13.

v_0	v_f	a	d	t
2.5 m/s	–1.6 m/s	?	1.0 m	X

$$v_f^2 = v_0^2 + 2ad$$
$$(-1.6\text{ m/s})^2 = (2.5\text{ m/s})^2 + 2(a)(1.0\text{ m})$$
$$a = \frac{(-1.6\text{ m/s})^2 - (2.5\text{ m/s})^2}{2(1.0\text{ m})}$$
$$= -1.8\text{ m/s}^2$$

14.

v_0	v_f	a	d	t
2.0 m/s	0	X	2.7 m	?

$$d = \left(\frac{v_f - v_0}{2}\right)t$$
$$2.7\text{ m} = \left(\frac{0 + 2.0\text{ m/s}}{2}\right)t$$
$$t = \frac{2(2.7\text{ m})}{2.0\text{ m/s}}$$
$$= 2.7\text{ s}$$

This is the time for the ball to roll up the incline. It will take the same time to come down. Therefore, the total time is

$$2(2.7\text{ s}) = 5.4\text{ s}$$

15.

v_0	v_f	a	d	t
5.0 m/s	–5.0 m/s	?	0	3.0 s

$$a = \frac{v_f - v_0}{t}$$
$$= \frac{-5.0\text{ m/s} - 5.0\text{ m/s}}{3.0\text{ s}}$$
$$= -3.3\text{ m/s}^2$$

16.

v_0	v_f	a	d	t
20.0 m/s	?	–9.80 m/s^2	–30.0 m	?

a) $v_f^2 = v_0^2 + 2ad$
$= (20.0\text{ m/s})^2 + 2(-9.80\text{ m/s}^2)(-30.0\text{ m})$

$v_f = -31.4\text{ m/s}$

b) $a = \frac{v_f - v_0}{t}$

$$-9.80\text{ m/s}^2 = \frac{(-31.4 - 20.0)\text{ m/s}}{t}$$
$$t = \frac{(-31.4 - 20.0)\text{ m/s}}{-9.80\text{ m/s}^2}$$
$$= 5.24\text{ s}$$

17.

v_0	v_f	a	d	t
11.0 m/s	X	–9.80 m/s^2	–5.0 m	?

Find v_f first
$v_f^2 = v_0^2 + 2ad$
$= (11.0\text{ m/s})^2 + 2(-9.80\text{ m/s}^2)(-5.0\text{ m})$

$v_f = -14.8\text{ m/s}$

Now find t

$$a = \frac{v_f - v_0}{t}$$
$$-9.80\text{ m/s}^2 = \frac{-14.8\text{ m/s} - 11.0\text{ m/s}}{t}$$
$$t = \frac{-14.8\text{ m/s} - 11.0\text{ m/s}}{-9.80\text{ m/s}^2}$$
$$= 2.6\text{s}$$

18.

v_0	v_f	a	d	t
X	0	–9.80 m/s^2	?	2.65 s

If it takes 5.30 s to go up and down, it will take $\frac{5.30\text{ s}}{2} = 2.65\text{ s}$ to reach the highest point.

Now find v_0

$$a = \frac{v_f - v_0}{t}$$
$$-9.80\text{ m/s}^2 = \frac{0 - v_0}{2.65\text{ s}}$$
$$v_0 = 26.0\text{ m/s}$$

Find d

$$d = \left(\frac{v_f - v_0}{2}\right)t$$
$$= \left(\frac{0 + 26.0\text{ m/s}}{2}\right)(2.65\text{ s})$$
$$= 34.4\text{ m}$$