2

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91171M

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NZQA
NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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

Ahupūngao, Kaupae 2, 2017

91171M Te whakaatu māramatanga ki te pūhanga manawa

2.00 i te ahiahi Rāmere 10 Whiringa-ā-rangi 2017
Whiwhinga: Ono

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

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

Ki roto i ō tuhinga, whakamahia ngā whiriwhiringa tohutau mārama, ngā kupu, ngā hoahoa hoki, tētahi, ētahi rānei o ēnei, ki hea hiahiatia ai.

Me hoatu te wae tika o te Pūnaha Waeine ā-Ao (SI) ki ngā tuhinga tohutau.

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

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–19 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

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

TAPEKE

MĀ TE KAIMĀKA ANAKE

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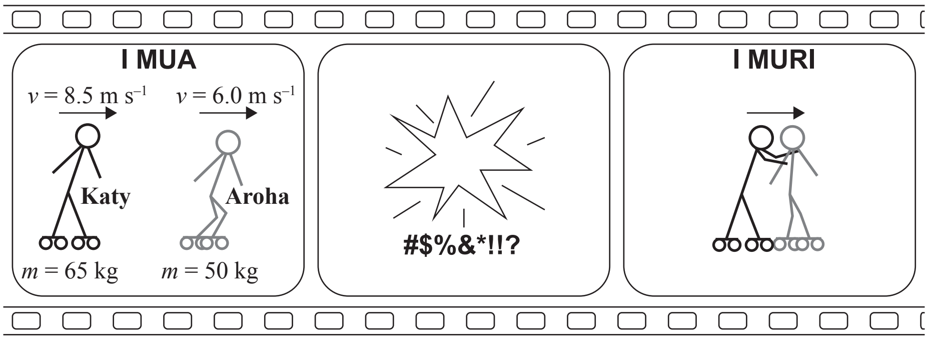
TŪMAHI TUATAHI: RETIRETI RŌRA

Kei te retireti rōra a Katy, 65.0 kg, rāua ko Aroha, 50.0 kg. Kei te neke a Aroha ki te taha matau i te tere pūmau o te 6.0 m s^{-1}, ā, kei te neke anō a Katy ki te taha matau, i muri i a Aroha, i te tere pūmau o te 8.5 m s^{-1}. Ka tuki a Katy ki a Aroha, ka pupuri i ōna pokohiwi, ka neke haere tahi rāua ki te taha matau i tētahi tere pūmau.



(a) He aha te rahinga ahupūngao ka pūmau i te wā o te tukinga rorohakore i waenga i a Katy rāua ko Aroha?

Tuhia ngā whakapae ka puta i a koe.

(b) Tātaihia te tere tūhono o Katy rāua ko Aroha i a rāua e retireti tahi ana i muri i te tukinga.

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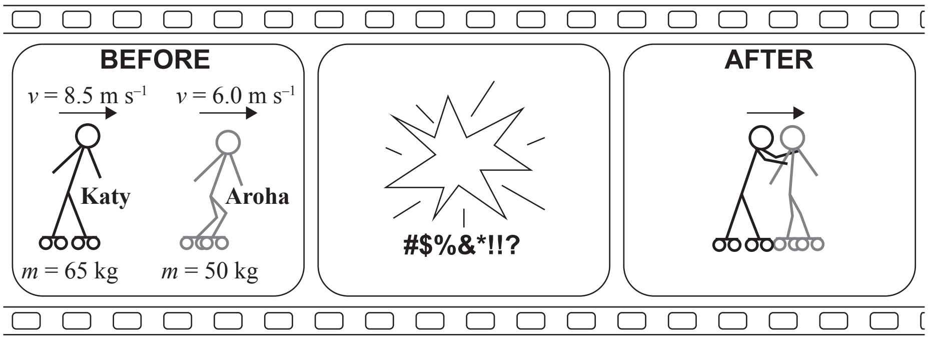
QUESTION ONE: ROLLER SKATING

Katy, 65.0 kg, and Aroha, 50.0 kg, are roller skating. Aroha is moving to the right at a constant velocity of 6.0 m s^{-1} and Katy is also moving to the right, behind Aroha, at a constant velocity of 8.5 m s^{-1}. Katy collides with Aroha, holds her shoulders, and they move together to the right at a constant velocity.



