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UNIVERSITI MALAYSIA PERLIS

Peperiksaan Akhir Semester Kedua
Sidang Akademik 2018/2019

Mac 2019

DNT122 – Applied Mechanics
[Mekanik Gunaan]

Masa : 3 jam

Please make sure that this question paper has **ELEVEN (11)** printed pages including this front page before you start the examination.
*[Sila pastikan kertas soalan ini mengandungi **SEBELAS (11)** muka surat yang bercetak termasuk muka hadapan sebelum anda memulakan peperiksaan ini.]*

This question paper has **TWO (2)** parts:
*[Kertas soalan ini mengandungi **DUA (2)** bahagian:]*

PART A : This section has **FOUR (4)** questions. Answer **ALL** questions. (80 Marks)
*[**BAHAGIAN A** : Bahagian ini mengandungi **EMPAT (4)** soalan. Jawab **SEMUA** soalan. (80 Markah)]*

PART B : This section has **TWO (2)** questions. Answer **ONE (1)** question only.(20 Marks)
*[**BAHAGIAN B** : Bahagian ini mengandungi **DUA (2)** soalan. Jawab **SATU (1)** soalan sahaja. (20 Markah)]*

Each questions contributes **TWENTY (20)** marks.
*[Setiap soalan menyumbang **DUA PULUH (20)** markah.]*

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PART A
Answer ALL FOUR (4) questions.
[Bahagian A]
[Jawab SEMUA EMPAT (4) soalan.]

Question 1
[Soalan 1]

(a) Briefly explain the vector and scalar quantity and provide example for each case.
[Terangkan secara ringkas tentang kuantiti vektor dan skala dan sertakan contoh bagi setiap satu.]
(4 Marks / *Markah*)

(b) Three forces act on the frame as shown in **Figure 1**. Replace this force system by an equivalent resultant force and couple moment acting at *A*.
*[Tiga daya bertindak pada bingkai seperti yang ditunjukkan dalam **Rajah 1**. Gantikan sistem daya dengan daya paduan setara dan pasangan momen pada A.]*
(6 Marks / *Markah*)

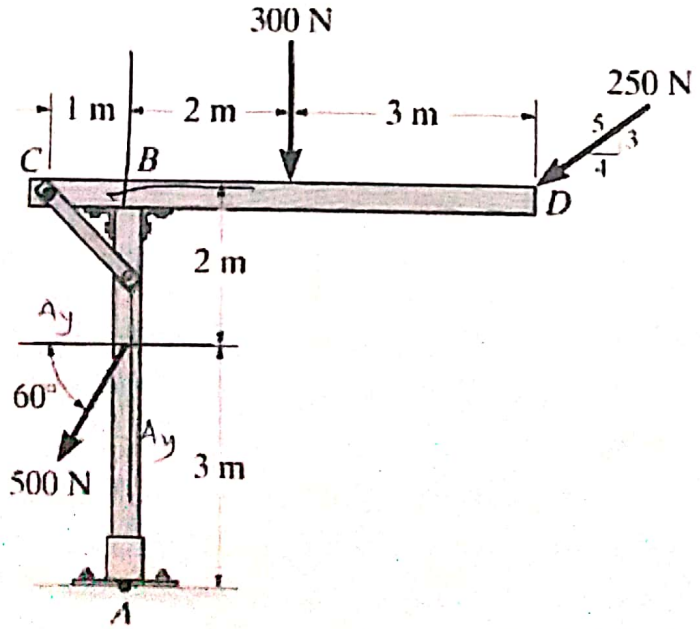

Figure 1
[Rajah 1]

(c) Two cables use to support the precast concrete plate as shown in **Figure 2**.
*[Dua kabel digunakan untuk menyokong plat konkrit pratuang seperti yang ditunjukkan dalam **Rajah 2**.]*

(i) Compute the force in each cable. Express each force in Cartesian vector form.
[Kirakan daya pada setiap kabel. Tunjukkan setiap daya dalam bentuk Cartesian vektor.]

(4 Marks / *Markah*)

(ii) Calculate the resultant of the forces exerted by the two cables.
[Kirakan daya paduan yang dikenakan oleh kedua-dua kabel.]

(2 Marks / *Markah*)

(iii) Determine the magnitude and the coordinate direction of angles of resultant force acting on the two cable.
[Tentukan magnitud dan arah koordinat sudut-sudut daya paduan yang bertindak pada kedua-dua kabel.]

