

Note changes to problems 1 and 2.

INS Physics Midquarter Concept Inventory

1.
 - a. A 25-W bulb is plugged into a household, 120-V circuit. Calculate the current flowing through the bulb.
 - b. A 60-W bulb is added, in parallel, to the circuit described above. Calculate the resistance of the 60-W bulb and the fraction of the current flowing through the 25-W bulb.
 - c. A 100-W bulb is added, in parallel, to the circuit described above. Calculate the resistance of the 100-W bulb and the fraction of the current flowing through the 25-W bulb.
 - d. In a circuit in which various elements are connected in parallel, how is fraction of the current flowing through the elements determined by the resistance of the elements?
 - e. Suppose that a super-conducting element is added, in parallel to the last circuit described above. What do you expect the fraction of the current through the 25-W bulb to be?
2. Charge 1, Q1, is $+1.2 \mu\text{C}$ and is located at (0, 2 nm). Charge 2, Q2, is $-2.3 \mu\text{C}$ and is located at (1 nm, 0). Charge 3, Q3, is $-3.4 \mu\text{C}$ and is located at (2 nm, 2 nm). Note the signs of the charges carefully.
 - a. *Sketch* the configuration of the charges, and the forces, including the resultant.
 - b.
 - Calculate the magnitude of the force Q1 exerts on Q3.
 - Calculate the direction of the force Q1 exerts on Q3.
 - Calculate the horizontal component of the force Q1 exerts on Q3.
 - Calculate the vertical component of the force Q1 exerts on Q3.
 - c.
 - Calculate the magnitude of the force Q2 exerts on Q3.
 - Calculate the direction of the force Q2 exerts on Q3.
 - Calculate the horizontal component of the force Q2 exerts on Q3.
 - Calculate the vertical component of the force Q2 exerts on Q3.
 - d.
 - Calculate the sum of the horizontal force components.
 - Calculate the sum of the vertical force components.
 - Calculate the magnitude of the resultant force on Q3.
 - Calculate the direction of the resultant force on Q3.
3. The density of steel is 7850 kg/m^3 . A 2.7 g piece of steel has an apparent mass of 2.63 g when submerged in an unknown liquid.
 - a. Calculate the volume of the piece of steel.

- b. Calculate the mass and volume of the displaced liquid. Give explanation of your calculations.
 - c. Based on this result, is the unknown liquid likely to be water?
4. A uniform disc with mass 50 g and radius 10 cm is positioned on a very long incline so that the center of the disc is 43 cm above a table. The disc rolls down the incline. A sketch will be useful.
- a. Calculate the speed of the disc just as it reaches the table.
 - b. Calculate the speed of the disc if it were dropped to the table from its initial position.
 - c. No mention has been made of the angle of the incline. In part a., the angle of the incline does not determine final speed - the disc has the same speed for any inclination. What does the angle of the incline determine?