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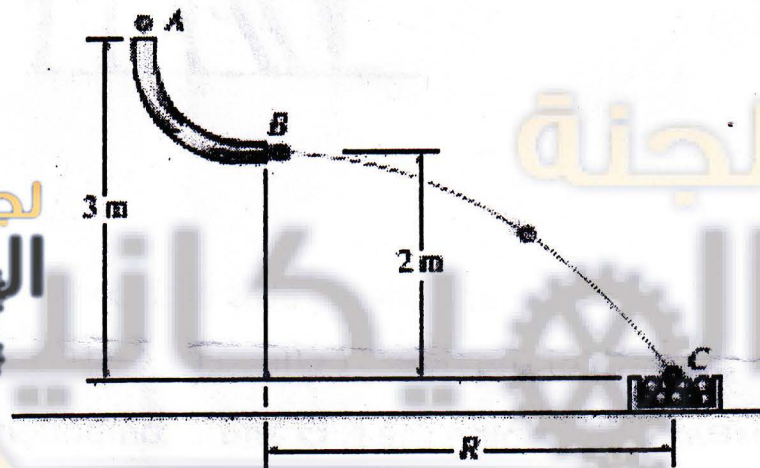
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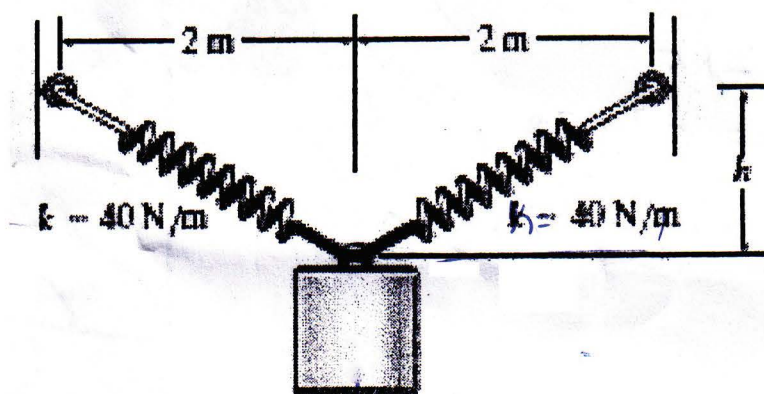
[youtube.com/MechanicalFet](https://www.youtube.com/MechanicalFet)



Q1:- Balls having a mass of 10 g fall from rest at A through the glass tube and accumulate in the can C . Determine the placement R of the can from the end of the tube and at which speed the balls fall into the can. Neglect the size of the can.

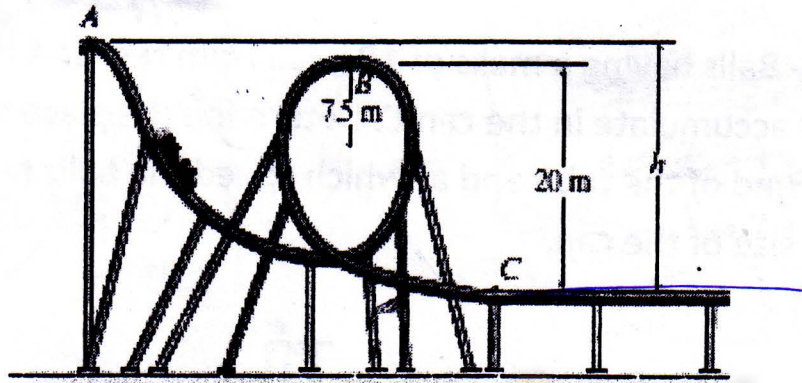


Q2:- The cylinder has a mass of 25 kg and is released from rest when $h=0$. Determine its speed when $h=3\text{ m}$. The spring each have an unstretched length of 2 m .

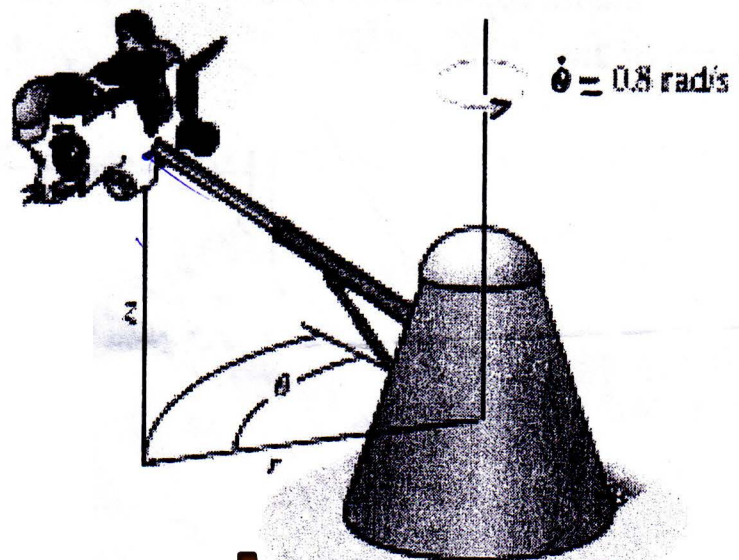


لجنة الميكانيك - الإتجاه الإسلامي

Q3:- The roller coaster car having a mass m is released from rest at point A . If the track is to be designed so that the car does not leave it at B , determine the required height h . Also, find the speed of the car when it reaches point C . Neglect friction..



