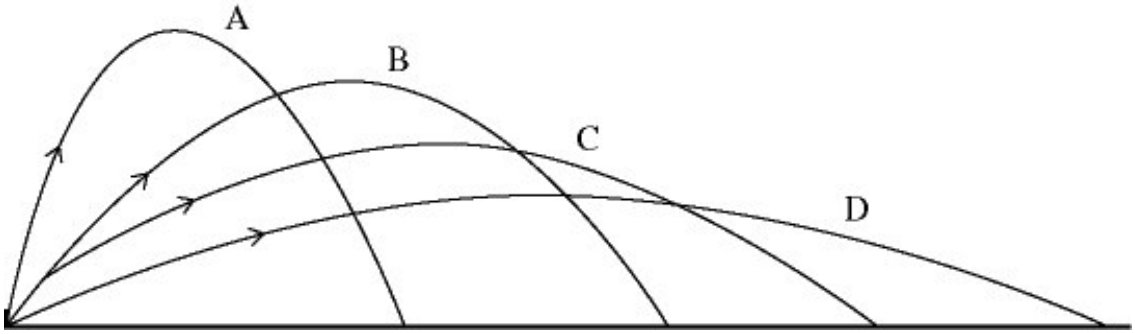
PART II: Newton's Law

Question 1

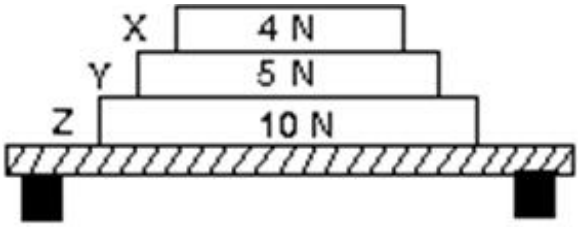
The figure below (top of next page) shows trajectories of four artillery shells. Each fired with the same initial speed. Which trajectory remains in the air for the longest time? Circle the right answer. **Hint**: ask yourself how to throw a ball so that it remains in the air for the longest period.

A) B) C) D) E) All were in the air for the same amount of time



Question 2

Three books (X, Y, and Z) rest on a table. The weight of each book is indicated. The force of book Z on book Y is:

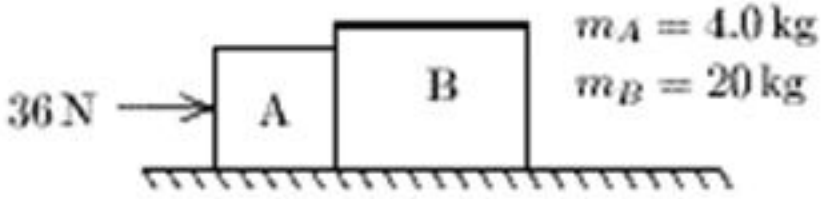


Note that the **weight** of the blocks is in **Newton = N**

A) 0 B) 5N C) 9N D) 14N E) 19

Question 3

Two blocks (A and B) are in contact on a horizontal frictionless surface. A 36-N constant force is applied to A as shown. The magnitude of the **net force** on A is:



A) 1.5N B) 6.0N C) 29N D) 30N E) 36N

Answer: B

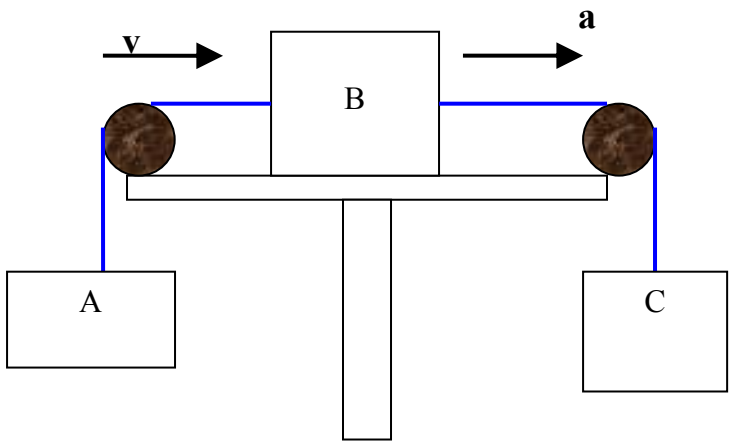
Question 4

A box of textbooks of $m = 24.8$ kg rests on a loading ramp that makes an angle θ with the horizontal. The coefficient of kinetic friction is $\mu_k = 0.25$ and the coefficient of static friction is $\mu_s = 0.35$. A) As the angle θ is increased, find the minimum angle at which the box starts to slip. B) At this angle, find the acceleration once the box has begun to move.

C) At this angle, how fast will the box be moving after it has slid a distance 5.0 m along the loading ramp? Use the kinetic equation

Question 5

In the diagram below block A has a mass of 4.00 kg and block B has mass 12.00 kg. The coefficient of kinetic friction between block B and the table is $\mu_k = 0.25$. Block B is moving right and accelerating to the right with $a = 2.00\ m/s^2$.

