**PHYS 2101 — Test I**

*Sunday, 5 October 2003 — 5:00 – 6:30 p.m.*

| **ID No:** |
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| **NAME:** |
| **SECTION:** |

| 1 | 2 | 3 | 4 | Total |
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| **Full Mark: 40 points** | **Please check that your examination paper has 4 pages!** |
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1. A truck traveling at a constant speed of 20 m $s^{-1}$ passes a parked police car. After the truck has gone 150 m, the police car starts to follow with an acceleration of 4 m $s^{-2}$. After the police car reaches the truck, they both begin to slow down and both stop after 10s.
   a) At what time does the police car reach the truck?
   b) What is the distance between them when they stop?
   c) Find the average velocity of the truck during the whole motion.

(10 points)

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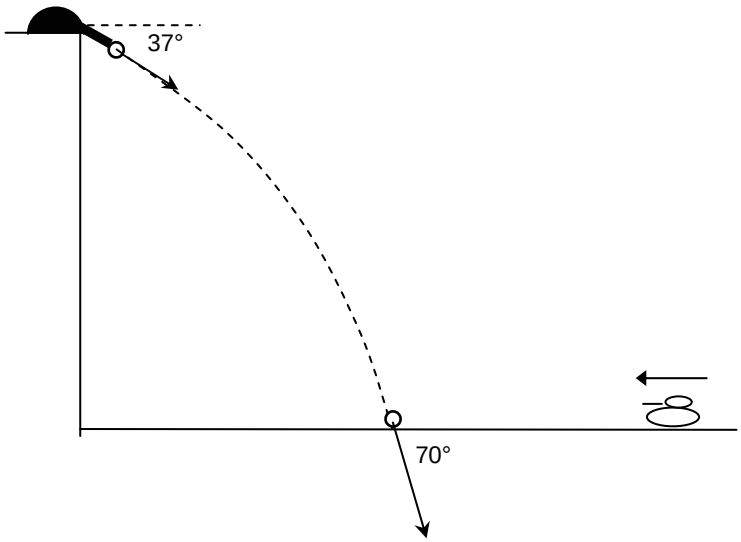
2. A cannon is on a hill and is pointed at an angle of 37° below the horizontal. The cannon is fired at a tank on the ground traveling toward the hill with an initial speed of 15 m $s^{-1}$ and accelerating at 2 m $s^{-2}$. The cannon ball hits the tank after 8 s at an angle of 70° below the horizontal.
   a) Find the initial velocity of the cannon ball.
   b) How high is the hill?
   c) How far away from the bottom of the hill was the tank initially?
   d) What is the speed of the cannon ball when it hits the tank?

(10 points)

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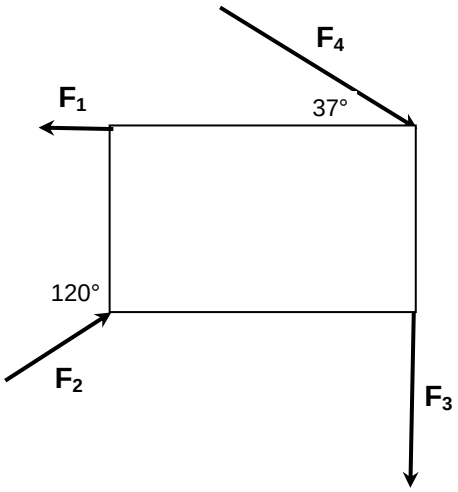
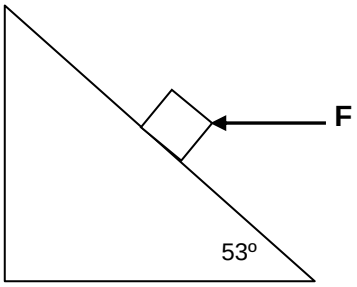
3. a) Four forces of magnitudes, $F_1$ = 10 N, $F_2$ = 20 N, $F_3$ = 30 N and $F_4$ = 40 N are acting on a plate as shown. Find the magnitude and direction of the net force on the plate.

(4 points)




b) A horizontal force F = 120 N is acting on a block of weight W = 100 N on a 53° inclined plane. The coefficient of static friction between the block and the plane is 0.6. Find the direction and magnitude of the friction force. Explain your reasoning.

(4 points)

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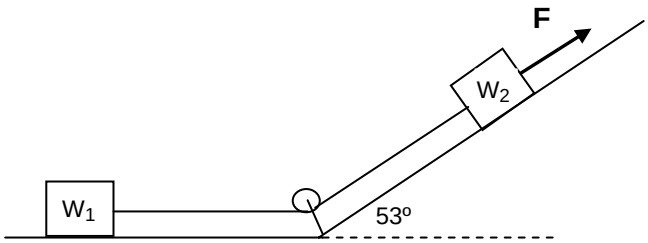
4. A block of weight $W_1$ = 60 N on a horizontal plane is tied to a second block of weight $W_2$ = 100 N on a 53° inclined plane. The second block is pulled with a force F along the plane. The coefficients of static and kinetic friction between the blocks and the planes are 0.5 and 0.4, respectively.
   a) For which value of F are the friction forces zero?
   b) Find the maximum value of F before the system begins to slide.
   c) Find the directions and magnitudes of the friction forces if F = 60 N. Explain your reasoning.
   d) Find the acceleration of the system if F = 150 N.

(12 points)

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