Q4- The amusement park ride rotates with constant angular velocity $\dot{\Theta} = 0,8$ rad/s. If the path of the ride is defined by $r = (3\sin\Theta + 5)$ m and $Z = (3\cos\Theta)m$, determine the r , Θ and Z components of force exerted by seat on the 20-kg boy when $\Theta = 120^\circ$



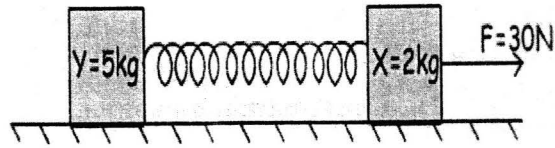
لجنة الميكانيك - الإتجاه الإسلامي

Dynamics ME 312

Second examination

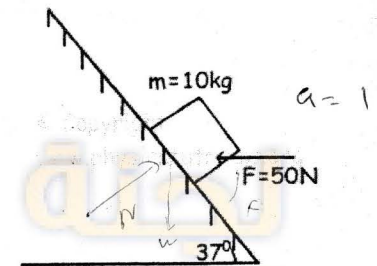
Date: 17/7/2012

1. As you can see in the picture given below, two boxes are placed on a frictionless surface. If the acceleration of the box X is 5 m/s^2 , find the acceleration of the box Y.



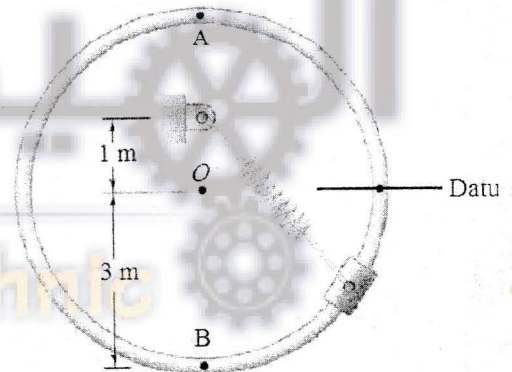
- a) 5 m/s^2 b) 2 m/s^2 **c) 4 m/s^2** d) 3.5 m/s^2

2. System in the given picture below, box moves under the effect of applied force and gravity with 1 m/s^2 acceleration. the friction constant between the box and surface equal.



- a) 1/10 b) 1/11 **c) 1/20** d) 1/15

3. A 1-kg collar is attached to a spring and slides without friction along a circular rod in a vertical plane. The spring is undeformed when the collar is at point A. If the spring's constant is 100 N/m , the total potential energy when the collar is at point B is (use the datum shown)



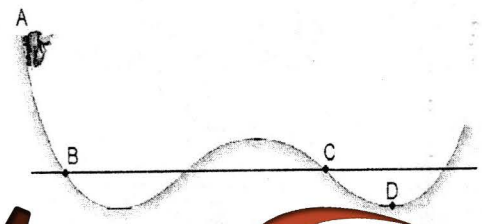
- a) 170.6 J b) 200 J c) 229.4 J d) 270.6 J

4. A 2-kg particle initially moving with an initial velocity of 5 m/s in the horizontal plane was subjected to a 10 N force acting in the opposite direction. How long would it take the particle to come to a complete stop?

- a) 0.5 s **b) 1 s** c) 1.2 s d) 2 s

5. A rollercoaster car is released from rest at position A and it moves without friction along the track shown. The speed of the car as it passes through position B is

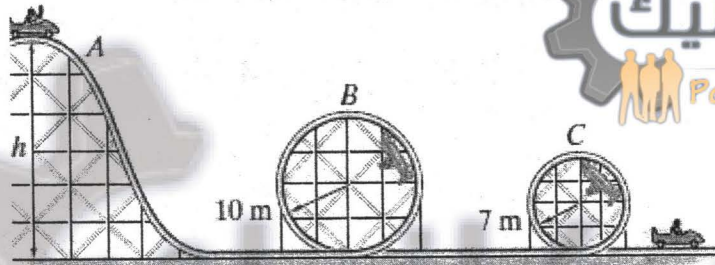
- e) less than its speed as it passes through position D**
 f) equal to its speed as it passes through position D
 g) more than its speed as it passes through position D
 h) the given information is not sufficient



