

**FORCE**

1. (a) (i) • an arrow labelled R, to the right, drawn on the rope 1 (L3)  
*accept a labelled arrow to the right, drawn parallel to the rope*

(ii) • an arrow labelled G, vertically downwards 1 (L4)

(b) any **one** from 1 (L4)

- snow is smoother
- snow is more slippery

*accept 'snow is slippery'*  
*accept 'concrete or the path is rough'*  
*'snow is soft' or 'concrete is hard' are insufficient*

[3]

2. (a) Mars *accept '6 kg'* 1 (L5)  
*do not accept '24 N'*

(b) any **one** from 1 (L5)

- ✓ 4 kg weighs more on Earth

*accept the converse*  
*'different weights' is insufficient*

- ✓ the weight of the object is greater on Earth

*accept the converse*  
*accept 'Earth is 40 N and Venus is 36 N'*  
*accept 'Earth is 40 and Venus is 36'*  
*accept 'more newtons on Earth' or 'less newtons on Venus'*  
*accept 'there is a greater force on Earth'*  
*do not accept 'it has more mass on the Earth'*

(c) *answers must be in the correct order*  

- ✓ less (than) **or** smaller (than) **or** lower (than) 1 (L6)

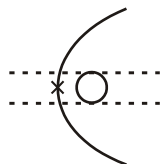
- ✓ the same (as) **or** equal (to) 1 (L6)

(d) (i) ✓ the greater the distance *accept 'it increases'* 1 (L5)  
*the greater the time for one orbit*

(ii) ✓ an answer from 1.6 to 6 inclusive 1 (L6)

(e)

1 (L6)



award a mark for X marked on the orbit within the tolerances shown

[7]

3.

(a) B

1 (L5)

(b) (i) A and C

accept 'lift and weight'

1 (L5)

answers may be in either order

**both** letters are required for the mark

(ii) D and B

accept A and C

1 (L5)

answers may be in either order

**both** letters are required for the mark

(c) (i) ✓ Force D is greater than force B. ✓

1

if more than one box is ticked, award no mark

(ii) ✓ Force A is greater than force C. ✓

1

if more than one box is ticked, award no mark

[5]

4.

(a) any **one** from

1 (L4)

✓ the forces are balanced

ignore references to gravity if the answer is in terms of balanced forces

✓ the forces are equal **or** the same

'the sides are equal' is insufficient

✓ the forces are both 1000 N

accept 'the forces are both 1000'

accept 'the newtons are even'

do **not** accept 'both teams weigh 1000 N'

✓ they pull with the same force **or** equally hard

accept 'both teams have the same strength'

(b) an arrow drawn to the right

1 (L3)

accept an arrow drawn to the right anywhere on the drawing

- (c) any **one** from 1 (L4)
- ✓ team A pulled harder than team B *accept 'team A pulled harder' or 'team A pulled more' or 'they pulled harder'*  
*accept the converse*
  - ✓ team A was stronger *accept 'they used more strength'*
  - ✓ team A was pulling with more than 1000
  - ✓ team B was pulling with less than 1000
  - ✓ there was more force to the left *accept 'there are more newtons to the left'*

- (d) 1200 N ✓ 1 (L4)
- if more than one box is ticked, award no mark*

- (e) friction 1 (L4)

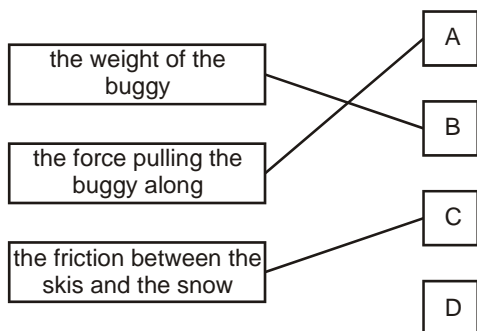
[5]

5. (a) (i) point plotted for (150, 1.5) to  $\pm$  half a small square 1 (L5)
- (ii) line of best fit 1 (L6)
- the anomalous point should be avoided*  
*the line need not be drawn through the origin*
- (b) point at (300, 3.8) circled *accept this result circled in the table* 1 (L6)
- (c) (i) a number from 640 to 660 1 (L6)
- (ii) a number from 0.4 to 0.6 1 (L6)
- consequential marking applies to both c i and c ii*  
*accept answers consistent with the graph drawn*

