PHYSICS DEPARTMENT
FALL SEMESTER 2014/2015

PHYSICS 105 (FIRST EXAM)
(Oct.. 28th, 2014)

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

Useful Information: **Some Results Are Rounded.. CONSIDER (ACCELERATION DUE TO GRAVITY) $g = 9.8\ m/s^2$**

List your final answers in this table using ***Capital Letters***
Only the answer in this table will be graded

Question	Q1:	Q2:	Q3:	Q4:	Q5:	Q6:	Q7:	Q8:	Q9:	Q10:
Final Answer										

Q1: A jet aircraft landing on an aircraft carrier is brought to a complete stop from a velocity of 215 km/h in 250 m. What is its average acceleration (in m/s^2)?

A) -92.59 B) -52.3 C) -32.6 D) -9.6 E) -7.1

Q2: A car starts moving from rest at a constant acceleration until it reaches a speed of 60 m/s. The magnitude of the average velocity of the car (in m/s) during this period is:

A) 10 B) 30 C) 40 D) 50 E) 60

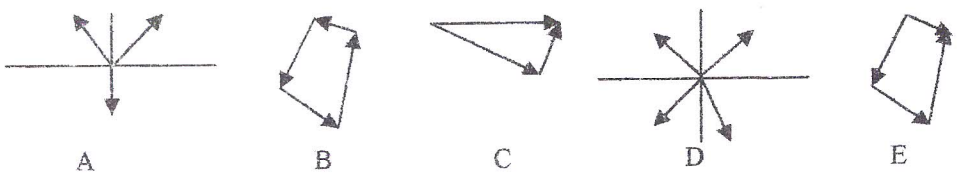
Q3: An object moved from rest on a straight line with a constant acceleration. After a certain time t, its speed was 4 m/s. It then moved 50 m with the same acceleration, if its speed was 6 m/s by the end of these 50 m, then the time t (in seconds) is:

A) 20.0 B) 29.1 C) 10.0 D) 35.2 E) 42.8

Q4: Two objects are dropped from a bridge, an interval of 1.00 s apart. What is the vertical distance separating them (in m) 1.00 s after the second object is released? (Neglect air resistance)

A) 4.90 B) 9.80 C) 14.7 D) 19.8 E) 39.2

Q5: Each of the following diagrams represents a set of forces acting on an object. If the object moves with a constant velocity, which diagram best represents the forces acting on it?



A B C D E

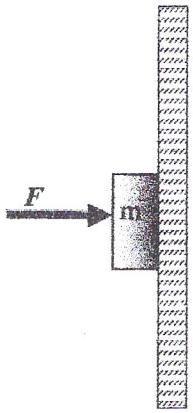
A) E B) D C) A D) E E) B

Q6: A cyclist travels 400 m northeast from a reference point. The cyclist then travels 200 m north. What are the magnitude (in m) and direction θ (north of east) of the cyclist's total displacement?

A) 476, θ = 53.5° B) 560, θ = 59.6° C) 662, θ = 55.6° D) 598, θ = 65.1° E) 623, θ = 69.1°

Q7: A 2-kg object is held stationary on a wall by a horizontal force F as shown. The static coefficient of friction between the object and the wall is 0.5. What is the minimum force required to hold the object from sliding down?

A) 39.2 N B) 9.8 N C) 29.4 N D) 49 N E) 19.6 N

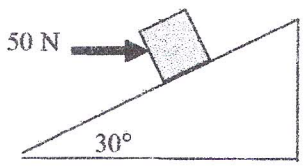


Q8: A student is sitting on the right hand side in a bus, facing the direction of travel. The bus turns left while the student remains in the same position on the seat. While turning, the student experiences

A) A force to the left and a force to the right
B) A resultant force backward
C) A resultant force to the right
D) A resultant force to the left
E) Zero resultant force

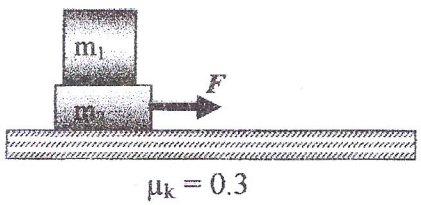
Q9: A horizontal, 50 N force acts on a 15-kg block on an inclined plane making an angle of 30° with the horizontal as shown in the figure. If the block slides down the plane at a constant speed, what is the coefficient of kinetic friction between the block and the surface?

A) 0.48 B) 0.58 C) 0.24
D) 0.20 E) 0.28



Q10: The figure shows an object of mass $m_1 = 2$ kg placed on top of another object $m_2 = 3$ kg which can move on a horizontal surface. A force (F) of 20.0 N acts on m_2 to the right. If the coefficients of kinetic friction between the surfaces are 0.3, and the coefficient of static friction between m_1 and m_2 is 0.5, what is the force acting on m_1?