6. The 0.5-lb ball is shot from the spring device. The spring has a stiffness $k = 10$ lb/in. and the four cords C and plate P keep the spring compressed 2 in. when no load is on the plate. The plate is pushed back 3 in. from its initial position. If it is then released from rest, the speed of the ball when it reaches a position $s = 30$ in. on the smooth inclined plane is

- a) 32.3 ft/s b) 64.3 ft/s c) 23.4 ft/s d) 16.4 ft/s

(for questions 7,8,9) The roller-coaster car has a mass of 800 kg, including its passenger. If it is released from rest at the top of the hill A ,



7. What is the normal reaction on the car when the car is at B

- a) 16.8 N b) 17.8 N c) 0 N d) 16.4 N

8. the minimum height h of the hill so that the car travels around both inside loops without leaving the track is. Neglect friction, the mass of the wheels, and the size of the car.

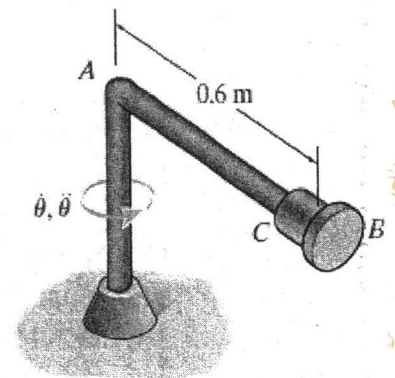
- a) 25 m b) 21 m c) 23.4 m d) 25.5 m

9. What is the normal reaction on the car when the car is at C ?

- a) 16.8 N b) 17.8 N c) 0 N d) 16.4 N

10. The 0.5-kg collar C can slide freely along the smooth rod AB . At a given instant, rod AB is rotating with an angular velocity of $\theta^\circ = 2$ rad/s and has an angular acceleration of $\theta^{\circ\circ} = 2$ rad/s² the normal force of rod AB on the collar at this instant is

- a) 1.2 N b) 0.6 N c) 1.8 N d) 6 N



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BAU-FE-MED
Dynamics-second-19/12/2011

Student Name :.....

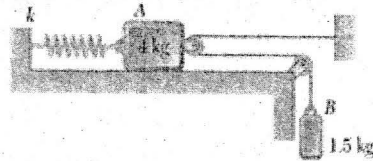
Dr. N. Jubeh

.....Time & Days:.....

Dr. S.Al- Lubani

Dr. K. Khasawneh

Q1: Blocks *A* and *B* have masses of 4 kg and 1.5 kg, respectively, and are connected by a cord-and-pulley system and released from rest in the position shown with the spring undeformed. Knowing that the constant of the spring is 250 N/m, determine the velocity of block *B* after it has moved 150 mm,



a-1.195115 m/s

b- 1.147083 m/s

c- 1.09695 m/s

d- 1.044414 m/s

Q2: Q2: The freight cars *A* and *B* have a mass of 20 Mg and 15 Mg, respectively. Determine the velocity of *A* after collision if the cars collide and rebound, such that *B* moves to the right with a speed of 2 m/s. If *A* and *B* are in contact for 0.6 s, find the average impulsive force which acts between them



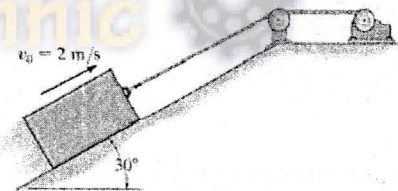
a-75 kN

b-87.5 kN

c- 105 kN

d- 65.625 kN

Q3-The 50 kg block is hoisted up the incline using the cable and motor arrangement shown. The coefficient of kinetic friction between the block and the surface is $\mu_k = 0.4$. If the block is initially moving up the plane at a velocity of 2 m/s, and at this instant, $t = 0$, the motor develops a tension in the cord of $T = (300 + 120\sqrt{t})$ N, where t in seconds, determine the velocity of the block when $t = 3$ sec.



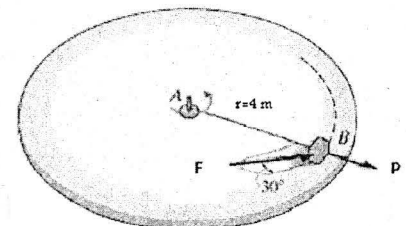
a-1.9189 m/s

b- 3.40399 m/s

c-5.5868 m/s

d-8.3721 m/s

Q4- The 0.31 kg block rests on a surface for which the coefficient of the kinetic friction is $\mu_k = 0.5$. It is acted upon by a radial force of $F = 7$ N always directed at 30° from the tangent to the path as shown. and a horizontal force of $P = 2$ N. If the block is initially moving in a circular path with a speed of 2 m/s at the instant the forces are applied, determine the time required before the tension in the cord becomes 30 N.



a- 0.7971 s

b- 1.0771 s

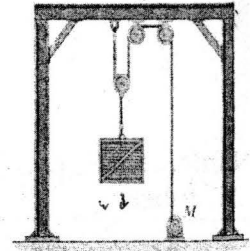
c- 1.3036 s

d- 1.4991 s



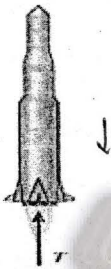
لجنة الميكانيك - الإتجاه الإسلامي

Q5-The 100-kg crate is hoisted by the motor M. If the velocity of the crate increases uniformly from 1.5 m/s to 4.5 m/s in 6s, determine the tension developed in the cable during the motion.



