

Physics-145 Summer 2019

Homework No. 3

Q1) A wooden cubic block with dimensions of $1\text{ m} \times 1\text{ m} \times 1\text{ m}$ is thrown into a water pool. If only half of the cube was immersed in water while the other half was floating.

a) Calculate the buoyancy force exerted by water on the cube (density of water = 1000 kg/m^3)?

b) What is the density of the wooden cube?

Q2) If the flow rate of blood through human aorta is about $90\text{ cm}^3/\text{s}$. If the aorta has a radius of 1.0 cm , calculate the velocity of the blood flow in units of cm/s ?

Q3) Water runs in a pipe of 20 mm diameter at a velocity of 5 m/s . The pipe needs to be connected to a hose of smaller diameter. What is the diameter of the hose so that water flows at 15 m/s ?

Q4) A big closed water tank has a constant pressure of 2 atm at its top. A small hole is made at a distance of 4 m below the water tank level.

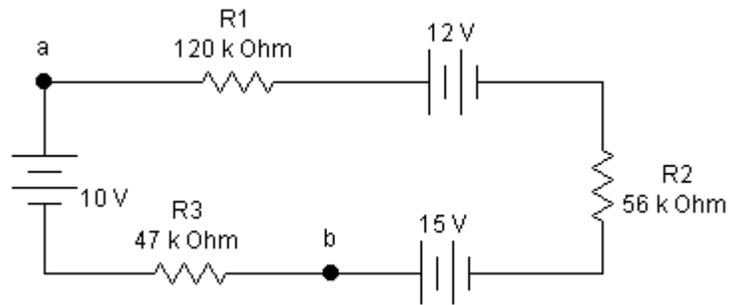
a) What is the velocity of water out of the hole?

b) If the tank is opened, what will be the velocity of water out of the hole?

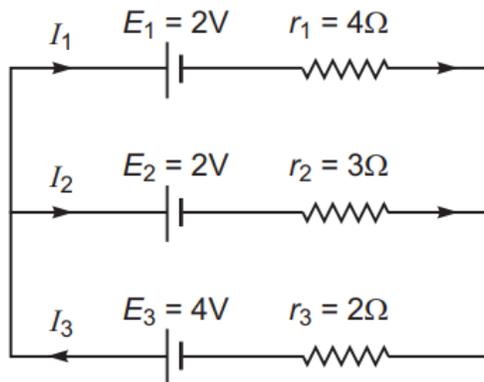
Q5) Water (density = $1.0 \times 10^3 \text{ kg/m}^3$) flows through a horizontal tapered pipe. At the wide end its speed is 4.0 m/s. The difference in pressure between the two ends is $4.5 \times 10^3 \text{ Pa}$. What is the speed of water at the narrow end?

Q6) Water flows at 12 m/s in a horizontal pipe with a pressure of $3.0 \times 10^4 \text{ N/m}^2$. If the pipe diameter is doubled, what is the pressure in the wider section in N/m^2 ? (assume the density of water is equal to 1000 kg/m^3)

Q7) How much current will flow in the following circuit?

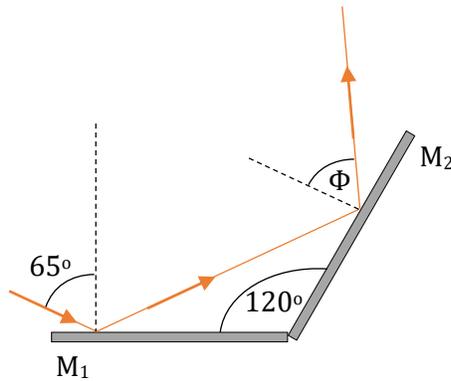


Q8) Use Kirchoff's rules to find the currents I_1 , I_2 , and I_3 in the circuit below.



Q9) Find the equivalent resistance for three 1.2 M Ω resistors connected in parallel.

Q10) Two mirrors make an angle of 120° with each other, as illustrated in the figure below. A ray is incident on mirror M_1 at an angle of 65° to the normal. Find the angle Φ of the ray after it is reflected from mirror M_2 .



Q11) A contact lens is made of plastic with a refractive index of 1.5. The lens has an outer radius of curvature of 4 cm (convex surface) and an inner radius of curvature of 8 cm (concave surface). What is the focal length of the lens?

Q12) A camera lens has a focal length of $+0.1$ m and was focused on a tree located 3 m from the camera's lens. If the tree highest is 2m, how tall is the image on the film?