47. (a) We consider what must happen to the coal that lands on the faster barge during one minute ($\Delta t = 60\,\text{s}$). In that time, a total of $m = 1000\,\text{kg}$ of coal must experience a change of velocity

$$\Delta v = 20\,\text{km/h} - 10\,\text{km/h} = 10\,\text{km/h} = 2.8\ \text{m/s}$$

where rightwards is considered the positive direction. The rate of change in momentum for the coal is therefore

$$\frac{\Delta \vec{p}}{\Delta t} = \frac{m\Delta \vec{v}}{\Delta t} = \frac{(1000)(2.8)}{60} = 46\ \text{N}$$

which, by Eq. 9-23, must equal the force exerted by the (faster) barge on the coal. The processes (the shoveling, the barge motions) are constant, so there is no ambiguity in equating $\frac{\Delta p}{\Delta t}$ with $\frac{dp}{dt}$.

(b) The problem states that the frictional forces acting on the barges does not depend on mass, so the loss of mass from the slower barge does not affect its motion (so no extra force is required as a result of the shoveling).