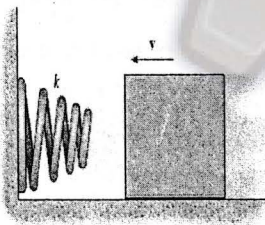
- a- 520.5 N b- 515.5 N c- 511.93 N d- 509.25 N

Q6-A rocket having a total mass of 8 Mg is fired vertically from rest. If the engines provide a constant thrust of $T = 350 \text{ kN}$, determine the power output of the engines as a function of time. Neglect the effect of drag resistance and the loss of fuel mass and weight.



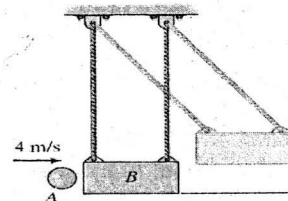
- a- 8.1t MW b- 9.69t MW c- 11.076t MW d- 12.46t MW

Q7- The 3-kg block slides along a smooth plane and strikes a *nonlinear spring* with a speed of $v = 4 \text{ m/s}$. The spring is termed “nonlinear” because it has a resistance of $F_s = ks^2$, where $k = 900 \text{ N/m}$. Determine the speed of the block after it has compressed the spring $s = 0.2 \text{ m}$



- a- 4.75 m/s b- 3.794 m/s c- 3.117 m/s d- 5.111 m/s

Q8-The 2 kg ball is thrown at the suspended 20 kg block with a velocity 4 m/s. if the coefficient of restitution between the ball and the block is 0.8 determine the speed of the block after the impact.



- a- 0.305 m/s b- 0.6545 m/s c- 1.333 m/s d- 0.965 m/s



لجنة الميكانيك - الإتجاه الإسلامي



BAU-FE-MED

Dynamics- Second Exam- A

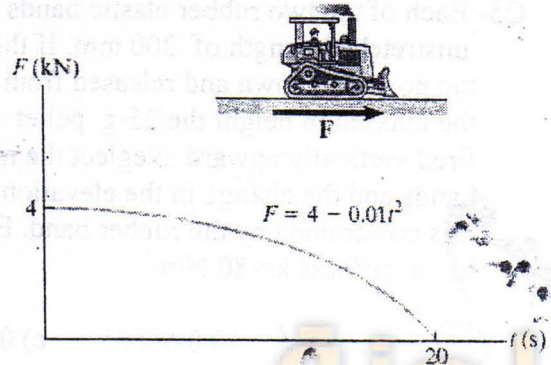
Student Name :.....

...Time & Days:..... ٩:٦٠ ← ٤

Instructor: ...أحمد الكعبي... ..

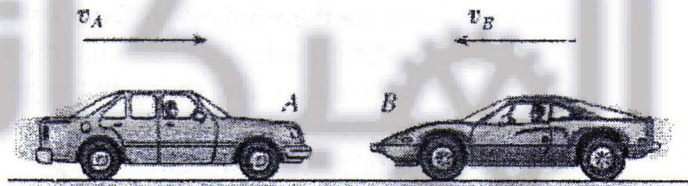
Choose the correct answer for each question:

Q1: The 28-Mg bulldozer is originally at rest. Determine its speed when $t = 7$ sec, if the horizontal traction F varies with time as shown in the graph.



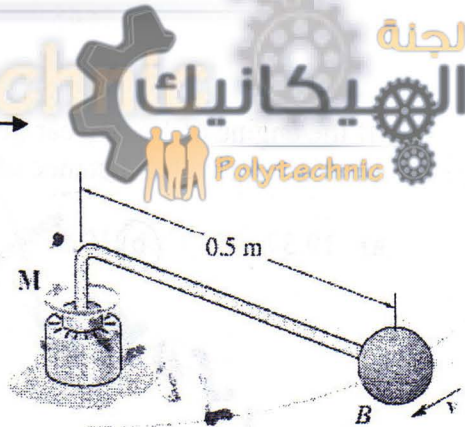
- a) 0.8592 b) 0.9592
c) 1.0592 d) 0.7592

Q2: The car A has a weight of 4200- N and is traveling to the right at 3 m/s. Meanwhile a 3000-N car B is traveling at 6 m/s to the left. If the cars crash head-on and become entangled, determine their common velocity (value and direction) just after the collision. Assume that the brakes are not applied during collision.