(a) What physical quantity is conserved during the above inelastic collision between Katy and Aroha?

State any assumptions you have made.

(b) Calculate the combined velocity of Katy and Aroha as they skate together after the collision.

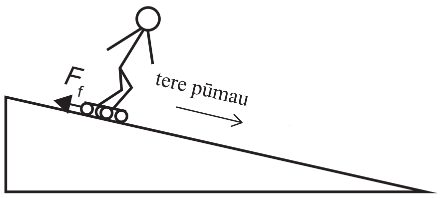
MĀ TE KAIMĀKA ANAKE

(c) I te wā ka tuki a Katy ki a Aroha, ka pā ki a rāua tētahi tōpana nā te tukinga. He 2.5 hēkona te roa o te tukinga.

Tātaihia te rahi o te tōpana i pā ki a Aroha.

(d) Ka heke tere pūmau a Katy i tētahi rōnaki whāriki. I te hoahoa i raro, e whakaaturia ana te tōpana waku, F_f, i waenga i ana retireti me te whāriki.

(i) Tātuhia ka tapa i ērā atu o ngā tōpana ka pā ki a Katy.



Ki te hiahia koe ki te tuhi anō i tō hoahoa tōpana, whakamahia te hoahoa kei te whārangi 14.

(ii) Ki te tapawhā i raro, tātuhia he hoahoa pere kati e whakaatu ana kei te taurite ngā tōpana ka pā ki a Katy.

Whakaingoatia ia tōpana.

Ki te hiahia koe ki te tuhi anō i tō hoahoa pere, whakamahia te tapawhā kei te whārangi 14.

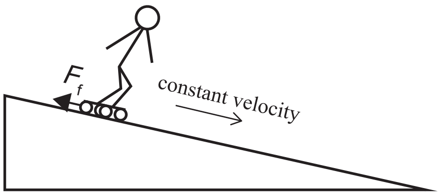
(c) As Katy collides with Aroha, they both experience a force due to the collision. The duration of the collision is 2.5 s.

Calculate the size of the force experienced by Aroha.

ASSESSOR'S USE ONLY

(d) Katy goes down a carpeted ramp at a constant velocity. On the diagram below, the friction force, F_f, between her skates and the carpet is shown.

(i) Draw and name all other forces acting on Katy.



If you need to redraw your force diagram, use the diagram on page 15.

(ii) In the box below, draw a closed vector diagram, showing that forces acting on Katy are balanced.

Name each force.

If you need to redraw your vector diagram, use the box on page 15.

TŪMAHI TUARUA: TE HŪPEKE TEITEI

Kei te whakataetae a Sarah, he kaipara 55.0 kg te taumaha, i te hūpeke teitei e ngana ai ia kia whiti atu tōna tinana i te pae me te kore pā atu. I tōna taunga atu, he mēterehi kei te papare i tana takanga.

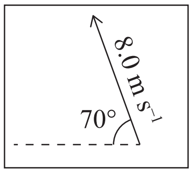
He mea urutau nō: www.britannica.com/sports/high-jump

Ki te hiahia koe ki te tuhi anō i tēnei hoahoa tōpana, whakamahia te tapawhā kei te whārangi 14.

(a) Tātaihia te rahi o te tōpana, ngā tōpana rānei ka pā ki a Sarah i muri tonu i te peketanga, i te pūwāhi 2 i te hoahoa i runga ake.

Tātuhia (t)ētahi pere i te patawhā hei tohu i te/ngā ahunga o te/ngā tōpana.

(b) I te wā o tētahi o ngā hūpeke, ko te tere tuatahi o Sarah, mai i te peketanga, he 8.0 m s^{-1} i te koki o te 70° ki te huapae.