A) 2.1 N B) 5.9 N C) 9.8 N D) 3.9 N E) 11.2 N



Physics (105)
First Exam / 28/10/2014, Solutions

Q1] $v^2 - v_0^2 = 2a\Delta x$

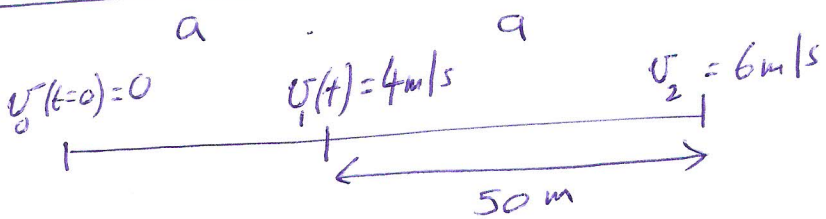
$$v_0 = 215\ \frac{km}{hr} \times \left(\frac{1000\,m}{1\,km}\right) \times \left(\frac{1\,hr}{3600\,s}\right) \simeq 59.7\ m/s$$

$$\Rightarrow a = \frac{0 - (59.7)^2}{2(250)} \simeq -7.1\ m/s^2.$$

Q2] For constant acceleration

$$\bar{v} = \frac{1}{2}(v_0 + v) = \frac{1}{2}(0+60) = 30\ m/s$$

Q3] Second stage



$$v_2^2 - v_1^2 = 2a\Delta x$$

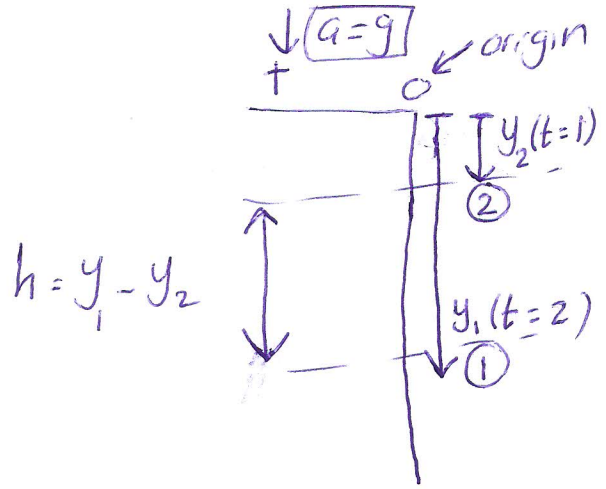
$$(6)^2 - (4)^2 = 2a(50)$$

$$\Rightarrow a = 0.2\ m/s^2$$

First stage

$$v_1 = v_0 + at \Rightarrow t = \frac{4-0}{0.2} = 20\ s.$$

Q4]



$$y_1 - 0 = 0 + \frac{1}{2}(9.8)(2)^2$$

$$y_1 = 19.6 \text{ m}$$

$$y_2 = 0 = 0 + \frac{1}{2}(9.8)(1)^2$$

$$y_2 = 4.9$$

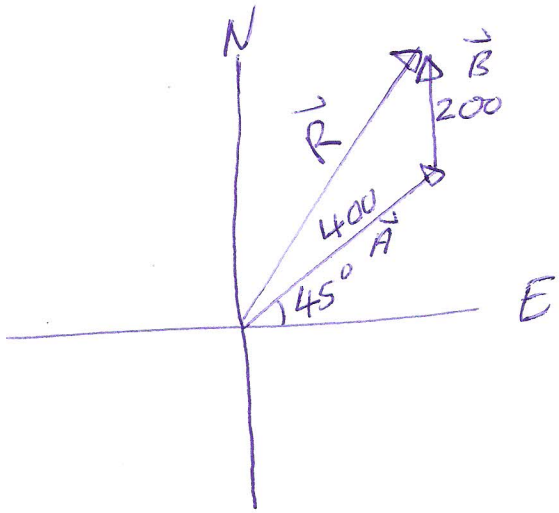
$$\Rightarrow h = y_1 - y_2 = 14.7 \text{ m}$$

Q5] constant velocity $\Rightarrow a = 0$

$\Rightarrow$ resultant force $= 0$

The only diagram that represents a zero resultant force is (B) i.e the answer is item (or option) E) B.

