THE UNIVERSITY OF JORDAN **PHYSICS DEPARTMENT**

PHYSICS 105 (First Exam) **First Semester (Nov. 3rd, 2015)**

Student's Name (Arabic):..... Registration #.....

Lecturer's Name:..... Section # .....

CONSIDER (ACCELERATION DUE TO GRAVITY) g = 9.8 m/s^2

Q1) An object moving with a constant acceleration has a velocity of 20 cm/s when its position x = 10 cm. Its position 6.0 seconds later is x = –30 cm. What is the acceleration of the object (in cm/s^2)?

A) -8.9 B) -5.1 C) 9.8 D) 4.4 E) -6.3

Q2) A stone falls from a cliff 80 m high. The magnitude of the average velocity during the first 4 seconds of its fall (in m/s) is:

A) 3.5 B) 9.1 C) 14.7 D) 19.6 E) 21.3

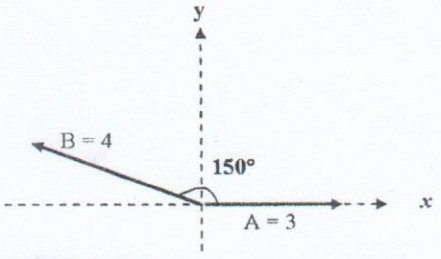
Q3) A child throws a ball from the top of building downward with a speed of 5.0 m/s. It strikes the ground with a speed of 34 m/s. The height of the building (in m) is:

A) 58 B) 42 C) 29 D) 17 E) 63

Q4) A man starts from the origin and walks 15 m along the positive x – axis. He then moves along the negative x – axis back to the origin. If the time of the whole trip is 5 s, then his average speed (in m/s) is

A) 0 B) 4 C) 2 D) 5 E) 6

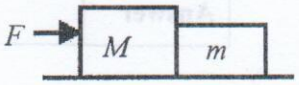
Q5) Vectors A and B are represented as shown in the figure. What is the angle of their resultant with respect to the positive x-axis?



A) 25° B) 103° C) 77°

D) 55° E) 112°

Q6) A block of mass M = 6.0 kg is in contact with another block of mass m = 4.0 kg on a frictionless surface, as shown in the Figure. The force F = 30 N is applied as shown in the figure. What is the magnitude of the force of the M block on the m block?



A) 12.0 N B) 6.0 N C) 8.0 N

D) 10.0 N E) 4.0 N

Physics for Medical Students (0342105)

First Exam 3rd/Nov/2015

Solutions

Q1] $x_f - x_i = v_i t + \frac{1}{2}at^2$

$-30 - 10 = 20t + \frac{1}{2}at^2 \Rightarrow -40 = 20(6) + \frac{1}{2}a(6)^2$

$-160 = 18a \Rightarrow a = -8.9\ m/s^2$

Q2] $\downarrow +$ $\boxed{a = g}$

$v_i = 0$, $v_f = v_i + gt \Rightarrow v_f = (9.8)(4)$

$\therefore v_f = 39.2\ m/s$

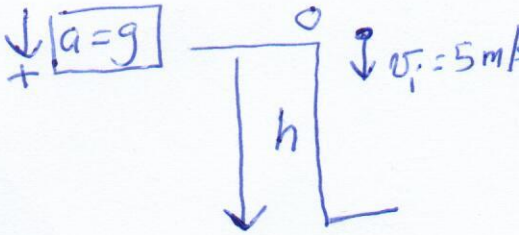
$\bar{v} = \frac{1}{2}(v_i + v_f) = \frac{39.2}{2} = 19.6\ m/s$

Q3] $v_i = 5\ m/s$, $v_f = 34\ m/s$

$v_f^2 - v_i^2 = 2g(y_f - y_i)$

$(34)^2 - (5)^2 = 2g(h - 0)$

$\therefore h \simeq 58\ m.$



Q4] $\bar{s} = \frac{\text{total distance}}{\text{total time}} = \frac{15 \times 2}{5} = 6\ m/s$

Q5]

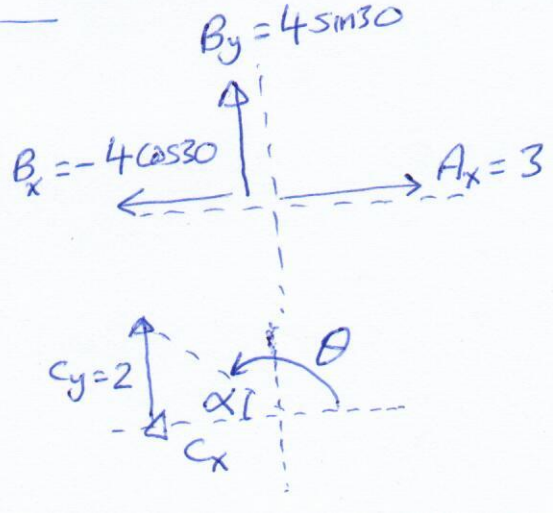
$\vec{C} = \vec{A} + \vec{B}$

$C_x = A_x + B_x = 3 - 4\frac{\sqrt{3}}{2} = -0.464$

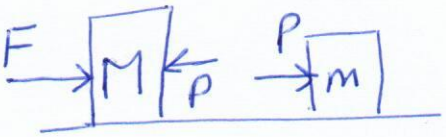
$C_y = A_y + B_y = 0 + 4 \times \frac{1}{2} = 2$

