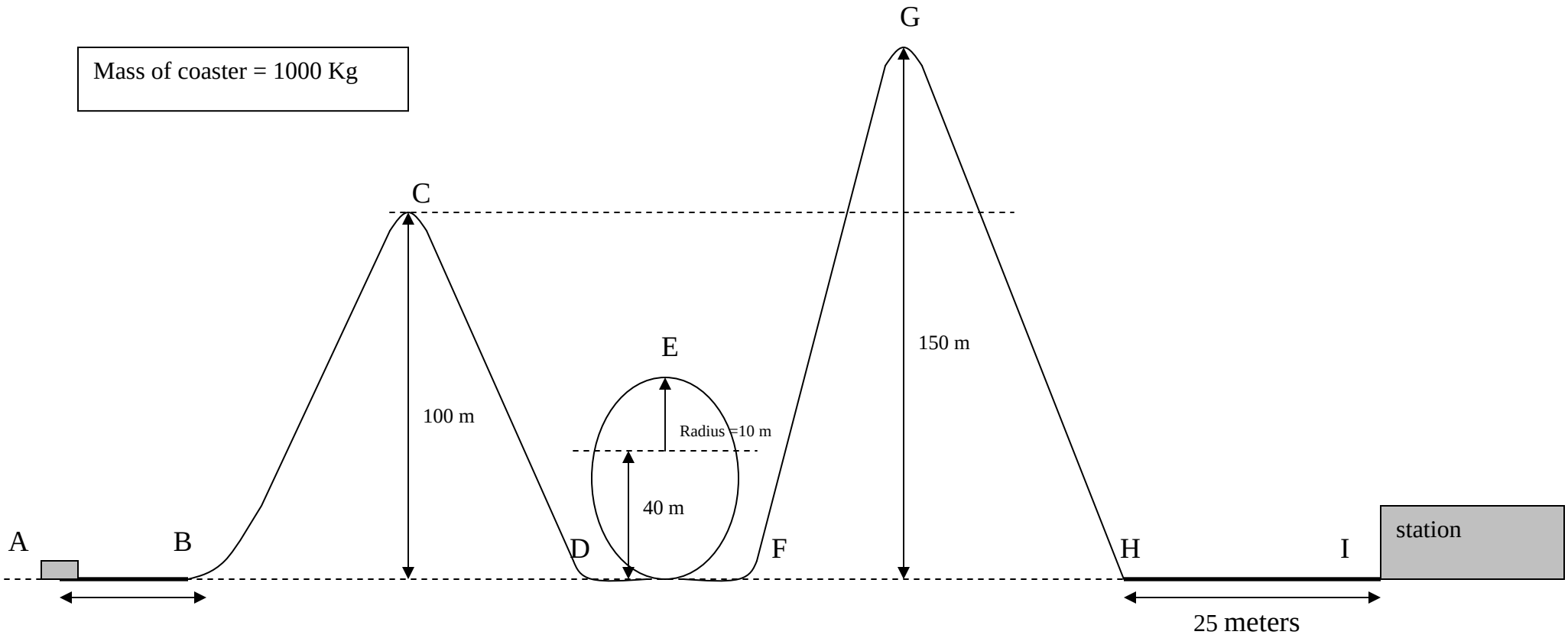
Name _____ Physics

Mechanics and Energy Combo Activity



**The train starts from rest at point A and accelerates to point B

Start and First Hill

1. Calculate the potential energy at point C.

2. How much kinetic energy is needed at point B to reach the top?

3. What must the coaster's speed be at point B to possess this kinetic energy?

4. If the coaster moves from A→ B in 8 seconds, what is the rate of acceleration of the coaster?

    4a. How much net force is required to produce this acceleration?

    4b. If the coaster encounters 300N of frictional force, determine the force applied by the propulsion system.

    4c. Complete the freebody diagram below

    4d. Calculate the momentum of the coaster at point B.

5. How much distance does the coaster cover between A→B?

6. What happens to the kinetic energy as you move from B→C?

7. How much kinetic energy does the coaster possess at point D?

8. What is the speed of the coaster at point D?

Loop

9. Describe what happens to the kinetic and potential energy as the coaster move from point D→E?

10. Calculate the kinetic energy of the coaster at the top of the loop.

11. Calculate the speed of the coaster at the top of the loop using the kinetic energy.

11a. Calculate the centripetal acceleration of the coaster at the top of the loop (hint..think circular motion).

11b. Since the centripetal acceleration and gravity are pointing in the same direction, subtract gravity from you centripetal acceleration number. This is actually the centripetal acceleration the rider experiences.

from 11.a _____ - 9.8 m/s^2 = _____

11b. Calculate the centripetal force a 75 kg rider experiences at the top of the loop.

Second Hill

12. As the coaster moves from F → G it "runs out" of energy at the dashed line. Calculate how much additional energy is needed (supplied by moving belt) to get the coaster to the top of the hill.

13. How much kinetic energy does the coaster have at point H?

14. What is the speed of the coaster at point H?

Home-stretch

15. The coaster needs to come to a complete stop by the time it reaches point I. Calculate the deceleration of the coaster as it moves from point H → I.

16. How much force is required to produce this deceleration (ignore friction).

17. Calculate the impulse imparted onto the coaster to make it stop (hint..think change in momentum)

Congrats..You're Done!