(4 Marks / *Markah*)

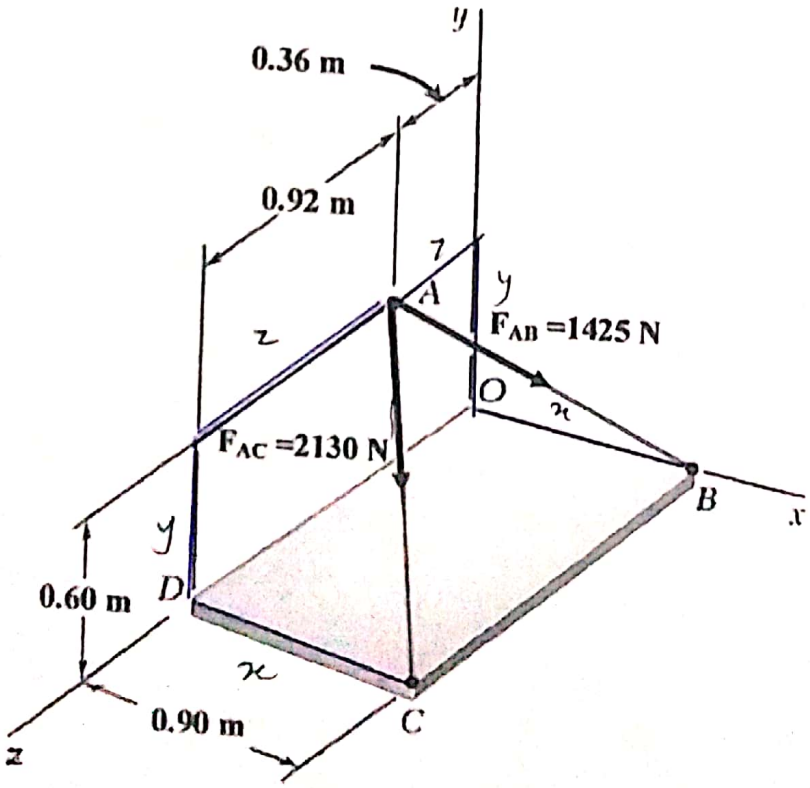

Figure 2
[Rajah 2]

Question 2
[Soalan 2]

(a) A truss used to support the bridge as shown in **Figure 3** is held with cable at A and pin at D. With the aid of free body diagram, determine the reaction support at A and D.
*[Sebuah kekuda digunakan untuk menyokong jambatan seperti yang ditunjukkan dalam **Rajah 3** dipegang oleh kabel pada A dan pin pada D. Dengan bantuan rajah bebas, tentukan tindak balas sokongan pada A dan D.]*

(6 Marks / *Markah*)

(b) By using the method of joint and the aid of free body diagram, determine the force at :
[Dengan menggunakan kaedah sambungan dan bantuan gambarajah badan bebas,tentukan daya pada:]

(i) point D and E.
[titik D dan E.]

(6 Marks / *Markah*)

(ii) point B and F
[titik B dan F.]

(6 Marks / *Markah*)

(c) With the aid of free body diagram, identify the each member of the truss whether is in tension or compression condition.
[Dengan menggunakan bantuan gambarajah badan bebas , kenalpasti samaada setiap kekuda dalam keadaan tegangan atau mampatan.]

(2 Marks / *Markah*)