Q6] $\vec{R} = \vec{A} + \vec{B}$



$$A_x = 400\cos 45 = \frac{400}{\sqrt{2}}$$

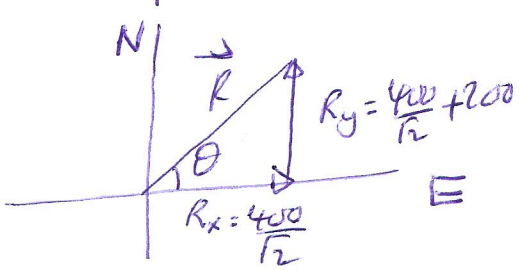
$$A_y = 400\sin 45 = 400/\sqrt{2}$$

$$B_x = 0, \quad B_y = 200$$

$$\Rightarrow R_x = \frac{400}{\sqrt{2}}, \quad R_y = \frac{400}{\sqrt{2}} + 200$$

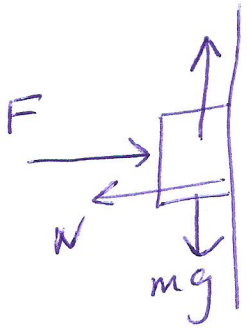
$$R = \sqrt{R_x^2 + R_y^2} \approx 559.6 \text{ m} \sim 560 \text{ m}$$

$$\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right) = 59.6^\circ$$



q7] $\sum F_x = 0$

$F - N = 0 \Rightarrow \boxed{F = N}$



For object to remain stationary $f_{s,max} \geq mg$

but $f_{s,max} = \mu_s N = \mu_s F$

$\Rightarrow \mu_s F \geq mg \Rightarrow F \geq \frac{mg}{\mu_s}$

$\therefore F_{minimum} = \frac{2 \times 9.8}{0.5} = 39.2$ Newton

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q8] D) a resultant force to the left.

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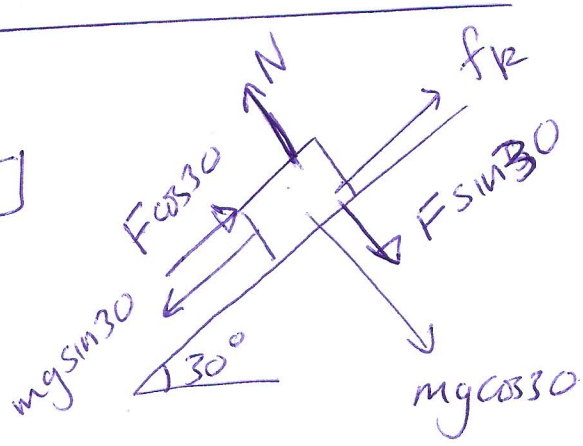
q9]

$mg\sin 30 - F\cos 30 - f_k = 0$ — [1]



$N - F\sin 30 - mg\cos 30 = 0$

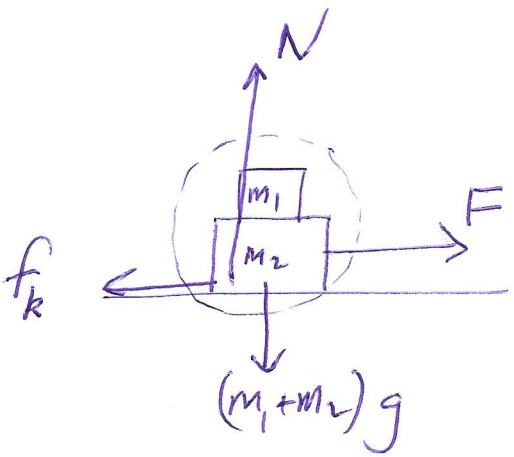
$N = (50)(\frac{1}{2}) + (15)(9.8) \times \frac{\sqrt{3}}{2} = 152.3$ Newton.

$f_k = \mu_k N = 152.3\,\mu_k$. Substitute in [1] $\Rightarrow$

$(15)(9.8)(\frac{1}{2}) - \frac{50\sqrt{3}}{2} = \mu_k (152.3)$

$\Rightarrow \mu_k \simeq 0.20$

Q10] First, Assume m_1 and m_2 move together as one object, and find the acceleration.



$$\rightarrow + \quad F - f_k = (m_1 + m_2)\, a$$

$$20 - \mu_k \underbrace{(m_1+m_2)g}_{N} = (m_1+m_2)a$$

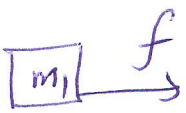
$$20 - 0.3(5)(9.8) = 5a$$

$$\therefore a = 1.06 \ m/s^2 .$$

The force that moves m_1 to the right is the static friction (assuming they move together). and that force should be $\leq f_{s,max}$.

How do we find the force?

$$f = m_1 a = 2(1.06) \simeq 2.1 \text{ Newton.}$$



$$f = 2.1 < f_{s,max} = (0.5)(2)(9.8)$$
$$= 9.8 \text{ Newton.}$$

$\Rightarrow$ both objects move together and the force that moves m_1 to the right is static friction. $f = f_s$.