- ✓ the pattern is revealed **or** observed more easily *accept 'it allows you to see a pattern'*
  - ✓ it tells you the pattern without working it out *accept 'you can tell the rule by looking at it'*
  - ✓ it gives readings between the recorded readings *accept 'it is easier to make predictions'*
  - ✓ you can see if there are results that are wrong **or** do not fit the pattern *accept 'it shows better **or** more quickly the more mass the more weight'*
- accept 'the data is continuous'*  
*do **not** accept 'it is more accurate **or** precise'*

[6]

6. (a)



3 (L3)

*if more than one line is drawn from any one force award no mark for that force*

(b) 800

1 (L4)

*accept '80 x 10'*

(c) any **one** from

1 (L4)

- it weighed more
- the mass was greater
- it weighed less at the end

*accept 'it was heavier'*

*accept 'it only weighed 130 at the end'*

*accept 'there was more food **or** fuel **or** supplies'*

*accept 'more pressure'*

- they spread out the weight
- they have a bigger surface **or** area
- they can slide easily

*accept 'they do not sink into the snow'*  
*accept 'wheels sink'*

*accept 'they reduce the pressure'*  
*accept 'less friction'*

*'they are bigger' is insufficient*  
*'it can slide' is insufficient*

(e) any **one** from 1 (L4)

- there is a bigger surface **or** area
- there is a bigger force
- it catches more air **or** wind

*do not accept 'there is more air resistance'*

[7]

7. (a) (i) C 1 (L3)

(ii) B 1 (L3)

(b) 20 1 (L3)

(c) any **one** from 1 (L4)

- ✓ friction
- ✓ air resistance **or** drag
- ✓ reaction

*accept 'upthrust'*  
*do not accept 'gravity'*

[4]

8. (a) (i) 12.5 m/s 1 (L7)

*accept ' $\frac{400}{32}$  m/s'* 1 (L7)  
*accept 'metres per second' **or** 'ms<sup>-1</sup>' for m/s*  
*the unit is required for the mark*

*do not accept 'mps'*

(ii) they are equal **or** the same 1 (L7)

*accept 'they are balanced'*

(b) the forward force is greater than the backward force *accept the converse* 1 (L7)  
*accept 'the forward force is greater' or 'the backward force is smaller'*  
*do not accept 'the forward force becomes greater or increases'*

any **one** from 1 (L7)

- ✓ because air resistance **or** drag is smaller **or** reduced *accept 'less friction'*
- ✓ because there is a smaller surface area

*'she is more streamlined' is insufficient as it is given in the question*

[4]

9. (a) (i) any **two** from 2 (L6)

- ✓ gravity **or** weight
- ✓ friction
- ✓ reaction
- ✓ air resistance

*accept 'upthrust'*

*accept 'drag'*  
*do not accept 'centrifugal force' or 'centripetal force' or 'g-force'*

(ii) any **one** from 1 (L6)

- ✓ constant speed
- ✓ steady speed
- ✓ it stays the same

*accept 'it is the same' or 'it does not change'*

(b) friction is less 1 (L5)

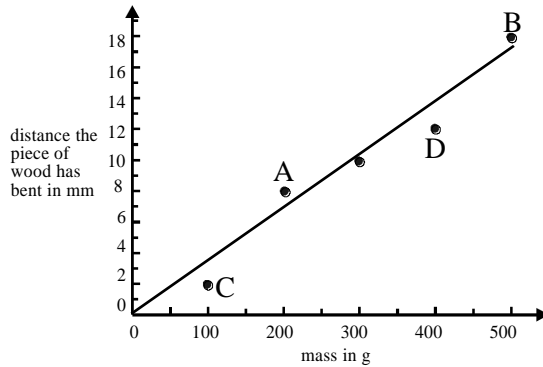
*'it is smoother' or 'it is slippery' are insufficient*

(c) it increases *accept 'he goes more quickly'* 1 (L6)  
 because there is less air resistance **or** friction 1 (L6)

*accept 'he is streamlined or aerodynamic'*

[6]

