See back cover for an English translation of this cover

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91171M

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SUPERVISOR'S USE ONLY

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Ahupūngao, Kaupae 2, 2013

91171M Te whakaatu māramatanga ki te pūnaha pūkahakaha

2.00 i te ahiahi Rāapa 13 Whiringa-ā-rangi 2013
Whiwhinga: Ono

Paetae	Paetae Kaiaka	Paetae 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 ngā whārangi kei muri i te pukapuka nei, ka āta tohu ai i ngā tau pātai.

Tirohia mehemea kei roto nei ngā whārangi 2 – 15 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

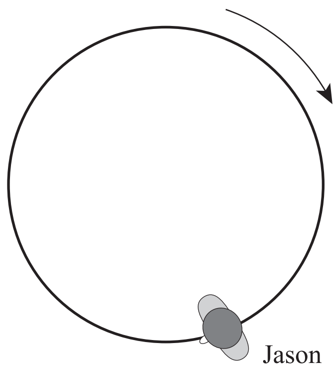
Kia 60 meneti hei whakautu i ngā pātai o tēnei pukapuka.

PĀTAI TUATAHI: NEKEHANGA

Ka haere a Jason ki tētahi papa tākaro mō te rā.

Ka tū ia ki tētahi hōiho tāwhiowhio, e huri ana ki tētahi tere aumou.

E whakaatu ana te hoahoa i raro i a Jason e tū ana ki te hōiho āwhiowhio, e huri whakatekaraka ana.



(a) Ki te hoahoa i runga, tuhia he pere ki a Jason hei whakaatu i te ahunga o tana tere i taua pūwāhi.

(b) He 4.0 m te pūtoro o te hōiho āwhiowhio. He 15 hēkona te roa o te huri amio katoa. Ko te papatipu o Jason he 65 kirokaramu.

Tātaitia te tōpana amio whakaroto e hiahiatia kia amio haere tonu a Jason.

You are advised to spend 60 minutes answering the questions in this booklet.

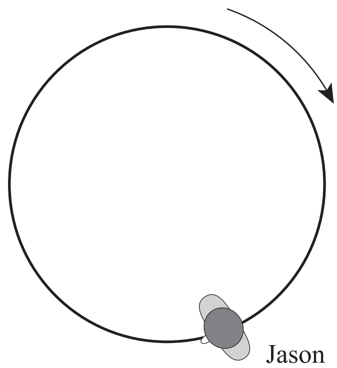
ASSESSOR'S USE ONLY

QUESTION ONE: MOTION

Jason spends a day at an amusement park.

He stands on a merry-go-round, which turns at a constant speed.

The diagram below shows Jason standing on the merry-go-round, which is going around in a clockwise direction.



(a) On the diagram above, draw an arrow on Jason to show the direction of his velocity at that point.

(b) The radius of the merry-go-round is 4.0 m. The merry-go-round takes 15 s to do a complete circle. Jason has a mass of 65 kg.

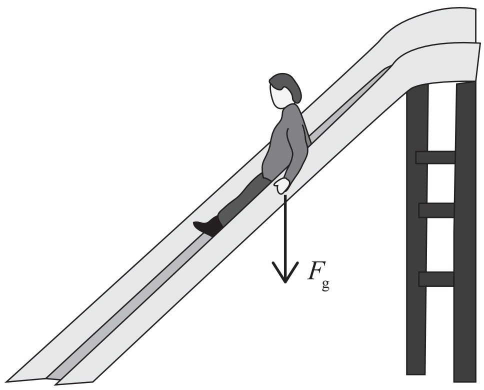
Calculate the centripetal force needed to keep Jason moving in a circle.

(c) Kātahi ka haere a Jason ki te eke mā runga kāta. Tata ana ia ki te mutunga ka whakapōturi ia ki te 2.5 m s^{-2}, ā, ka tū ia i roto i te 4.2 hēkona.