$\tan\alpha = \left|\frac{C_y}{C_x}\right| \Rightarrow \alpha \sim 77$

$\theta = 180^\circ - 77^\circ = 103^\circ$



Q6]



$\rightarrow +$

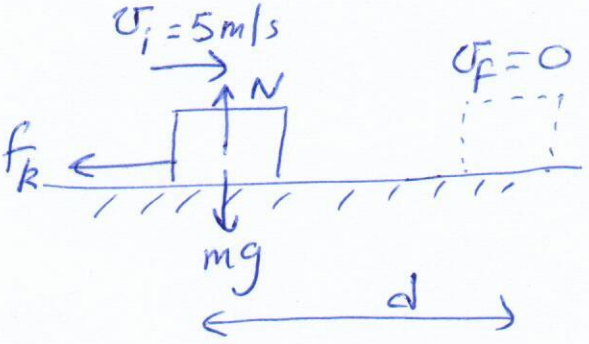
For mass M: $F - P = Ma$ — ①

for mass m: $P = ma$ — ②

$\Rightarrow$ ① + ② $\Rightarrow F = (m+M)a \Rightarrow a = 30/10 = 3\ m/s^2$.

From ② $P = (4)(3) = 12\ N$.

Q7]



$\rightarrow +$ $W_{nc} = \Delta K + \Delta U$

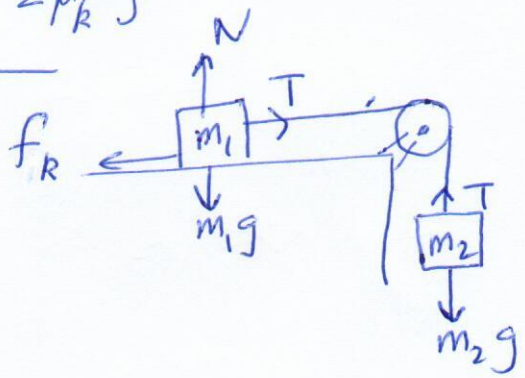
f_k is the only non-conservative force that does work in this case $\Rightarrow$

$f_k d \cos 180^\circ = \frac{1}{2} m (v_f^2 - v_i^2) + 0$

$-\mu_k mgd = \frac{1}{2} m (0 - 25) \Rightarrow d = \frac{25}{2\mu_k g} \simeq 6.4\ m$

Q8] $\downarrow +$ $m_2 g - T = m_2 a$ — ①

$\rightarrow +$ $T - f_k = m_1 a$ — ②

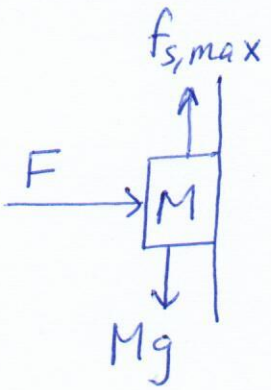


① + ② $\Rightarrow m_2 g - f_k = (m_1 + m_2) a$

$a = \frac{m_2 g - f_k}{m_1 + m_2} = \frac{2g - \mu_k m_1 g}{m_1 + m_2}$

$a = 2.6\ m/s^2$.

Q9] stationary $M \Rightarrow$



$$Mg \leq f_{s,max}$$

$$Mg \leq \mu_s N = \mu_s F$$

$$\therefore Mg \leq \mu_s F \Rightarrow F \geq \frac{Mg}{\mu_s}$$

$$\therefore F_{min} = \frac{Mg}{\mu_s} = \frac{3 \times 9.8}{0.2} = 147 \text{ Newton.}$$

Q10] There are Two nonconservative forces in this example that do work f_k and P.

$$W_{total} = \Delta K$$

$$W_{f_k} + W_p = \frac{1}{2} m (v_f^2 - v_i^2)$$

$$W_{f_k} + (P\cos 30)(8)\cos(0) = \frac{1}{2}(20)(2.6^2 - 0.5^2)$$

$$W_{f_k} + 160 \times \frac{\sqrt{3}}{2} \times 8 = 10(2.6^2 - 0.5^2)$$

$$\therefore W_{f_k} = 65.1 - 1108 \simeq -1043 \text{ J}.$$

Note Since no statement says that the acceleration is constant $\Rightarrow$ cannot use $\Sigma F = ma$ and the equations of motion to solve this question.

Time in Q1 is **8** s

Question	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Answer	E	C	A	B	D	C	D	B	A	C

Time in Q1 is **6** s

Question	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Answer	A	D	A	E	B	A	A	D	E	B