- a) 0.72 ← b) 0.82 c) 0.82 → d) 0.72 →

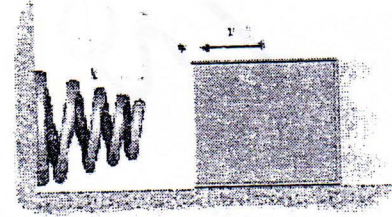
Q3 : The ball B has a mass of 10 kg and is attached to the end of a rod whose mass can be neglected. If the shaft is subjected to a torque ($M = 2t^2 + 4$) N.m , where t is in seconds, determine the speed of the ball when $t = 6$ sec . The ball has a speed $v = 2$ m/s when $t = 0$.



- a) 33.6 b) 36.6 c) 35.6 d) 34.6

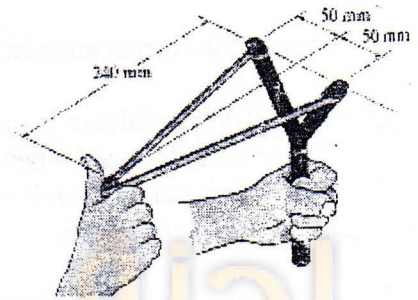


Q4- The 3.0 kg block slides along a smooth plane and strikes a nonlinear spring with a speed $v = 4$ m/s. The spring is termed "nonlinear" because it has resistance of $F_s = ks^2$, where $k = 900$ N/m². Determine the speed of the block after it has compressed the spring, $s = 0.2$ m.



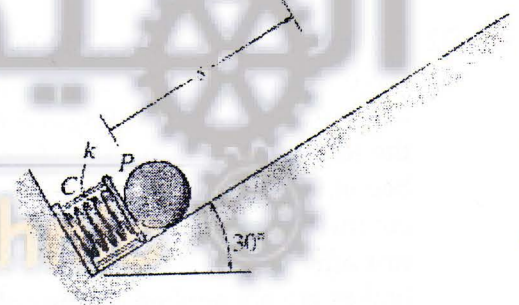
- a) 3.9947 b) 3.8947 c) 3.6947 d) 3.7947

Q5- Each of the two rubber elastic bands of the slingshot has unstretched length of 200 mm. If they are pulled back to the position shown and released from the rest. Determine the maximum height the 25-g pellet will reach if it is fired vertically upward. Neglect the mass of the rubber bands and the change in the elevation of the pellet while it is constrained by the rubber band. Each rubber band has a stiffness $k = 80$ N/m.



- a) 0.66505 b) 0.65505 c) 0.67505 d) 0.64505

Q6. The 0.5-kg ball is shot from the spring device shown. Determine the smallest stiffness k which is required to shoot the ball a maximum distance $S = 30$ cm up the plane. The spring in the given position is compressed by 3 cm, and the ball is released from rest.

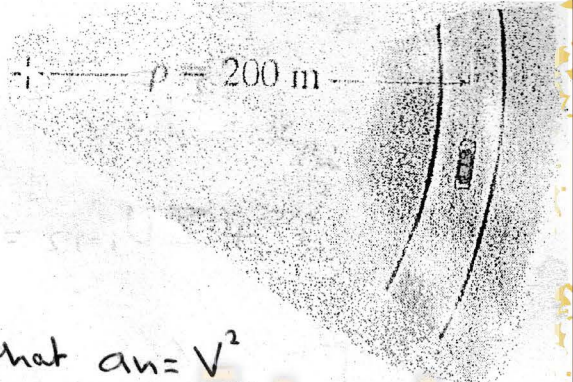


- a) 1655 b) 1645 c) 1635 d) 1625

Q7- If the engine of 1.5 Mg car generates a constant power of 15 kW, determine the speed of the car after it has traveled distance of 250m on a level road starting from rest. Neglect the friction.

- a) 19.37 b) 19.57 c) 19.47 d) 19.67

Q1:- If the coefficient of static friction between the tires and the road surface is $\mu_s = 0.25$, determine the maximum speed of 1500 Kg car without causing it to slide when it travels on curve, neglect the size of the car.



$$\mu_s = 0.25$$

$$m = 1500 \text{ Kg}$$

$$\sum F_n = m a_n \quad \text{and we know that } a_n = \frac{V^2}{r}$$

* we must to find N to find F_r

$$m g = N$$

$$\rightarrow N = 14715 \text{ N}$$



$$\Rightarrow F_r = N * \mu_s \rightarrow 14715 * 0.25 = 3678.75 \text{ N}$$

$$\Rightarrow F_r = m \frac{V^2}{r} \rightarrow 3678.75 = 1500 * \frac{V^2}{200}$$

$$V^2 = 490.5 \rightarrow V = 22.147 \text{ m/s} \quad \#$$

5

لجنة الميكانيك - الإتجاه الإسلامي

Q2:- If the coefficient of kinetic friction between the 100 Kg crate and the plane is $\mu_k = 0.25$, determine the speed of the crate at the instant the compression of the spring is $X=1.5\text{m}$. Initially the spring is unstretched and the crate is at rest.