Mā te tātaitai i te tere tīmata o Jason, whakatauhia te tawhiti ka haere i a ia e whakatū haere ana.

(d) Ka noho a Jason ki runga i tētahi retireti, e ai ki te hoahoa i te taha matau.

E **aumou** ana te tere o tana reti ki raro.



(i) Tuhia te rahi o te tōpana **more** ki a Jason.

(ii) Ki te hoahoa i te taha matau, tuhia ngā tōpana e toe ana (hei pere whai tapanga) kei runga i a Jason.

Kua oti kē te F_g te tuhi mōu.

(iii) Whakaotihia ka tapa i te hoahoa **pere tāpiri** o ngā tōpana kei runga i a Jason.

(He aumou tonu te tere o tana reti haere.)

MĀ TE KAIMĀKA ANAKE

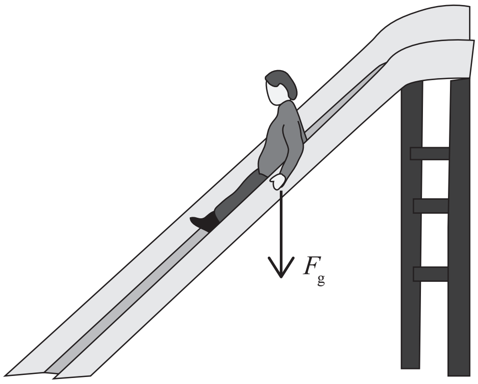
ASSESSOR'S USE ONLY

(c) Jason then goes for a ride on a go-kart. Towards the end of the ride, he decelerates at 2.5 m s^{-2} and comes to a stop in 4.2 seconds.

By calculating Jason's initial velocity, determine the distance he travels while coming to a stop.

(d) Jason sits on a slide, as shown in the diagram on the right.

He is sliding down at **constant** speed.



(i) State the size of the **net** force on Jason.

(ii) On the diagram on the right, draw the remaining forces (as labelled vectors) acting on Jason.

F_g has been drawn for you.

(iii) Complete and label the **vector addition** diagram of the forces acting on Jason.

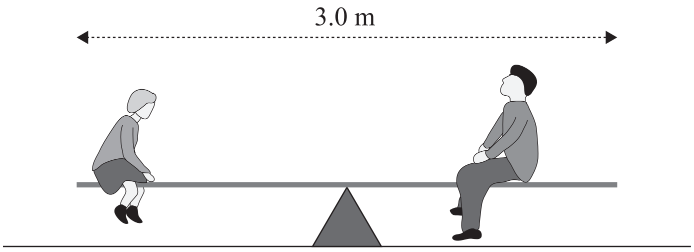
(He continues to slide at constant speed.)

MĀ TE KAIMĀKA ANAKE

PĀTAI TUARUA: NGĀ TŌPANA ME TE NEKENGA

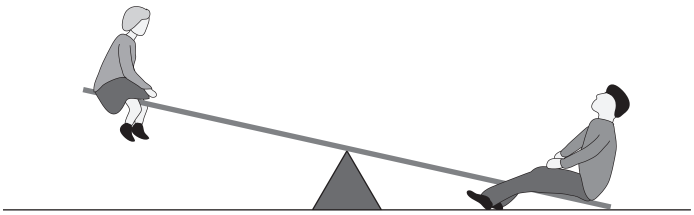
E tohu ana te hoahoa i raro i tētahi **pīoi**[2] i runga kaurori i tōna **pokapū**, ā, e noho ana a Jane ki tētahi taha me tōna matua ki tētahi kia noho taurite ai te pīoi. He 60 kirokaramu te papatipu o te pīoi.

(a) Ki te hoahoa i raro, tuhia ngā pere whai tapanga hei whakaatu i ngā tōpana katoa kei runga i te pīoi.



(b) Ka neke a Jane ki tētahi pito o te pīoi me tōna matua ki tērā atu pito.