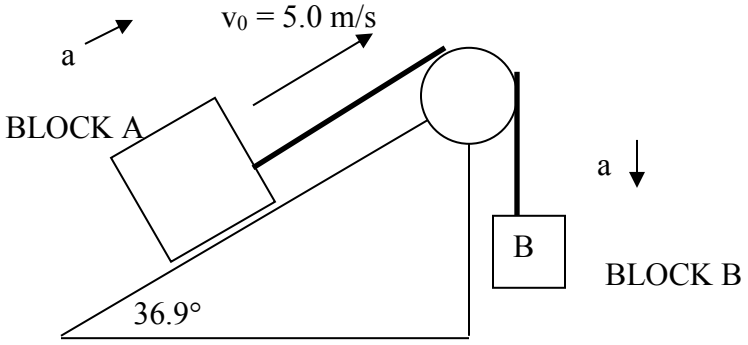


The rope is massless and there is no friction in the pulley

(a) Draw a free-body diagram of block A. Hence find the tension in the rope connecting Blocks A and B. (b) Draw a free-body diagram of block B. Calculate the friction force on block B. Determine the tension of the rope connecting blocks B and C. (c) Finally, draw a free-body diagram of block C. Determine the mass of block C.

Question 6

Block A of mass $m_A = 2.0$ kg is moving up a 36.9° incline with a speed of $v_0 = 5.0$ m/s. It is attached to block B of mass $m_B = 4.0$ kg, by a massless frictionless rope-pulley system. The coefficient of kinetic friction between Block A and the surface of the incline is $\mu_k = 0.2$. Block A moves up 0.5 m to the top of incline. Assume block A accelerates up incline and B is accelerating downward as in diagram.

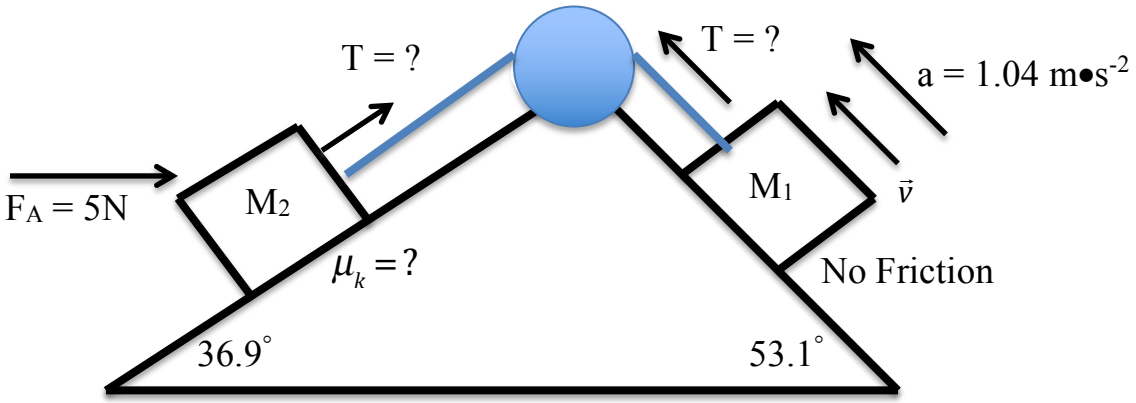


A) Draw a free-body diagram of block B, then use Newton's second law to write an equation that includes the tension of the rope, T and the acceleration, a. B) Draw a free body diagram on block A showing all the forces on A and the direction of its acceleration, a. Draw the x-y axes parallel and perpendicular to the incline. C) Use the diagram in part b) to find the normal force (perpendicular to incline) and the force

of friction (parallel to incline) on block A. D) Using diagram from part b, determine the x-component (parallel to incline) of the net force, and use the second law to write an equation that include the tension of the rope, T and the acceleration, a. E) The two equations from part a) and d) are two equations with two unknown a and T. Solve them to obtain the tension T and acceleration a.

Question 7

In the diagram, box 1(M_1=2kg) lies on **frictionless incline** of 53.1°, and is **moving up** the incline with acceleration $a = 1.04 m \bullet s^{-2}$. Box 1 is connected by an ideal rope through a frictionless pulley to box 2 (M_2=7kg), which rests on a 36.9° incline with friction. Block 2 is acted on by a horizontal force of magnitude F_A = 5N. The **tension** (T = ?) and **kinetic coefficient** ($\mu_k = ?$) are **unknown**.



a) Draw a free-body-diagram (FBD) of all forces on block 1 (M_1), which includes the direction of its acceleration. **Calculate** the **tension**, T.

b) Draw a free-body diagram (FBD) of all forces acting on block 2 (M_2). Use this to determine the **magnitude** and **direction** of the friction force $f_{k,2}$, acting on block 2. Calculate the **coefficient** of **kinetic friction**, μ_k, between surfaces of block 2 and incline.