Tātaihia te wā mō Sarah kia eke ia ki te teitei mōrahi, arā, te pūwāhi 3 i te hoahoa i runga ake.

QUESTION TWO: HIGH JUMP

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Sarah, a 55.0 kg athlete, is competing in the high jump where she needs to get her body over the crossbar successfully without hitting it. Where she lands, a padded mattress cushions her fall.

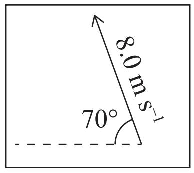
Adapted from: www.britannica.com/sports/high-jump

(a) Calculate the size of the force(s) acting on Sarah just after the take-off, in position 2 in the above diagram.

Draw an arrow(s) in the box to show the direction(s) of the force(s).

If you need to redraw this force diagram, use the box on page 15.

(b) During one of the jumps, the initial velocity of Sarah, at take-off, is 8.0 m s^{-1} at an angle of 70° to the horizontal.



Calculate the time it takes for Sarah to reach the maximum height – position 3 in the diagram above.

I muri i tana peketanga, ka takoto noa ia i te pūwāhi 4, e ai ki te hoahoa kei te whārangi o mua. E 20 ngā pūniko e ōrite ana te hora i te wāhi o te mēterehi i tau ia. He 4.5 cm te kōpeketanga toharite o ia pūniko. He 55.0 kg te papatipu o Sarah.

(c) Tātaitia te pūngao moe kūtorotoro e putu ana i tētahi pūniko kotahi o te mēterehi.

(d) I te taunga atu o Sarah ki te mēterehi i muri i te peketanga, he tino nui te tōpana ki tōna tinana.

Matapakitia kia RUA ngā huringa ki ngā **pūniko** o te mēterehi ka taea kia hāneanea ake te taunga o Sarah.

Whakamāramahia ngā mātāpono ahupūngao hei whakaaroaro e tutuki ai ēnei huringa.

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

After Sarah has jumped, she lies motionless in position 4, as shown in the diagram on the previous page. There are 20 springs evenly spaced in the area of the mattress where she lands. The average compression of each spring is 4.5 cm. Sarah's mass is 55.0 kg.

(c) Calculate the elastic potential energy stored in a single spring of the mattress.

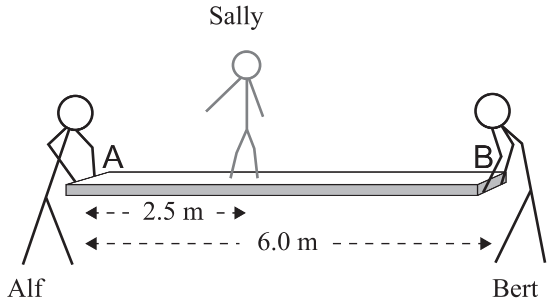
(d) When Sarah lands on the mattress after the jump, the force on her body is quite large.

Discuss TWO changes that could be made to the **springs** of the mattress to make Sarah's landing more comfortable.

Explain any physics principles that should be considered to make these changes.

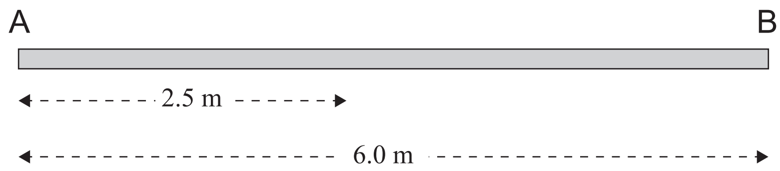
MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATORU: HE KAIKANIKANI MANINIRAU



E takoto ana tētahi papa rākau rite he 5.0 kg te papatipu me te 6.0 m te roa, ki ngā ringaringa o ngā kaimahi maninirau e rua, a Alf rāua ko Bert. He 2.5 m te tawhiti mai o te tū a Sally, he kaikanikani maninirau 40.0 kg tōna papatipu, mai i te pito A o te papa, e whakaaturia ana i runga.