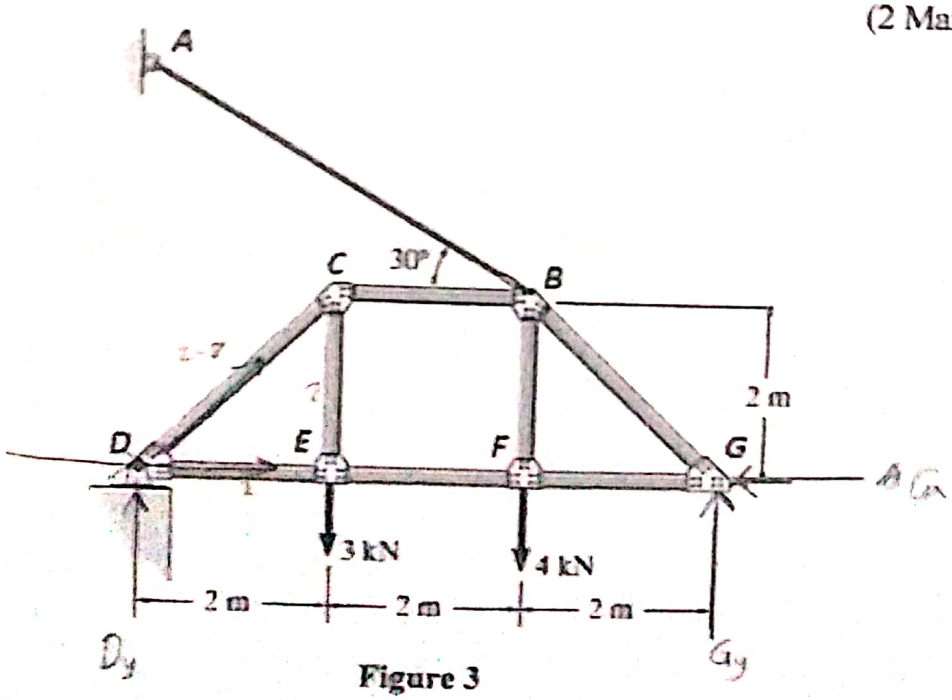

Figure 3
[Rajah 3]

Question 3
[Soalan 3]

(a) The conveyor belt delivers each 12 kg crate to the ramp at A with the velocity, v_A = 2.5 m/s as shown in **Figure 4**. Given the coefficient of kinetic friction between each crate and the ramp is μ_k = 0.3.
*[Sebuah konveyor menghantar setiap 12 kg beban kepada tanjakan di A dengan halaju, v_A = 2.5 m/s seperti yang ditunjukkan dalam **Rajah 4**. Diberi pekali geseran kinetik di antara beban dengan tanjakan ialah μ_k = 0.3.]*

(i) Draw the free body diagram.
[Lukiskan gambarajah badan bebas.]

(4 Marks / *Markah*)

(ii) Evaluate the velocity at B, if θ = 30°.
[Nilaikan halaju pada B jika θ = 30°.]

(6 Marks / *Markah*)

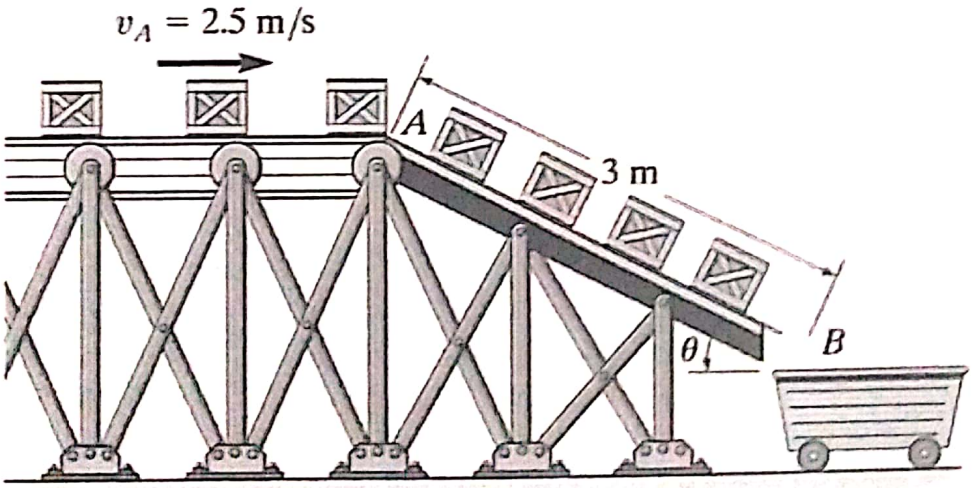

Figure 4
[Rajah 4]

$F = ma$

$V_B \cos 30 - 0.3 \times 12(10) = \frac{12 \times 10.3}{\cos 30}$

$V_B = \frac{30.3}{\cos 30}$

V_B

$V_B = V_c + V_{B/A}t$

$2.5 = 0 + V_B \cos 30 (t)$

(b) Force 150 N required to push the 50 kg crate in **Figure 5** from rest. With the aid of free body diagram, when t = 4s. Given the coefficient of kinetic friction between the floor and the crate is $\mu_k = 0.2$.

