

**Sultan Qaboos University**  
**Department of Physics, College of Science**  
**PHYS2107: Physics for Engineering I - Test 2**

<b>Name:</b>
<b>ID No:</b>

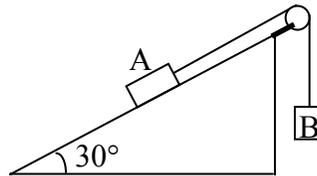
1	2	3	4	Tot.

<b>Full Mark: 40 points</b>	<b>Answer all questions</b>
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**Monday, 17<sup>th</sup> April 2006**

**Time: 5:15 – 6:45 pm**

1. Two blocks A and B are connected with a cord over a massless pulley, as shown in the figure. The mass of block A, on the 30°-inclined plane, is 25 kg and the coefficient of kinetic friction and static friction are  $\mu_k = 0.15$  and  $\mu_s = 0.4$ , respectively.



- a) Find the minimum mass of block B so that the block A is about to slide down the inclined plane.
- b) Find the maximum mass of block B so that the block A is about to slide up the inclined plane.
- c) What is the mass of block B and the tension in the cord when the block A is accelerated up the inclined plane with  $1.5 \text{ m/s}^2$ .

**(mark: 3+3+4)**

2. A 1.5 kg block, initially at rest at the origin ( $x_0 = 0$  and  $y_0 = 0$ ), is subjected to a unique force  $\mathbf{F} = 2\mathbf{i} + 5y\mathbf{j}$  (*entries are in Newton*).

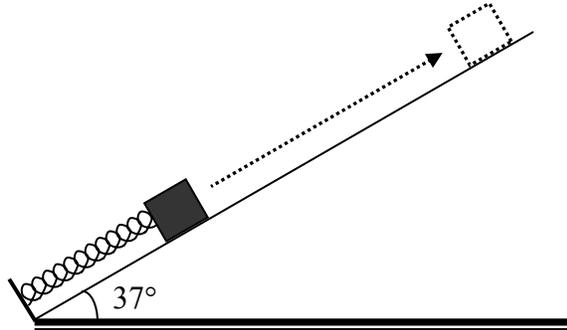
a) What work is done by the force  $\mathbf{F}$  as the block moves from a position  $\mathbf{r}_1 = 1.5\mathbf{i} + 2\mathbf{j}$  to  $\mathbf{r}_2 = -2\mathbf{i} + 4\mathbf{j}$  (with the entries in meters)?

b) Is the block accelerated or decelerated between positions  $\mathbf{r}_1$  and  $\mathbf{r}_2$ ? Justify your answer.

c) What is the speed of the block at  $\mathbf{r}_1 = 1.5\mathbf{i} + 2\mathbf{j}$ ?

(mark: 4+2+4)

3. A 1.5 kg block is pushed against a spring (block is not attached to the spring) on  $37^\circ$ -inclined plane, until the spring is compressed 35 cm and released from rest. The coefficient of kinetic friction between the block and the inclined plane is  $\mu_k = 0.35$ ; and the spring constant is 150 N/m.



- a) What is the change in gravitational potential energy of the block when it momentarily stops?
- b) What is the corresponding increase  $\Delta E_{th}$  in the thermal energy of the block-floor system?

(mark: 6 + 4)

4. Two particles, of masses  $m_1 = 1.5 \text{ kg}$  and  $m_2 = 2 \text{ kg}$ , slide initially across a frictionless horizontal plane with velocities  $\mathbf{v}_1 = 2\mathbf{i} - 5\mathbf{j}$  and  $\mathbf{v}_2 = -4\mathbf{i} + 10\mathbf{j}$ , respectively. They collide and stick together.

- a) What is the velocity (magnitude and direction) of the center of mass before and after the collision?
- b) What is the impulse on the particle  $m_1$  due to collision?
- c) What is the change in kinetic energy of the system?

**(mark: 4+3+3)**