(a) Ki te hoahoa i runga, tātuhia ka whakaingoa i ngā tōpana katoa ka pā ki te papa.



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

Kei te taurite te āhua o te papa i te wā e tū noa ana a Sally, 2.5 m te tawhiti mai i te pito A o te papa.

(b) (i) Whakaahuahia mai ngā āhuatanga e hiahiatia ana mō te papa kia taurite ai te āhua.

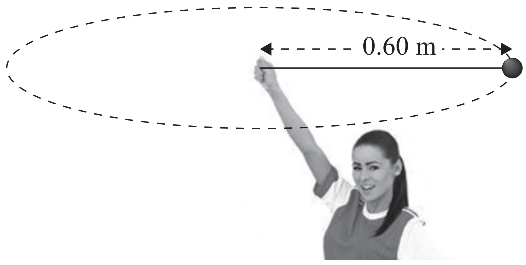
(ii) Tātaihia te tōpana whakahuri whakatekaraka tapeke kei te pito A o te papa.

(c) (i) Tātaihia te rahi o te tōpana i pā ki a Alf, e pupuri ana ia i te pito A o te papa.

MĀ TE KAIMĀKA ANAKE

(ii) Whakamāramahia mai mēnā ka pā ki a Alf tētahi panonitanga tōpana i te neketanga o Sally mai i tōna tūnga onāianei ki te pito B i te wā o tana whakaaturanga kanikani.

(d) I te wā o tētahi o ana whakaaturanga kanikani, kei te takahurihuri a Sally i tētahi pōro i runga ake o tōna māhunga i tētahi porowhita whakapae, e whakaaturia ana i raro.

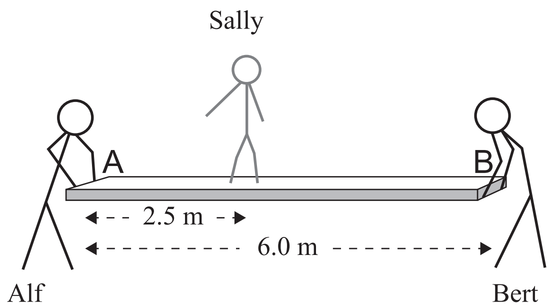


E rima nga huringa o te pōro, he 0.050 kg te papatipu, i roto i te 4.0 s. He 0.60 m te roa o te aho mai i te pōro ki te ringa o Sally.

Tātaihia te rahi o te tōpana i pā ki te pōro i ēnei huringa.

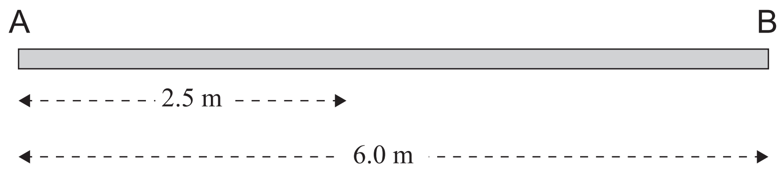
ASSESSOR'S USE ONLY

QUESTION THREE: A CIRCUS DANCER



A uniform wooden plank of mass 5.0 kg and length 6.0 m is resting in the hands of two circus employees, Alf and Bert. Sally, a circus dancer of mass 40.0 kg, stands 2.5 m away from end A of the wooden plank, as shown above.

(a) In the diagram below, draw and name all forces acting on the plank.



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

The plank is in a state of equilibrium when Sally is standing still, 2.5 m away from end A of the plank.

(b) (i) Describe the conditions needed for the plank to be in an equilibrium state.

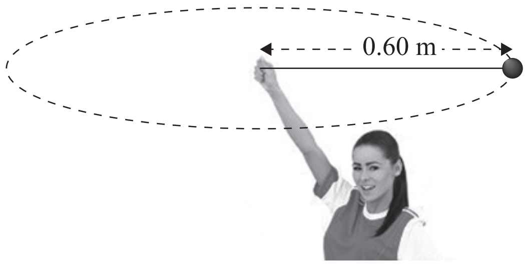
(ii) Calculate the total clockwise torque around end A of the plank

(c) (i) Calculate the size of the force experienced by Alf, who is holding end A of the plank.

