Sally travels by car from one city to another. She drives for 28.0 min at 81.0 km/h, 33.0 min at 36.0 km/h, and 32.0 min at 69.0 km/h, and she spends 12.0 min eating lunch and buying gas.
(a) Determine the average speed for the trip.

(b) Determine the total distance traveled.

Solution:

By the definition, average speed is:

$$v_{av} = \frac{S_{total}}{t_{total}}$$

To find time in hours:

$$t_h = \frac{t_{min}}{60}$$

Traveled distance:

$$S = vt$$

So, average speed is:

$$v_{av} = \frac{v_1 \frac{t_1}{60} + v_2 \frac{t_2}{60} + v_2 \frac{t_2}{60}}{\frac{t_1}{60} + \frac{t_2}{60} + \frac{t_3}{60} + \frac{t_4}{60}}$$

$$v_{av} = \frac{81.0 \frac{km}{h} \cdot \frac{28.0}{60} h + 36.0 \frac{km}{h} \cdot \frac{33.0}{60} h + 69.0 \frac{km}{h} \cdot \frac{32.0}{60} h}{\frac{28.0}{60} h + \frac{33.0}{60} h + \frac{36.0}{60} h + \frac{12.0}{60} h} \approx 52.0 \frac{km}{h}$$

And total traveled distance

$$s = v_1 \frac{t_1}{60} + v_2 \frac{t_2}{60} + v_2 \frac{t_2}{60} = 81.0 \frac{km}{h} \cdot \frac{28.0}{60} h + 36.0 \frac{km}{h} \cdot \frac{33.0}{60} h + 69.0 \frac{km}{h} \cdot \frac{32.0}{60} h = 94.4 \, km$$

Answer: Average speed: $v_{av} \approx 52.0 \frac{km}{h}$

Traveled distance is $s = 94.4 \, km$