E whakaatu ana te hoahoa i raro ka ahatia i te nohonga a Jane ki tētahi pito o te pīoi me te noho atu o tōna matua ki tērā atu pito.



papatipu o Jane	=	30 kg
papatipu o te matua o Jane	=	72 kg
papatipu o te pīoi	=	60 kg
roa o te pīoi	=	3.0 m

Tātaitia te rahi o te tōpana tautoko mai i te papa i te pito e noho ana te matua o Jane.

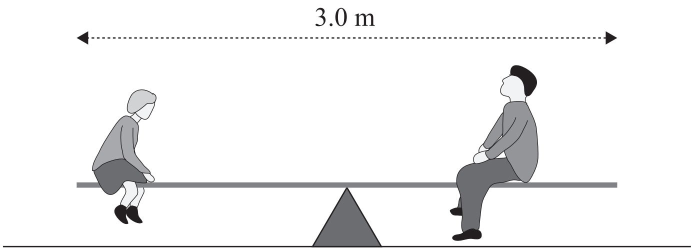
Whakaawhiwhia tō whakautu ki te maha tika o ngā mati tāpua.

[2] **tiemi**

QUESTION TWO: FORCES AND MOTION

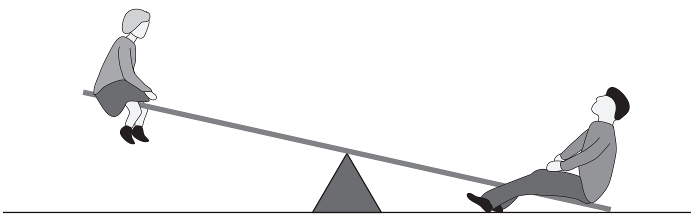
The diagram below represents a **see-saw** on a pivot at its **centre** with Jane and her dad sitting on opposite sides such that the see-saw is in equilibrium. The mass of the see-saw itself is 60 kg.

(a) On the diagram below, draw labelled vectors to show all the forces acting on the see-saw.



(b) Jane and her dad move to opposite ends of the see-saw.

The diagram below shows what happens when Jane sits at one end of the see-saw while her dad sits at the other end.



Jane's mass	=	30 kg
Jane's dad's mass	=	72 kg
mass of see-saw	=	60 kg
length of see-saw	=	3.0 m

Calculate the size of the support force from the ground at the end where Jane's dad sits.

Round your answer to the correct number of significant figures.

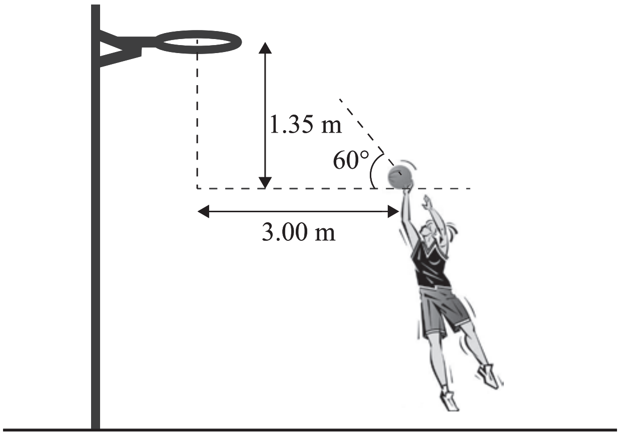
MĀ TE KAIMĀKA ANAKE

Ka whakamātau a Hillary ki te whiu i tētahi pōro poitūkohu ki roto i tētahi pīrori.

(c) Whakamāramahia te pānga tōpana kei runga i te pōro, ina rere atu i te ringa o Hillary kia tae rawa ki tana teitei mōrahi.

Me waiho e koe ngā pānga o te parehau[3].

(d) I tētahi atu wā, he 3.0 mita te tū tawhiti o Hillary i te pīrori. Ka whiua e ia te pōro me te tere tīmata o te 6.5 m s^{-1} ki tētahi koki o te 60° mai i te huapae. Kei runga ake te pīrori i te taha raro o te pōro mā te 1.35 m i te tīmatanga o te whiunga.



