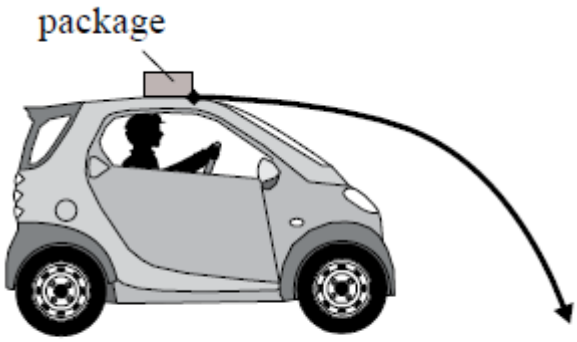
National 5
Physics

# Solutions to Dynamics & Space exam questions

**1.** (a) (i)




1

(ii) It moves with constant velocity in the horizontal direction (1)

while accelerating due to the force of gravity in the vertical direction (1)

2

(b) $g = 9.8$ (m s$^{-2}$) (1) data

$a = \frac{v - u}{t}$ (1)

$9.8 = \frac{v\ (-\ 0)}{0.55}$ (1)

$v = 5.4$ m s$^{-1}$ (1) [number **and** unit must be correct]

4

**2.** (a) (i) If A exerts a force on B, B exerts an equal but opposite force on A.
Or
To every action (force) there is an equal and opposite reaction (force)

1

(ii) Engine/exhaust pushes gases down(A on B) (1)
gases push engine/exhaust up (B on A) (1)

2

(b)

$$F_{UN} = ma \quad (1)$$

$$8200000 = 2 \cdot 05 \times 10^6 \times a \quad (1)$$

$$a = 4 \text{ m s}^{-2} \quad (1)$$

3

**3** (a) It is accelerating
OR
Speeding up (NOT 'going down the flume') 1

(b)

$$\text{distance} = \text{area under graph} \qquad (1)$$

$$= \frac{1}{2} \times 7 \cdot 5 \times 5 + 20 \times 5 \qquad (1)$$

$$= 18 \cdot 75 + 100$$

$$= 118 \cdot 75 \text{ m}$$

3

(c)

$$a = \frac{v - u}{t} \qquad (1)$$

$$= \frac{15 - 5}{5} \qquad (1)$$

$$= 2 \text{ m s}^{-2} \qquad (1)$$

3

**4** (a) $s = vt$ (1)

$11 = 20 \times t$ (1)

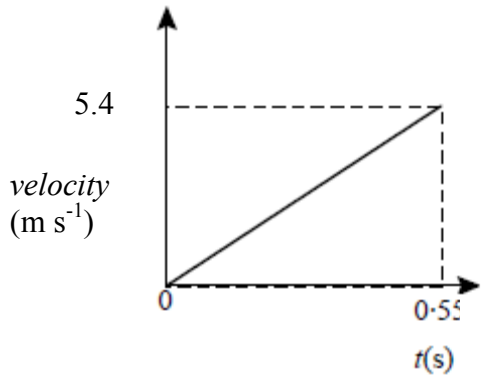
$= 0{\cdot}55$ s (1) [number **and** unit must be correct] 3

(b) $a = \frac{v - u}{t}$ (1)

$9.8 = \frac{v - 0}{0.55}$ (1)

$v = 5.4$ m s$^{-1}$ (1) [number **and** unit must be correct] 3

(c)




2

(d)

$s$ = area under graph (1)

$s = ½ \times 0.55 \times 5.4$ (1)

$s = 1{\cdot}5$ m (1) [number **and** unit must be correct]

3

**5** (a) (i) Acceleration is the change of velocity (not speed) in unit time — 1

(ii) Direction of satellite is (continually) changing
**OR**
Velocity of satellite is (continually) changing
**OR**
There is an **unbalanced** force on the satellite — 1

(b) $F = 12 - 2 = 10$ N (1)

$F = ma$ (1)
$10 = 50 \times a$ (1)
$a = 0{\cdot}2$ m $s^{-2}$ direction is right (1) [number **and** unit must be correct] — 4

