45 An astronaut and his space suit have a combined mass of 157 kg. The astronaut is using a 5.0 kg tool kit to repair a solar panel on the International Space Station. When the tether connecting the astronaut to the space station becomes unattached, the astronaut, still holding the tool kit, starts to float away at 0.2 m/s.

a. Calculate how far from the space station the astronaut will be after 1 minute. Show your calculations and include units in your answer.

b. Calculate the momentum of the astronaut holding the tool kit as the astronaut floats away. Show your calculations and include units in your answer.

The astronaut decides the only way to change his motion and move back toward the space station is to throw the tool kit.

c. Identify the direction the astronaut must throw the tool kit: toward the space station or away from it. Use the law of conservation of momentum to explain how throwing the tool kit may return the astronaut to the space station.

d. Calculate the velocity with which the astronaut must throw the tool kit in order to float back toward the space station at 0.1 m/s. Show your calculations and include units in your answer.