23. (a) The change in kinetic energy is

$$\begin{aligned}\Delta K &= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 \\ &= \frac{1}{2}(2100\,\mathrm{kg})\left((51\,\mathrm{km/h})^2 - (41\,\mathrm{km/h})^2\right) \\ &= 9.66 \times 10^4\,\mathrm{kg}\cdot(\mathrm{km/h})^2\left((10^3\,\mathrm{m/km})(1\,\mathrm{h}/3600\,\mathrm{s})\right)^2 \\ &= 7.5 \times 10^4\ \mathrm{J}\ .\end{aligned}$$

(b) The magnitude of the change in velocity is

$$\begin{aligned}|\Delta\vec{v}| &= \sqrt{(-v_i)^2 + (v_f)^2} \\ &= \sqrt{(-41\,\mathrm{km/h})^2 + (51\,\mathrm{km/h})^2} \\ &= 65.4\ \mathrm{km/h}\end{aligned}$$

so the magnitude of the change in momentum is

$$|\Delta\vec{p}| = m\,|\Delta\vec{v}| = (2100\,\mathrm{kg})(65.4\,\mathrm{km/h})\left(\frac{1000\,\mathrm{m/km}}{3600\,\mathrm{s/h}}\right) = 3.8 \times 10^4\,\mathrm{kg}\cdot\mathrm{m/s}\ .$$

(c) The vector $\Delta\vec{p}$ points at an angle θ south of east, where

$$\theta = \tan^{-1}\left(\frac{v_i}{v_f}\right) = \tan^{-1}\left(\frac{41\,\mathrm{km/h}}{51\,\mathrm{km/h}}\right) = 39^\circ\ .$$