Practise Questions 3

SUVAT

1

- An aeroplane accelerates down a runway at 3.20 m/s^2 for 32.8 s until is finally lifts off the ground. Determine the distance travelled before take off.

$s =$

$u = 0$ m/s

$v =$

$a = 3.20$ m/s^2

$t = 32.8$ s

$$s = ut + \frac{1}{2}at^2$$

$$s = (0\text{ m/s}) \times (32.8\text{ s}) + 0.5(3.20\text{ m/s}^2) \times (32.8\text{ s})^2$$

$$s = 1720\text{ m}$$

10

- A *Macropus* is capable of jumping to a height of 2.62 m. Determine the take off speed of the *Macropus*.

$s = 2.62\,m$

$u =$

$v = \phi\ m/s$

$a = -9.8\ m/s^2$

$t =$

$$v^2 = u^2 + 2as$$

$$(\phi\ m/s)^2 = u^2 + 2 \times (-9.8\ m/s^2) \times (2.62\,m)$$

$$\phi\ m^2/s^2 = u^2 - 51.35\ m^2/s^2$$

$$51.35\ m^2/s^2 = u^2$$

$$u = 7.17\ m/s$$

2

- A Holden starts from rest and accelerates uniformly over a time of 5.21 seconds for a distance of 110 m. Determine the acceleration of the Holden.

$s = 110\,m$

$u = 0\,m/s$

$v =$

$a = ?$

$t = 5.21\,s$

$$s = ut + \frac{1}{2}at^2$$

$$110_m = (0\,m/s) \times (5.21s) + 0.5 \times (a) \times (5.21\,s)^2$$

$$110_m = (13.57\,s^2) \times a$$

$$a = (110\,m / 13.57\,s^2)$$

$$a = 8.10\,m/s^2$$

3

- Charlie Physics is riding the Pinjara Trophy at Pinjara. If Charlie free falls for 2.6 seconds, what will be his final velocity and how far will he fall?

$s =$

$u = 0\ m/s$

$v =$

$a = -9.8\ m/s^2$

$t = 2.6\ s$

$s = ut + \frac{1}{2}at^2$

$s = (0\ m/s) \times (2.6\ s) + 0.5 \times (-9.8\ m/s^2) \times (2.6\ s)^2$

$s = -33\ m$ (− direction)

$v = u + at$

$v = 0 + (-9.8\ m/s^2) \times (2.6\ s)$

$v = -25.5\ m/s$

4

- A racing car accelerates uniformly from 18.5 m/s to 46.1 m/s in 2.47 seconds. Determine the acceleration of the vehicle and the distance travelled.

$s =$

$u = 18.5\ m/s$

$v = 46.1\ m/s$

$a =$

$t = 2.47\ s$

$$a = \frac{\Delta v}{t}$$

$$a = \frac{v - u}{t}$$

$$a = \frac{(46.1\ m/s - 18.5\ m/s)}{2.47\ s}$$

$$a = 11.2\ m/s^2$$

$$s = ut + \frac{1}{2}at^2$$

$$s = (18.5 \times 2.47) + 0.5 \times (11.2\ m/s^2) \times (2.47\ s)^2$$

$$s = 45.7\ m + 34.1\ m$$

$$s = 79.8\ m$$

(s could also be found by using $v^2 = u^2 + 2as$

5

- A white feather is dropped on the moon from a height of 1.40 meters. The acceleration of gravity on the moon is 1.67 m/s^2. Determine the time for the white feather to fall to the surface of the moon.

$s = -1.40\,m$

$u = 0\,m/s$

$v =$

$a = 1.67\,m/s^2$

$t =$

$$s = ut + \frac{1}{2}at^2$$

$$-1.40\,m = (0\,m/s) \times t + 0.5 \times (-1.67\,m/s^2) \times t^2$$

$$-1.40\,m = 0 + (-0.835\,m/s^2) \times t^2$$

$$t^2 = \frac{(-1.40\,m)}{(-0.835\,m/s^2)}$$

$$t^2 = 1.68\,s^2$$

$$t = 1.29\,s$$

6

- Rocket powered sledges are used to test the human response to acceleration. If a rocket powered sledge is accelerated to a speed of 444 m/s in 1.8 seconds, then what is the acceleration and what is the distance that the sledge travels?

$s =$

$u = 0\ m/s$

$v = 44\ m/s$

$a =$

$t = 1.80\ s$

$$a = \frac{\Delta v}{t}$$

$$a = \frac{(v - u)}{t}$$

$$a = \frac{(444\ m/s - 0\ m/s)}{1.80\ s}$$

$$a = 247\ m/s^2$$

$$s = ut + \tfrac{1}{2}at^2$$

$$s = (0 \times 1.80) + 0.5 \times (247) \times (1.80)^2$$

$$s = 0\ m + 400\ m$$

$$s = 400\ m$$

(s can be found by using

$$v^2 = u^2 + 2as$$

7

- A motor bike accelerates uniformly from rest to a speed of 7.10 m/s over a distance of 35.4 m. Determine the acceleration of the motorbike.

$s = 35.4\,m$

$u = 0\,m/s$

$v = 7.10\,m/s$

$a =$

$t =$

$$v^2 = u^2 + 2as$$

$$(7.10\,m/s)^2 = (0\,m/s)^2 + 2 \times a \times 35.4\,m$$

$$50.4\,m^2/s^2 = (0\,m/s)^2 + (70.8\,m) \times a$$

$$(50.4\,m^2/s^2)\,(70.8\,m) = a$$

$$a = 0.712\,m/s^2$$

8

- An consultant engineer is designing the runway for an airport. Of all the planes that will use the airport, the lowest acceleration rate is likely to be 3 m/s^2. The take off speed for this plane will be 65 m/s. Assuming this minimum acceleration, what is the minimum allowed length for the runway?

$s =$

$u = 0\ m/s$

$v = 65\ m/s$

$a = 3\ m/s^2$

$t =$

$$v^2 = u^2 + 2as$$

$$(65\ m/s)^2 = (0\ m/s)^2 + 2 \times (3\ m/s^2) \times s$$

$$4225\ m^2/s^2 = (0\ m/s)^2 + (6\ m/s^2) \times s$$

$$s = \frac{(4225\ m^2/s^2)}{(6\ m/s^2)}$$

$$s = 704\ m$$

9

- A vehicle traveling at 22.4 m/s skids to a stop in 2.55 s. Determine the skidding distance of the vehicle (assume uniform acceleration).

$s =$

$u = 22.4\ m/s$

$v = \phi\ m/s$

$a =$

$t = 2.55\ s$

$$s = \frac{1}{2}(u+v)t \quad \text{or} \quad s = \frac{(u+v)}{2}t$$

$$s = \frac{(22.4\ m/s + \phi\ m/s)}{2} \times 2.55\ s$$

$$s = (11.2\ m/s) \times 2.55\ s$$

$$s = 28.6\ m$$