Branch: Macro
Course: Physics
Teaching form: Classes
Semester: 2
Academic Year: 2018/2019

PRACTICE PROBLEMS - SET 2
Conservation principles of material point

Problem #1.
A cart of mass $m_c = 160\ kg$ was running with a velocity (speed) $\upsilon = 2m/s.$ A boy of mass $m_b = 40\ kg$ catch up with him at velocity $\upsilon = 5m/s$ and drop-in. Determine the final velocity of cart with a boy.

Problem #2.
A girl of mass $m_g = 50\ kg$ running with a velocity $\upsilon = 5m/s$ jumped into the boat of mass $m_b = 150\ kg$. Determine a velocity at which a boat sailed away?

Problem #3.
A car of mass $m_1 = 950\ kg$ and a velocity $\upsilon_{1,i} = 16\ m/s$ approaches an intersection with a minivan of mass $m_2 = 1300\ kg$ and a velocity $\upsilon_{2,i} = 21\ m/s$. Both cars collide and stick together. Find the direction and final velocity υ_f of the wrecked vehicles just after the collision.

Problem #4.
A person of mass m = $75\ kg$ slides a distance $d = 5\ m$ on a straight water slide, dropping through a vertical height $h = 25\ m$. Determine the mechanical work done by gravity on the person? What is the height h if the mechanical work done by the gravity is $W = 2010\ J$?

Problem #5
A boy exerts a force $F = 11\ N$ at angle $\alpha = 29^\circ$ above the horizontal on a sled of mass $m_s = 6.4\ kg$. Find the work done by a boy and the final speed of the sled after it moves by a distance $d = 2\ m$, assuming the sled starts with an initial velocity $\upsilon = 0.5\ m/s$ and slides horizontally without friction.

Problem #6.
At the end of graduation ceremony, the graduates filing their caps into the air. Suppose that a cap of mass m = $0,12\ kg$ is thrown straight upward with an initial velocity $\upsilon = 7,85\ m/s$, and that the frictional forces can be ignored. Determine the speed of cap when it is reach a height $h = 1.18\ m$ above the release point. Show that the mechanical energy at release point is the same as mechanical energy at height $h = 1,18\ m$ above the release point.

Problem #7.
A skateboarder of mass $m = 55\ kg$ enters a ramp moving horizontally with a velocity $\upsilon = 6.5\ m/s$ and leaves the ramp moving vertically with a velocity $\upsilon = 4,1m/s$. Find the height of the ramp, assuming no energy loss to frictional forces.

Problem #8.
A block of mass $m_1 = 2.40\ kg$ is connected to a second block of mass $m_2 = 1,80\ kg$. When the blocks are released from the rest they move through a distance $d = 0,5\ m$, at which point m_2 hits the floor. Given that the coefficient of kinetic friction between m_1 and the horizontal surface is $\mu_k = 0,45$, find the speed of the blocks just before m_2 lands.

Problem #9.
You are driving a car down the hill with a slope at angle $\alpha = 15^\circ$ with a velocity $\upsilon = 90.0\ km/h$. You suddenly see a stationary car at some distance in front of you. In order to avoid the collision you slam on your brakes which locks the wheels. What is the length of skid marks if a coefficient of tire-road kinetic friction $f = 0.60$?

in some problems some additional assumption based on the general knowledge may be necessary