Whakaotihia he tātaitanga hei whakatau mēnā ka uru te pōro ki te pīrori, kāore rānei.

Tīmatahia tō whakautu mā te tātaitai i ngā wāhanga huapae, poutū hoki o te tere tīmata o te pōro.

[3] parenga hau

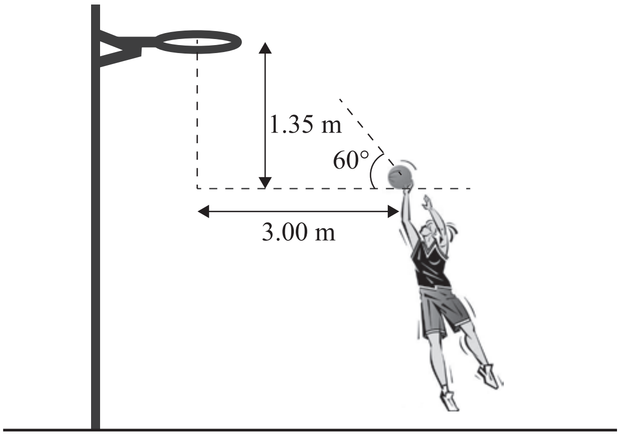
ASSESSOR'S USE ONLY

Hillary attempts to throw a basketball into a hoop.

(c) Explain the effect of the force(s) acting on the ball, once it has left Hillary's hand until it reaches maximum height.

You may ignore the effects of air resistance.

(d) On another occasion, Hillary stands 3.0 metres from the hoop. She throws a ball with an initial velocity of 6.5 m s^{-1} at an angle of 60° to the horizontal. The hoop is 1.35 m above the bottom of the ball when it is thrown initially.



Carry out calculations to determine whether or not the ball will go through the hoop.

Begin your answer by calculating the horizontal and vertical components of the initial velocity of the ball.

MĀ TE KAIMĀKA ANAKE

PĀTAI TUATORU: TOROHAKI ME TE PŪNGAO

E tauawhi ana tētahi pākaituki rapa[4] ki ia waka tukituki.

(a) He 240 kirokaramu te papatipu o tētahi waka tukituki. He 65 kirokaramu te papatipu o Jason, ā, he 2.4 m s^{-1} te tere o tana haere.

Tātaitia te rahi o te torohaki o Jason me tōna waka tukituki.

(b) I waihangatia ngā waka tukituki hei whakaiti i te wharanga.

Matapakitia ngā take e whai pākaituki rapa ngā waka tukituki huri noa i te waka.

Me kī he ōrite katoa te papatipu o ngā waka whai pākaituki me ērā kāore e whai pākaituki.
Me kī he ōrite te huringa o te tere o ngā waka whai pākaituki me ērā kāore e whai pākaituki.

[4] inarapa

QUESTION THREE: MOMENTUM AND ENERGY

ASSESSOR'S USE ONLY

Each bumper car has a rubber bumper all round it.

(a) The mass of a bumper car is 240 kg. Jason has a mass of 65 kg and is travelling at a speed of 2.4 m s^{-1}.

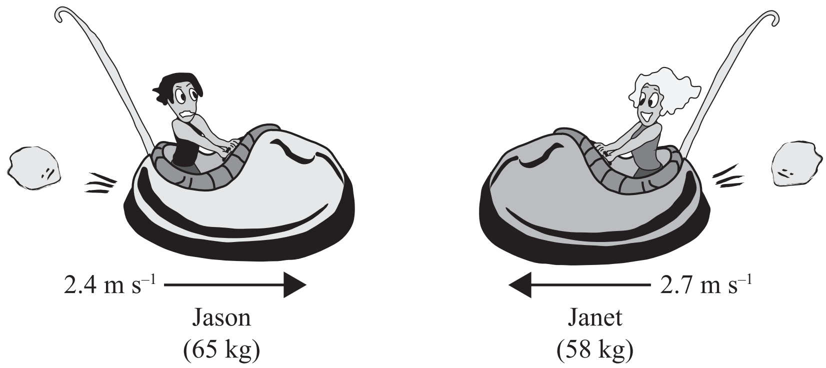
Calculate the size of the momentum of Jason and his bumper car.