ASSESSOR'S USE ONLY

(ii) Explain whether Alf experiences any change in force when Sally moves from her existing position towards end B during her dance routine.

(d) During one of her dance routines, Sally is spinning a ball above her head in a horizontal circle, as shown below.



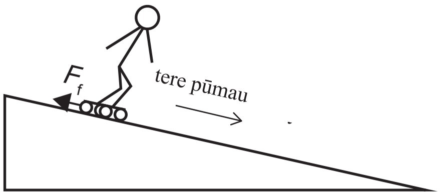
The ball of mass 0.050 kg makes 5 rotations in 4.0 s. The length of the string from the ball to Sally's hand is 0.60 m.

Calculate the size of the force experienced by the ball during these rotations.

MĀ TE KAIMĀKA ANAKE

HE HOAHOA TĀPIRI

Ki te hiahia koe ki te tuhi anō i tētahi o ō hoahoa ki te Tūmahi Tuatahi (d), whakamahia te hoahoa, te tapawhā hoki / rānei i raro nei. Kia mārama te tohu ko tēhea te hoahoa ka hiahia koe kia mākahia.



Ki te hiahia koe ki te tātuhi anō i tō hoahoa tōpana mō te Tūmahi Tuarua (a), whakamahia te tapawhā i raro nei. Kia mārama te tohu ko tēhea te hoahoa ka hiahia koe kia mākahia.

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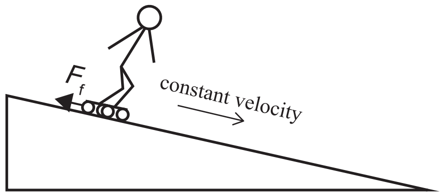
SPARE DIAGRAMS

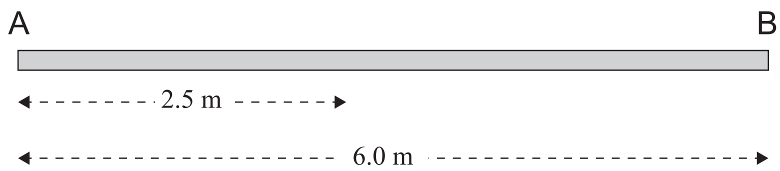
If you need to redraw either of your diagrams for Question One (d), use the diagram and / or box below. Make sure it is clear which diagram you want marked.



If you need to redraw your force diagram for Question Two (a), use the box below. Make sure it is clear which diagram you want marked.

MĀ TE KAIMĀKA ANAKE

Ki te hiahia koe ki te tuhi anō i tō hoahoa tōpana mō te Tūmahi Tuatoru (a), whakamahia te hoahoa i raro nei. Kia mārama te tohu ko tēhea te hoahoa ka hiahia koe kia mākahia.



If you need to redraw your force diagram for Question Three (a), use the diagram below. Make sure it is clear which diagram you want marked.

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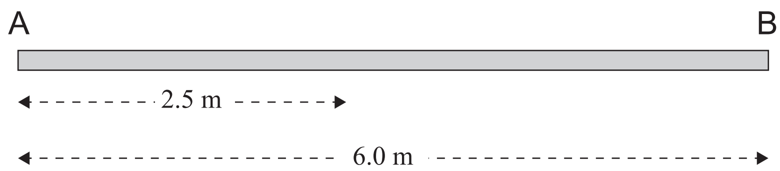

He whārangi anō ki te hiahiatia.
Tuhia te (ngā) tau tūmahi mēnā e tika ana.

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 2 Physics, 2017

91171 Demonstrate understanding of mechanics

2.00 p.m. Friday 10 November 2017
Credits: Six

91171M

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

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.