$$m = 100 \text{ Kg}, \mu_k = 0.25$$

$$S = 1.5 \text{ m}$$

$$T_1 + \sum U_{1 \rightarrow 2} = T_2$$

$$\Rightarrow \frac{1}{2} m V_1 + \sum U_{1 \rightarrow 2} = \frac{1}{2} m V_2^2$$

$$\Rightarrow \frac{1}{2} m V_1 + \left[mg \cos 45 \cdot 11.5 - F_r \cdot 11.5 - \frac{1}{2} K \cdot S^2 \right] = \frac{1}{2} m V_2^2$$

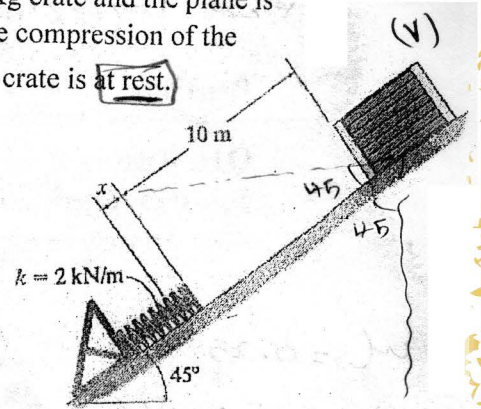
From rest

$$7977.225 - 1994.215 - 2250 = 50 V_2^2$$

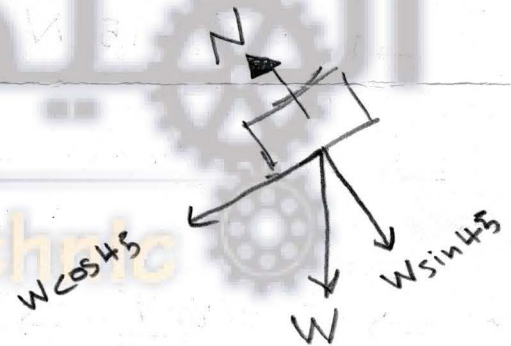
$$3733.01 = 50 V_2^2$$

$$V_2^2 = 74.6602$$

$$V_2 = 8.6406 \text{ m/s.} \quad \#$$



$$F_r = N \cdot \mu_k$$



$$\Rightarrow N - W \sin 45 = 0$$

$$N = mg \sin 45$$

$$N = 693.67 \text{ N}$$

$$\Rightarrow F_r = 173.41 \text{ N}$$

لجنة الميكانيك - الإتجاه الإسلامي

Q3:- Marbles having a mass of 5g fall from rest at A through the glass tube and accumulate at can at C, determine the displacement R of the can from the end of the tube and the speed of marble at C.

(A)

$$m = 5 \text{ kg}$$

we must find V_B first.

$$T_A + V_A = T_B + V_B$$

From rest

$$5 \times 9.81 \times 3 = \frac{1}{2} \times 5 \times V_B^2 + 5 \times 9.81 \times 2$$

$$147.15 = \frac{5}{2} V_B^2 + 98.1$$

$$\Rightarrow V_B^2 = \frac{19.62}{5/2} \rightarrow V_B = 4.429 \text{ m/s}$$

to find R we need to use ~~Newton's~~ laws of motion:

$$\uparrow S = S_0 + V_0 t + \frac{1}{2} a t^2 \rightarrow 0 = 0 + \frac{1}{2} \times 9.81 \times t^2 \Rightarrow t = 0.638 \text{ (s)}$$

$$\rightarrow S = S_0 + V_0 t \rightarrow R = 0 + 4.429 \times 0.6 \rightarrow R = 2.825 \text{ m}$$

~~$$T_A + V_A = T_B + V_B$$~~

$$T_B + V_B = T_C + V_C$$

$$\Rightarrow \frac{1}{2} \times 5 \times V_B^2 + 5 \times 9.81 \times 2 = \frac{1}{2} \times 5 \times V_C^2 + 0$$

$$49.04 + 98.1 = \frac{5}{2} V_C^2$$

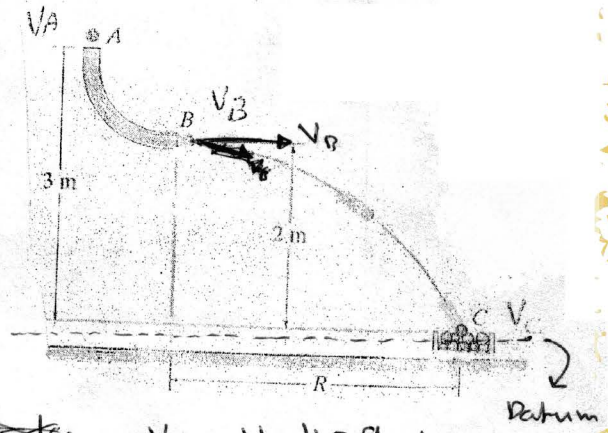
$$147.14 = \frac{5}{2} V_C^2 \rightarrow V_C = 7.67 \text{ m/s}$$