(b) The bumper cars are designed to minimise injury.

Discuss the reasons for the bumper cars having rubber bumpers all round them.

Assume cars with and without bumpers have the same mass. Assume change in velocity is the same with and without bumpers.

(c) Ka tuki a Jason ihu ki te ihu ki a Janet i roto i tōna waka tukituki. Kāore i te mahi tika ngā pākaituki, ā, i muri i te tukinga kua maukati tahitia ngā waka e rua. He 240 kg (kirokaramu) te papatipu o ia waka tukituki. He 65 kg te papatipu o Jason, ā, he 58 kg te papatipu o Janet. E tika atu ana te haere ki a rāua anō mai i ngā ahunga hāngai, he 2.4 m s^{-1} te tere o Jason ki te taha matau, ā, he 2.7 m s^{-1} te tere o Janet ki te taha mauī.



Tātaitia tō rāua tere tōpū i muri i te tukinga.

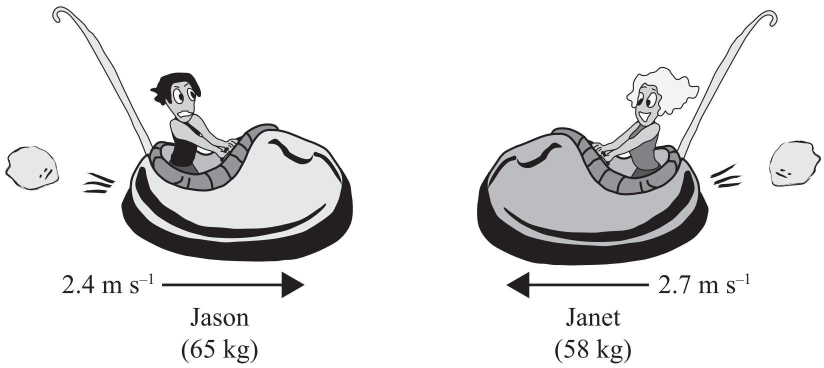
Whakaurua he ahunga ki tō whakautu.

(d) He 78 000 N m^{-1} te aumou whana o te pākaituki rapa kei te waka tukituki o Jason. I tētahi atu wā i tuki ia ki te pātū, ka pā te kōpeketanga o te 15 cm.

(i) Tātaitia te pūngao moe tāwariwari i roto i te pākaituki rapa.

(ii) Whakatauhia te tōpana whakahāngai mēnā i roa ake te tukinga i te 0.80 hēkona. Hōmai te waeine i roto i tō whakautu.

(c) Jason collides head-on with Janet who is in another bumper car. The bumpers don't work properly and after collision both cars lock together. The mass of each bumper car is 240 kg. Jason has a mass of 65 kg and Janet has a mass of 58 kg. They are travelling towards each other in opposite directions, Jason with a speed of 2.4 m s^{-1} to the right and Janet with a speed of 2.7 m s^{-1} to the left.



Calculate their combined velocity after collision.

Include a direction with your answer.

(d) The rubber bumper in Jason's bumper car has a spring constant of 78 000 N m^{-1}. On one occasion he collides with the wall, causing a compression of 15 cm.

(i) Calculate the elastic potential energy stored in the rubber bumper.

(ii) Determine the impulse if the collision lasted for 0.80 s. Include a unit with your answer.

ASSESSOR'S USE ONLY

He puka anō mēnā ka hiahiatia.
Tuhia te (ngā) tau 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, 2013

91171 Demonstrate understanding of mechanics

2.00 pm Wednesday 13 November 2013
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–PHYSR.

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 – 15 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.