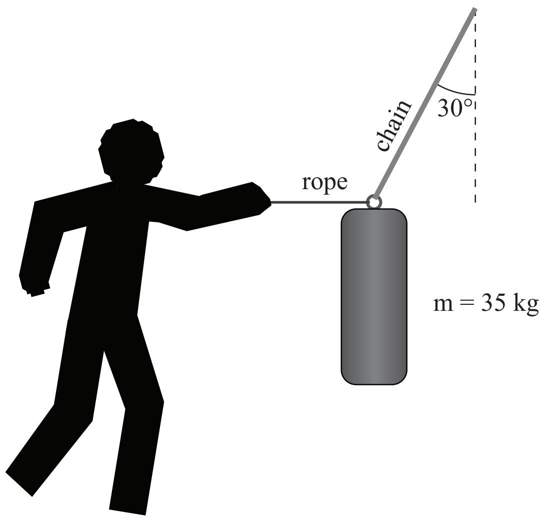
If you need to redraw your diagrams from Question Two, draw them below. Make sure it is clear which diagram you want marked.

ASSESSOR'S USE ONLY

(b)



(c)



Vector diagram

He puka anō mēnā ka hiahiatia.
Tuhia te (ngā) tāu pātai mēnā e hāngai ana.

TAU PĀTAI

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 2 Physics, 2014

91171 Demonstrate understanding of mechanics

2.00 pm Tuesday 18 November 2014
Credits: Six

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

91171M

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.

Make sure that you have Resource Sheet L2–PHYSMR.

In your answers use clear numerical working, words and/or diagrams as required.

Numerical answers should be given with an appropriate SI unit.

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 2–19 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.