~~$$\Rightarrow \uparrow S = S_0 + V_0 t \rightarrow V^2 = V_0^2 +$$~~

~~$$\downarrow V = V_0 + a t$$~~

~~$$V = 14.474 + 4.91 \times 0.638$$~~

2



لجنة الميكانيك - الإتجاه الإسلامي



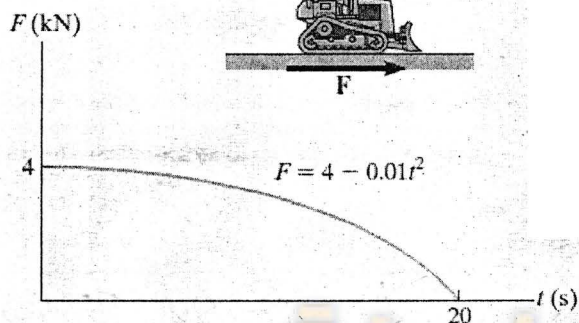
A
BAU-FE-MED
Dynamics-Second Exam

Student Name :.....

Time & Days:..... 11 ← 9:30

Write your answer in block below each question:

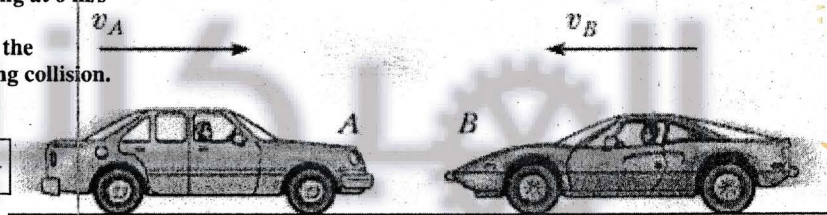
Q1: The 28-Mg bulldozer is originally at rest. Determine its speed when $t = 4$ sec, if the horizontal traction F varies with time as shown in the graph.



$V_f = 0.495 \text{ m/s}$

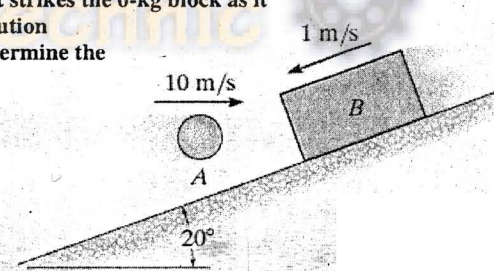
0.564

Q2: The car A has a weight of 4500- N and is traveling to the right at 3 m/s. Meanwhile a 3000-N car B is traveling at 6 m/s to the left. If the cars crash head-on and become entangled, determine their common velocity just after the collision. Assume that the brakes are not applied during collision.



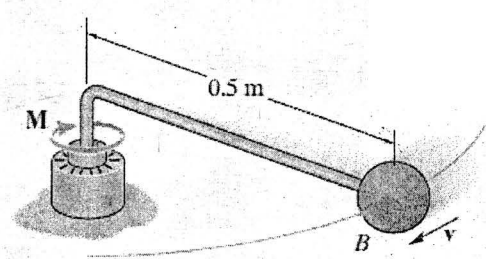
$V_f = -0.6 \text{ m/s}$

Q3: The 2-kg ball is thrown so that it travels horizontally at 10 m/s when it strikes the 6-kg block as it travels down the smooth inclined plane at 1 m/s. If the coefficient of restitution between the ball and the block is 0.6, and the impact occurs in 0.006 s, determine the average impulsive force between the ball and block.



$D = 25.2704$

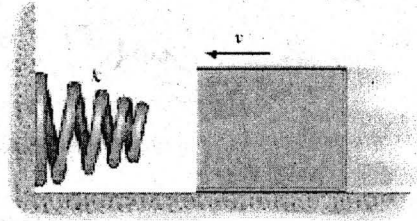
Q4 : The ball B has a mass of 10 kg and is attached to the end of a rod whose mass can be neglected. If the shaft is subjected to a torque $(M = 2t^2 + 4)$ N.m , where t is in seconds, determine the speed of the ball when $t = 2$ sec . The ball has a speed $v = 2$ m/s when $t = 0$.



