Islamic University Faculty of Engineering Department of Mechanical Engineering		الجامعة الإسلامية كليه الهندسة قسم الهندسة الميكانيكية

ME 222- DYNAMICS

QUIZ 4

Fall Semester 2016-2017

Name, Family Name : _____

ID # : _____ **Section # :** _____ **Signature :** _____

Marks
04

Date: 07/12/2016 **Max. Marks: 2 x 5 = 10**

Answer the following question.

Q.1 The 15-Mg boxcar A is coasting at 1 .5 m/s on the horizontal track when it encounters a 12-Mg tank car B coasting at 0.75 m/s toward it as shown in Fig. Q.1. If the cars collide and couple together, determine (a) the speed of both cars just after the coupling, and (b) the average force between them if the coupling takes place in 0.8 s.

$m_A = 15\times10^3\ kg$, $V_A = 1.5\ m/s(\rightarrow)$

$m_B = 12\times10^3\ kg$, $V_B = 0.75(\leftarrow) = -0.75\ m/s$

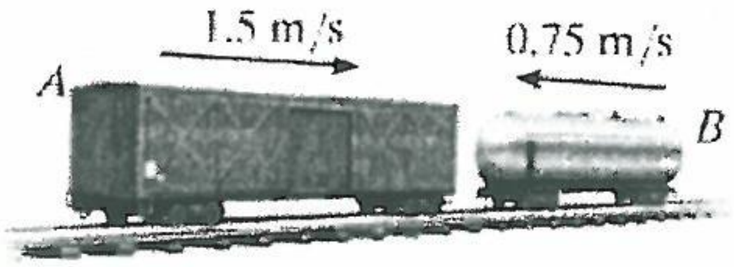
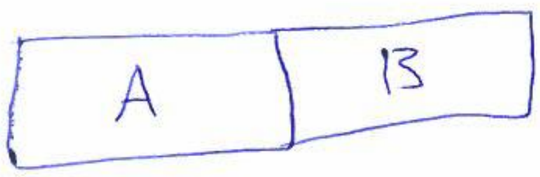


Fig. Q.1

$t = 0.8\ s$

$m_A V_{A_1} + m_B V_{B_1} = m_A V_{A_2} + m_B V_{B_2}$

$0 + 22500 = (m_A V_A) + (m_B V_B) = M_{AB} V_{AB_1}$



$m_{AB} = 27\times10^3\ kg$

$V_{AB_1} = 1.67\ m/s$

$V_{AB_1} = \dfrac{m_A V_{A_1} + m_B V_B}{M_{AB}} = 1.167\ m/s \Rightarrow mV = \int_{t_1}^{t_2} F\,dt$

$\Rightarrow 350(27\times10^3)(1.167) = F\times0.8 \Rightarrow F = 39375\ kN$

3

Q.2.The bag A, having a weight of 6 ib, is released from rest at the position Θ = 0°, as shown in Fig. Q.2. After falling to Θ = 90°, it strikes an = 18-lb box B. If the coefficient of restitution between the bag and box is e = 0.5, determine the velocities of the bag and box just after impact. What is the loss of energy during collision?

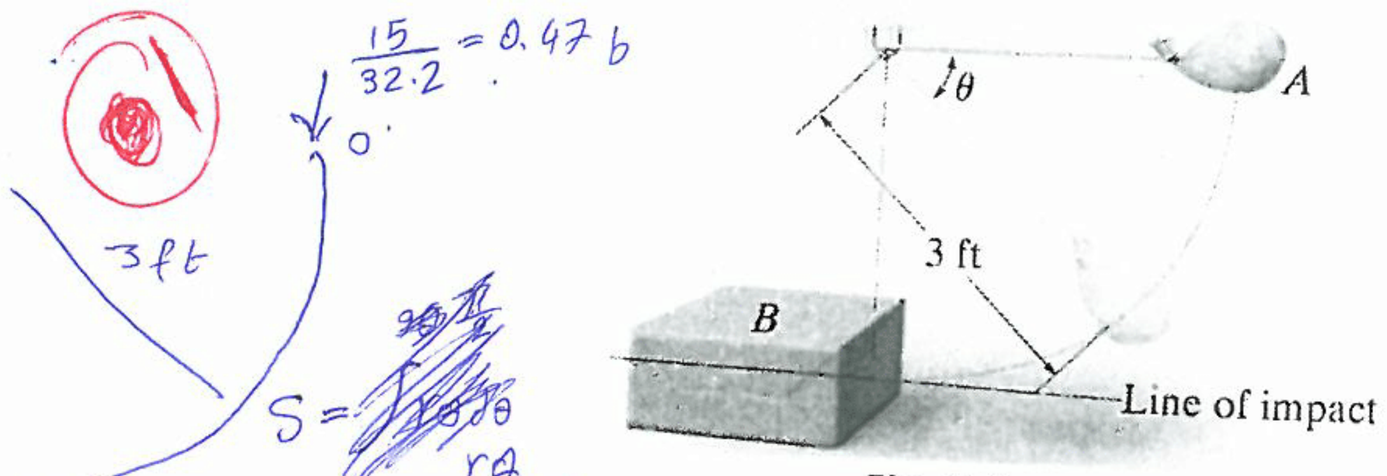


Fig. Q.2

$\frac{15}{32.2} = 0.47\ b$

3ft

$S = r\theta$

$= \frac{3}{2}\pi = 4.71$ ft

90

* ***For Instructor use only***

S O – 1 S O – 5	An ability to apply knowledge of mathematics, science, and engineering An ability to identify, formulate, and solve engineering problems
C O – 3 CO – 4	Solve problems involving impulse and momentum. Solve problems involving impact.
P I-1_28 P I-5_62	Apply basic concepts of Kinematics and kinetics to solve elementary problems Calculate for given problems the coefficients of restitution, forces and momentum; classify the impact (elastic or plastic) and determine the related energy losses Analyze given engineering dynamics problems by using Free Body Diagram (FBD) and applying concepts of linear impulse and linear momentum.