*[Daya 150 N digunakan untuk menolak sebuah beban 50 kg seperti **Rajah 5** dari keadaan pegun.Dengan bantuan Rajah badan bebas,. Diberi pekali geseran kinetic antara lantai dan beban adalah $\mu_k = 0.2$.]*

(i) Draw the free body diagram.
[Lukiskan gambarajah badan bebas.]

(2 Marks / *Markah*)

(ii) Evaluate the velocity of the crate when t = 4s.
[Nilaikan halaju beban tersebut bila t = 4s.]

(6 Marks / *Markah*)

(c) From the velocity calculation in question b(ii) estimate the power supplied to the crate.
[Dari pengiraan halaju dalam soalan b(ii) anggarkan kuasa yang dibekalkan kepada beban.]

(2 Marks / *Markah*)

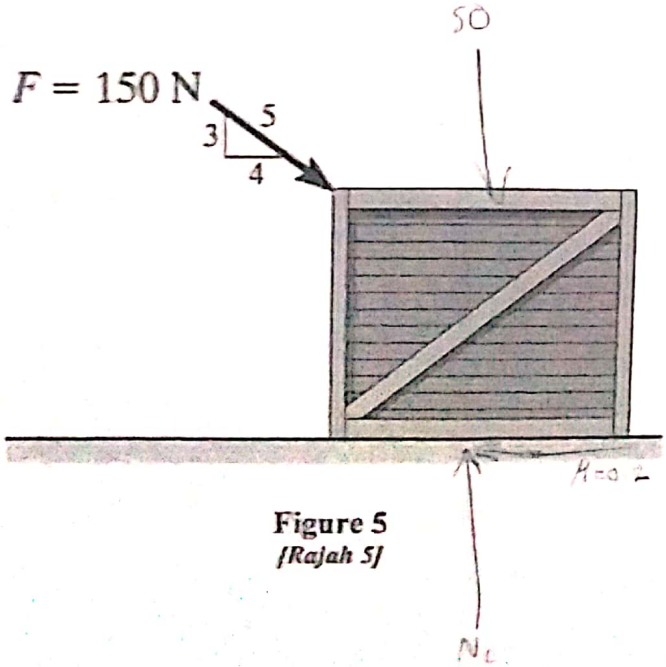

Figure 5
[Rajah 5]

Question 4
[Soalan 4]

(a) With the aid of sketches, briefly explain three Newton's law.
[Dengan bantuan lakaran, terangkan secara ringkas tentang ketiga-tiga Newton's Law.]

(6 Marks / *Markah*)

(b) Briefly explain about impending motion and motion.
[Terangkan secara ringkas tentang pergerakan yang bakal berlaku dan pergerakan.]

(2 Marks / *Markah*)

(c) A 20 kg crate is hold in equilibrium as shown in **Figure 6.**
[Beban 20 kg dipegang dalam keseimbangan seperti yang ditunjukkan dalam Rajah 6.]

(i) Draw the free body diagram for equilibrium.
[Lukis gambarajah badan bebas untuk kesimbangan.]

(2 Marks / *Markah*)

(ii) Calculate the tension in cable A, B and C.
[Kirakan tegangan dalam kabel A, B dan C.]

(6 Marks / *Markah*)

(iii) Determine the stretch in each of springs required, if each spring has an unstretched length of 2 m and a stiffness of k = 300 N/m.
[Tentukan regangan yang diperlukan pada setiap spring, jika setiap spring mempunyai panjang yang tidak terulur 2 m dan kekenyalan k = 300 N / m.]

(4 Marks / *Markah*)

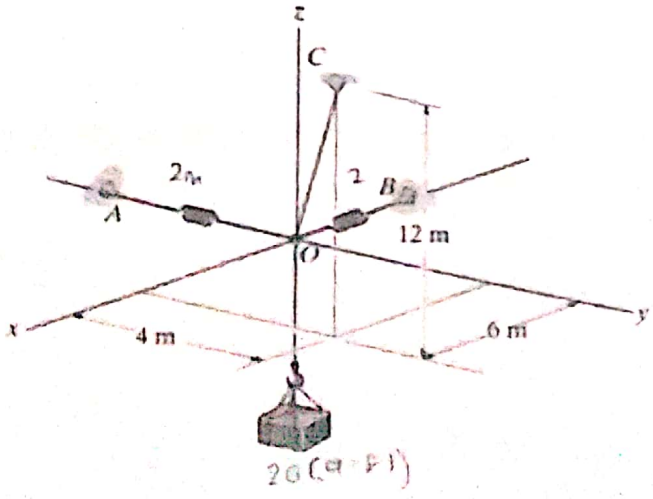

Figure 6
[Rajah 6]

PART B

Answer only ONE (1) question.

