10. 1st part of the motion

$$v = \frac{d}{t}$$

$$d = vt$$
$$= (5.0 \text{ m/s})(31 \text{ min} \times 60 \text{ s/min})$$
$$= 9.3 \times 10^3 \text{ m north}$$

2nd part of the motion

$$d = vt$$
$$= (7.0 \text{ m/s})(15 \text{ min} \times 60 \text{ s/min})$$
$$= 6.3 \times 10^3 \text{ m north}$$

Total: $9.3 \times 10^3 \text{ m} + 6.3 \times 10^3 \text{ m} = 1.56 \times 10^4 \text{ m}$ north

$$v = \frac{d}{t}$$
$$= \frac{1.56 \times 10^4 \text{ m}}{46 \text{ min} \times 60 \text{ s/min}}$$
$$= 5.7 \text{ m/s north}$$

11. 1st part of the motion

$$v = \frac{d}{t}$$

$$d = vt$$
$$= (8.0 \text{ m/s})(25 \text{ min} \times 60 \text{ s/min})$$
$$= 1.2 \times 10^4 \text{ m north}$$

2nd part of the motion

$$d = vt$$
$$= (5.0 \text{ m/s})(15 \text{ min} \times 60 \text{ s/min})$$
$$= 4.5 \times 10^3 \text{ m south}$$

Displacement is $1.2 \times 10^4 \text{ m} - 4.5 \times 10^3 \text{ m} = 7.5 \times 10^3 \text{ m}$ north

Distance is $1.2 \times 10^4 \text{ m} + 4.5 \times 10^3 \text{ m} = 1.65 \times 10^4 \text{ m}$

a) Average velocity $= \frac{\text{displacement}}{t}$

$$= \frac{7.5 \times 10^3 \text{ m}}{40 \text{ min} \times 60 \text{ s/min}}$$
$$= 3.1 \text{ m/s north}$$

b) Average speed $= \frac{\text{distance}}{t}$

$$= \frac{1.65 \times 10^4 \text{ m}}{40 \text{ min} \times 60 \text{ s/min}}$$
$$= 6.9 \text{ m/s}$$

12. Let t = time of motion of B

$\therefore t + 60 \text{ s}$ = time of motion of A

d is the same for both objects

Find d

For A	For B
$v = \frac{d}{t}$	$v = \frac{d}{t}$
$2.0 \text{ m/s} = \frac{d}{t + 60 \text{ s}}$	$3.0 \text{ m/s} = \frac{d}{t}$
$2.0 \text{ m/s} = \frac{(3.0 \text{ m/s})t}{t + 60 \text{ s}}$	$d = (3.0 \text{ m/s})t$

$$2.0(t + 60 \text{ s}) = 3.0\,t$$
$$2.0\,t + 120 \text{ s} = 3.0\,t$$
$$120 \text{ s} = t$$

$$t = 1.2 \times 10^2 \text{ s}$$

13. a)

time (s)	displacement (m)	displacement during time interval (m)	average velocity during time interval (m/s)
0	0		
0.10	0.012	0.012	0.12
0.20	0.024	0.012	0.12
0.30	0.035	0.011	0.11
0.40	0.047	0.012	0.12
0.50	0.060	0.013	0.13
0.60	0.072	0.012	0.12
0.70	0.085	0.013	0.13
0.80	0.097	0.012	0.12
0.90	0.108	0.011	0.11
1.00	0.120	0.012	0.12

b) Position-time graph