Answer on Question #40934, Physics, Mechanics | Kinematics | Dynamics

Question:

A 2-kg metal block slides on a rough horizontal surface inside an insulated box. After sliding a distance of 500.0 m, its temperature increased by 2.00 0C. Assuming that all heat generated by frictional heating goes into the metal block, and the metal has a specific heat capacity of 0.150 cal/(g.0C), find:

(i) How much work (heat Q) does the force of friction does on the block?

(ii) What is the coefficient of kinetic friction between the block and the surface?

Answer:

(i) The law of conservation of energy:

$$Q = A$$

where Q is amount of heat, A is work.

Amount of heat equals:

$$Q = cm\Delta t = 0.15\frac{cal}{g°\text{C}} \cdot 2000g \cdot 2°\text{C} = 600\,cal = 2512\,J$$

(ii) Work equals:

$$A = Fd$$

where F force of friction, d is distance.

Force of friction equals:

$$F = \mu mg$$

Therefore coefficient of kinetic friction equals:

$$\mu = \frac{A}{mgd} = 0.2561$$