[Bahagian B]

[Jawab SATU (1) soalan sahaja.]

Question 5

[Soalan 5]

(a) With the aid of sketches, briefly explain the central impact and oblique impact.

[Dengan bantuan lakaran, terangkan dengan ringkas tentang impak pusat dan impak serong.]

(4 Marks / *Markah*)

(b) **Figure 7** shows the measurements of a shot recorded on a video recorder during a basketball game. The ball passed through the hoop and barely missed the hands of the player B who attempted to block it. Neglect the size of the ball estimate the initial velocity, V_A.

*[**Rajah 7** menunjukkan pengukuran jaringan yang dirakam oleh rakaman video semasa permainan bola keranjang. Bola tersebut melalui gelung dan hampir terkena tangan pemain B yang cuba menghalang. Dengan mengabaikan saiz bola berkenaan, anggarkan halaju awal, V_A.]*

(6 Marks / *Markah*)

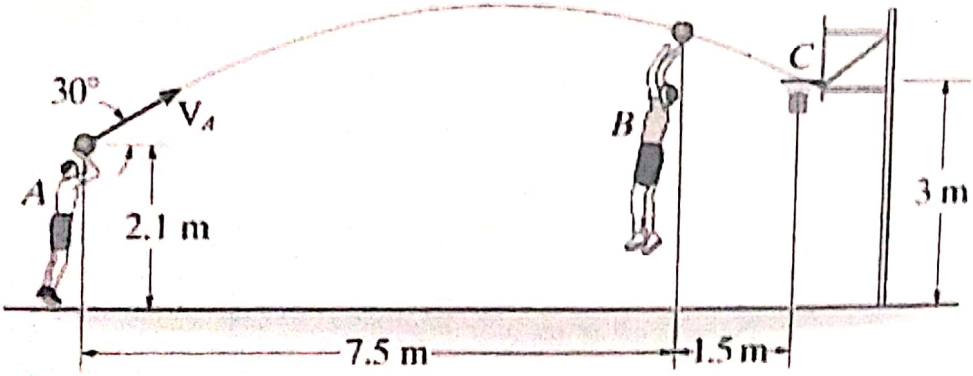

Figure 7

[Rajah 7]

(c) The 15000 kg car A and 25000 kg car B travel towards each other with the velocities as shown in **Figure 8**. If the coefficient of restitution between the bumpers is $e = 0.6$, determine;

*[15000 kg kereta A dan 25000 kg kereta B bergerak ke arah satu sama lain dengan halaju seperti ditunjukkan dalam **Rajah 8**. Jika pekali restitusi antara bumper adalah $e = 0.6$.]*

(i) the velocity of each car just after the collision.
[Kirakan halaju setiap kereta selepas pelanggaran.]

(5 Marks / *Markah*)

(ii) the energy losses during impact.
[Tentukan jumlah tenaga yang hilang semasa pelanggaran.]

(5 Marks / *Markah*)

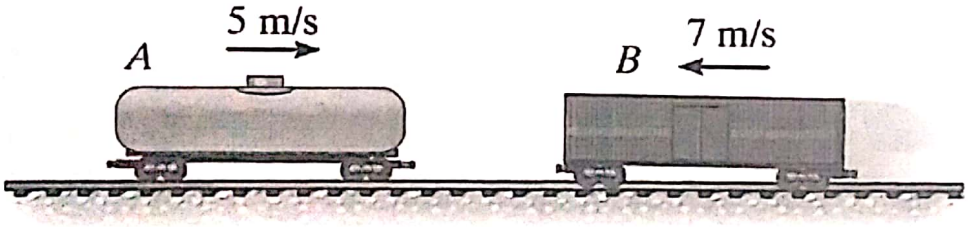

Figure 8
[Rajah 8]

Question 6
[Soalan 6]

(a) Briefly explain about Conservative Forces and Potential Energy
[Terangkan secara ringkas tentang Daya Konservatif dan Tenaga Berpotensi.]

