PHYSICS 251

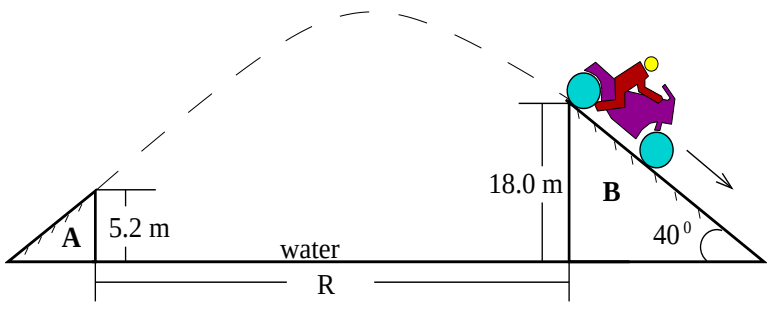
MIDTERM EXAM - WINTER 2002

Part A – **2 Point Questions**

1. C
2. A
3. E
4. D
5. D
6. A
7. B
8. D
9. B
10. A
11. D
12. E

Part B – **10 Point Questions**

13). A motorcycle rider has made a jump across a wide river as shown. The rider lands across the river on ramp B 18.0 m above the water level having left from ramp A 5.2 m above the water level. The motorcycle and rider land with a speed of 22.5 m/s at an angle of 40° below the horizontal.



a). What was the speed of the motorcycle and rider upon leaving ramp A?

$s = 21.45$ m/s

b). How long is the motorcycle and rider in the air?

$t = 3.66$ s

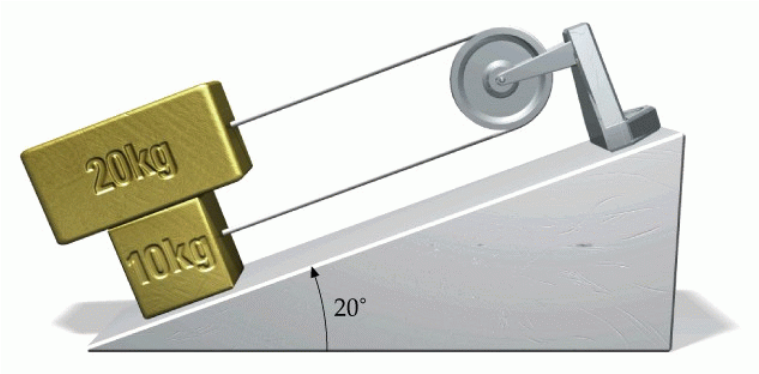
c). How wide is the river opening between the two ramps? (i.e. Find R.)

$R = 63.1$ m

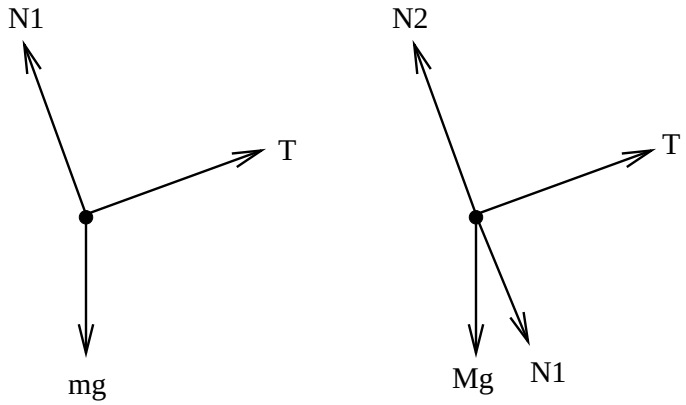
d). What is the maximum height reached by the motorcycle with respect to the water?

$y_{max} = 28.65$ m

14). The figure shows a 20-kg block sliding on a 10-kg block along a 20° incline. All surfaces are frictionless and the rope and pulley are massless.



a). Draw a *complete* and separate free-body diagram for each of the blocks.



b). Find the acceleration of each block.

$a = 1.12$ m/s^2. The 20 kg block goes down the incline, the 10 kg block goes up the incline.

c). Find the tension in the string that connects the two blocks.

$T = 44.8$ N

15). A car goes around a circular track of radius 20 m at a constant speed of 40 km/hr. The car has a mass of 900 kg. The track is assumed to be flat.

a). What is the coefficient of friction μ_s?

$\mu_s = 0.63$

b). If the car suddenly slams on its brakes, locking up the wheels, how long is the skid mark? Note: Assume $\mu_k = 0.9\mu_s$. Draw a picture of the direction of the skid.

$d = 11.10$ m