$V_f = 4.66666 \text{ m/s}$

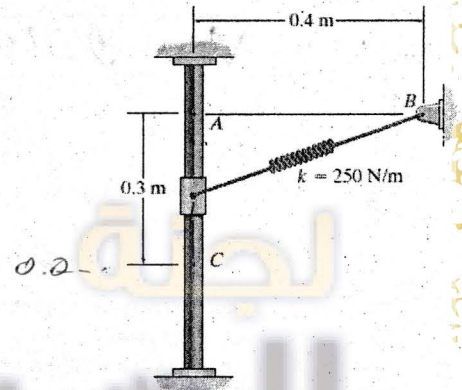
Q5- The 1.5 kg block slides along a smooth plane and strikes a nonlinear spring with a speed $v = 4 \text{ m/s}$. The spring is termed "nonlinear" because it has resistance of $F_s = ks^2$, where $k = 900 \text{ N/m}^2$. Determine the speed of the block after it has compressed the spring, $s = 0.2 \text{ m}$.

$$v = 3.5777 \text{ m/s}$$



Q6. The vertical guide is smooth and the 5-kg collar is released from rest at A. Determine the speed of the collar when it is at position C. The spring has an unstretched length of 300 mm.

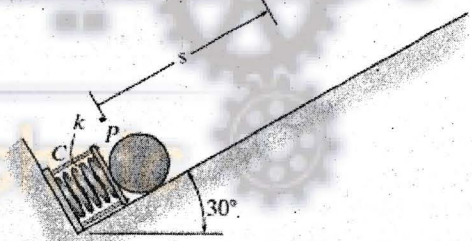
$$v_s = 0.241275 \text{ m/s}$$



Q7. The 0.5-kg ball is shot from the spring device shown. Determine the smallest stiffness k which is required to shoot the ball a maximum distance $S = 30 \text{ cm}$ up the plane after the spring is pushed back 3 cm and the ball is released from rest. The four cords C and plate P keep the spring compressed 2 cm when no load is on the plate.

$$k = 1$$

$$D_s = 1$$



Q8- If the engine of 1.5 Mg of a car generates of a constant power of 15 kW, determine the speed of the car after it has traveled distance of 200m on a level road starting from rest. Neglect the friction.

$$v_f = 0.0$$

$$m = 1.5 \times 10^3$$

$$P = 15 \times 10^3$$

$$D_s = 200$$

$$v_f = 0.0$$

$$\sum F_x = ma \quad \parallel \quad P = F \cdot v$$

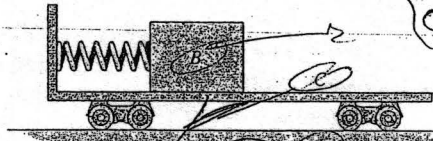
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AL-Balqa Applied University
Faculty of Engineering Technology

Mechanical department
Second exam - Dynamics
2008-2009
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Q1 (7 point)

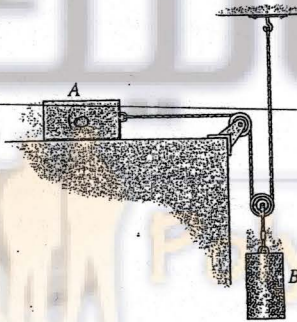
The block has a mass of 50 kg and rests on the surface of the cart having a mass of 75 kg. If the spring which is attached to the cart and not the block is compressed 0.2 m and the system is released from rest, determine the speed of the block with respect to the cart after the spring becomes undeformed. Neglect the mass of the wheels and the spring in the calculation. Also neglect friction. Take $k = 300 \text{ N/m}$.



Handwritten notes for Q1: 0.48 m/s and 0.379 .

Q2 (7 point)

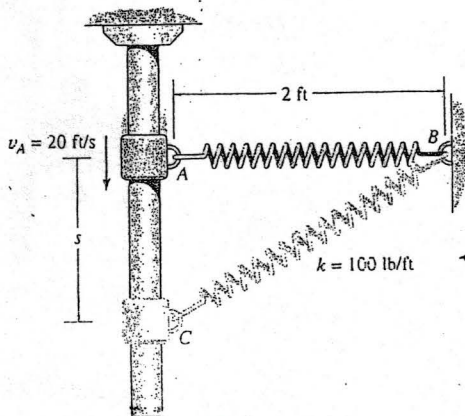
The 10-lb block A is traveling to the right at $v_A = 2 \text{ ft/s}$ at the instant shown. If the coefficient of kinetic friction is $\mu_k = 0.2$ between the surface and A, determine the velocity of A when it has moved 4 ft. Block B has a weight of 20 lb.



Handwritten notes for Q2: 0.36 ft/s and 11.9 ft/s .

Q3 (6 point)

The 2-lb block is given an initial velocity of 20 ft/s when it is at A. If the spring has an unstretched length of 2 ft and a stiffness of $k = 100 \text{ lb/ft}$, determine the velocity of the block when $s = 1 \text{ ft}$.



Handwritten notes for Q3: $F_x s$, F_{spring} , $\Delta X = 50.23$, 606 .

Handwritten notes for Q3: 17.205 ft/s .