**6.** D

**7.** B

**8.** D

**9.** (a)

$$a = \frac{v - u}{t} \quad (1)$$

$$= \frac{18 - 0}{15} \quad (1)$$

$$= 1 \cdot 2 \text{ m s}^{-1} \quad (1)$$

3

[number **and** unit must be correct]

(b)

$$s = \text{area under graph} \quad (1)$$

$$= (½ \times 15 \times 18) + (50 \times 18) \quad (1)$$

$$= 1035 \text{ m} \quad (1)$$

3

[number **and** unit must be correct]

(c) (i)

(wear) tight fitting clothes
OR
Crouch
OR
(wear) streamlined helmet
OR
streamlined shoes
OR
solid wheels

1

(ii)

Tyres
OR
(handle) grips
OR
brakes
OR
shoes on pedals
OR
saddle

1

**10.** (a)

$s = = vt$ (1)

$= 3\times10^{8} \times(1\times365\times24\times60\times60)$ (1) for speed of light

$= 9\cdot4608\times10^{15}$ (m) (1) for time substitution

3

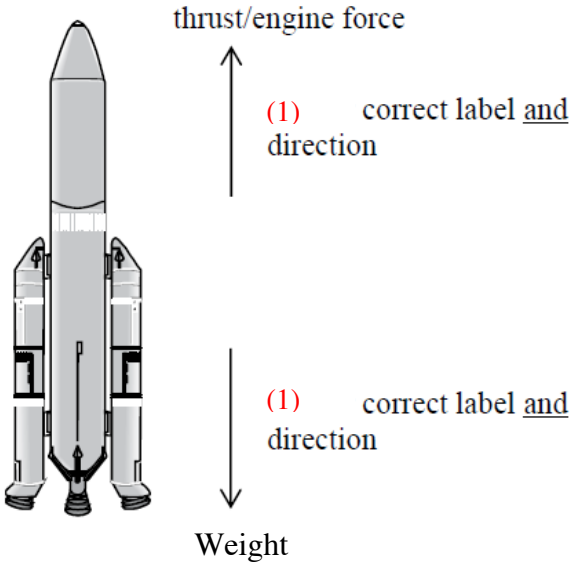
(b) Different frequencies/ wavelengths /signals
require different detectors/telescopes
OR
Certain detectors/telescopes cannot pick up certain
frequencies/wavelengths/signals
OR
Different signals have different frequencies/ wavelengths

1

**11.** B

**12.** C

**13.** (a)




2

(b) (i) $W = mg$ (1)
$= (3{\cdot}08 \times 10^5) \times 9.8$ (1)
$= 3{\cdot}02 \times 10^6$ N (1) [correct number **and** unit required] 3

(ii) $F_{unbalanced} = 3352\,000 - 3020\,000 = 332\,000$ (N) (1)
$F = ma$ (1)
$332\,000 = 3.08 \times 10^5 \times a$ (1)
$a = 1.08$ m s$^{-2}$ [correct number **and** unit required] (1) 4

(c) It moves with constant speed in the horizontal direction (1) while accelerating due to the force of gravity in the vertical direction (1) 2

(d) (i) The astronaut is falling (towards Earth) at the same rate as the ISS
OR 1
The astronaut is in freefall

(ii) The astronaut exerts a force against the wall and the wall exerts an equal and opposite force against the astronaut (causing him to move) 1

14. (a)

$a = \frac{v - u}{t}$ (1)

$= \frac{11 - 0}{5.8}$ (1)

$= 1.9 \text{ m s}^{-2}$ (1) [correct number **and** unit required] 3

(b) displacement = area under graph (1)

= ½ x (11 x 5·8) + (11 x 6) (1)

= 31·9 + 66

= 97·9 m [correct number **and** unit required] (1) 3

**15.** B

**16.** D

17. (a) (i) $s = vt$ (1)

$s = 2 \times 0{\cdot}75$ (1) 3

$s = 1{\cdot}50$ m (1) [correct number **and** unit required]

(ii) $a = \frac{v-u}{t}$ (1)

$9.8 = \frac{v-0}{0.75}$ (1)

$v = 7.35\ ms^{-1}$ (1) [correct number **and** unit required]

3

(b) (i) Same horizontal speed (1)
All objects fall with the same (vertical) acceleration. (1) 2

**18.** E

**19.** D

**20.** E