(4 Marks / *Markah*)

(b) **Figure 9** shows a ball is thrown by a man at A. The ball strike to the ground at B. If the time for ball to strike the ground is 2.5 s. Estimate the angle θ_A at which the ball was thrown.
[Rajah 9 menunjukkan sebiji bola dilontarkan oleh seorang lelaki pada A. Bola tersebut telah menghentam tanah pada B.Jika masa untuk bola menghentam tanah adalah 2.5 s. Anggarkan nilai sudut, θ_A di mana bola dilontarkan.]

(6 Marks / *Markah*)

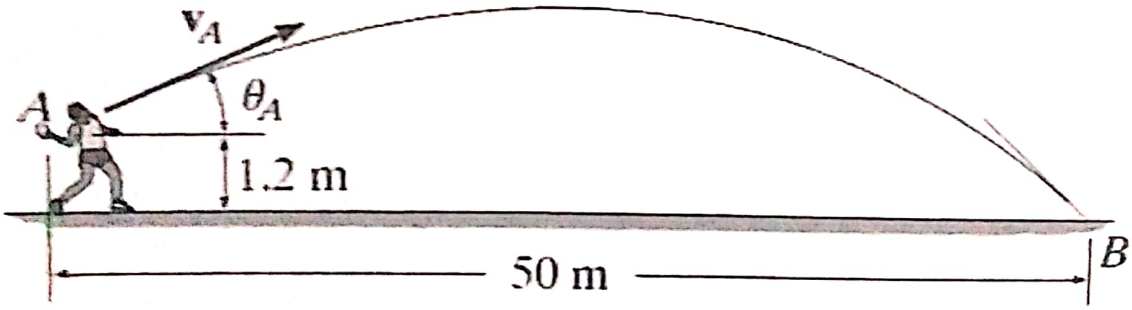

Figure 9
[Rajah 9]

$x = x_0 + v_{0x} t$

$50 = 0 + V_A \cos\theta_A (2.5)$

$V_A = \dfrac{20}{\cos\theta_A}$ — (1)

$y = y_0 + v_{0y} t + \frac{1}{2} g t^2$

(c) **Figure 10** shows the velocities of two steel blocks sliding without friction on a horizontal surface, immediately before impact. If after the impact the velocity of block B is observed to be 2.5 m/s to the right.
[Rajah 10** menunjukkan halaju dua blok keluli yang bergelongsor tanpa geseran pada permukaan mengufuk sebaik sebelum pelanggaran.Jika selepas pelanggaran halaju blok B adalah 2.5m/s ke kanan.]

(i) Determine the velocity after impact for block A.
[Tentukan halaju selepas pelanggaran bagi blok A.]

(3 Marks / *Markah*)

(ii) Compute the coefficient of restitution between the two blocks.
[Kirakan pekali restitusi antara dua blok tersebut.]

(2 Marks / *Markah*)

(iii) Calculate the energy losses during impact.
[Kirakan jumlah tenaga yang hilang semasa pelanggaran.]

(5 Marks / *Markah*)

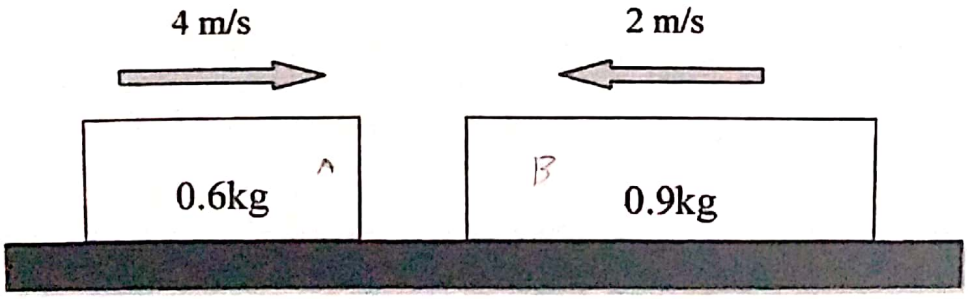

Figure 10
[Rajah 10]

$0.6(4) + 0.9(2) = 0.6(V_1) + 0.9(\overset{2.5}{\cancel{V_2}})$

$V_1 = 3.25$