10. (a) **Both the correct ball and the correct reason are required for the mark.**  
 the bowling ball because it has the greatest mass **or** it is the heaviest 1 (L5)  
*do not accept 'because it is bigger'*  
*'the bowling ball because it is bigger'*  
*insufficient*
- (b) any **one** from 1 (L5)  
 ✓ they are the same diameter *accept 'they are the same size'*  
 ✓ they produce the same air resistance **or** friction
- (c) (i) they would both reach the ground at the same time 1 (L5)  
 (ii) air resistance *accept 'friction'* 1 (L5)  
 (iii) **either**  
 ✓ the feather and the hammer landed at the same time 1 (L6)  
 there is no atmosphere **or** air resistance **or** air on the moon 1 (L6)  
**or**  
 ✓ they would take longer to fall on the moon 1  
 (L6)  
 because there is lower gravity than on the Earth 1 (L6)  
*do not accept 'there is no gravity on the moon'* [6]
11. (a) they are equal *accept 'they are balanced'* 1 (L5)  
 (b) (i) weight is greater than friction *accept 'they are not equal or balanced'* 1 (L5)  
 (ii) it increases 1 (L6)  
 it decreases 1 (L6)  
 (iii) it increases **or** it gets faster 1 (L6) [5]
12. (a) gravity **or** weight 1



(b) (i) 1

accept any straight line which goes through **or** below both points A and B **and** through **or** above both points C and D the line does **not** have to extend to an axis

(ii) 11.5 accept any answer from 10.0 to 13.0 1

[3]

13. (a) (i) any **one** from 1

✓ when the weight increases, the number of masses increases

accept 'they increase together' **or** 'they decrease together'

✓ the number of masses goes down if the weight goes down

✓ the number of masses increases with weight

(ii) 12 1

(b) (i) she would need fewer masses accept 'it would slide more easily' do **not** accept 'less friction' 1

(ii) put oil or water on the glass accept a named lubricant for oil accept 'lubricate the surfaces' accept 'polish the block of wood' accept 'put the block of wood on rollers **or** ball bearings' **or** on any objects used as rollers do **not** accept 'tilt the glass' 1

[4]

14. (a) (i) they hit the front of the car accept 'the car has to push the air molecules out of the way' 1 (L6)



*accept 'air hits the front of the car'*

(ii) any **one** from

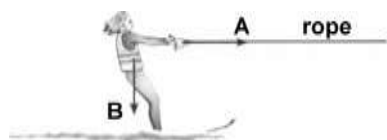
1 (L6)

- ✓ molecules **or** particles hit the car faster **or** harder  
*accept 'the car hits the air particles faster'*
- ✓ more molecules **or** particles hit the car  
*accept 'the car has to push more air each second' or 'the pressure gets greater at the front of the car' or 'the pressure difference increases'*

- (b) (i) larger than the air resistance *accept 'larger' or 'bigger'* 1 (L6)
- (ii) the same as the air resistance *accept 'the same' or 'equal'* 1 (L6)
- (c) any **one** from 1 (L6)
- ✓ it has to balance the air resistance
  - ✓ air resistance is larger *accept 'more molecules hit the car' or 'molecules hit the car faster' or 'the car has to push more air each second'*
- (d) friction 1 (L5)

[6]

15. (a) (i) 1 (L3)



- (ii) 1 (L3)

*the first mark is for an arrow pointing to the right, with **or** without the label **A** the arrow may be separate from, but parallel to, the rope*

*accept an arrow placed on the second drawing provided it is labelled **A***

*the second mark is for an arrow pointing vertically downwards, with **or** without the label **B***



*resistance **or** water resistance, but not both  
accept 'weight of the skis'  
do **not** accept 'weight' **or** 'gravity' **or** water  
pressure' **or** 'resistance'*

(c)

1 (L3)



*the mark is for an arrow pointing to the left, with **or** without the label C the arrow may be separate from, but parallel to, the rope accept an arrow placed on the first drawing provided it is labelled C*

(d) any **one** from

- ✓ it increases it
- ✓ it speeds it up
- ✓ it makes it go faster

accept 'makes it accelerate'

1 (L3)

*accept 'faster'  
do **not** accept 'it changes it'*

[6]

16. (a) the weight of the bricks ✓

*if more than two boxes are ticked, deduct one mark for each incorrectly ticked box*

1 (L3)

the push of the man's hands on the handles ✓

1 (L3)

*minimum mark zero*

(b) friction

1 (L4)

(c) any **one** from

1 (L3)

- ✓ speeds it up
- ✓ makes it bigger
- ✓ it accelerates

*accept 'makes it go faster' **or** 'faster'  
do **not** accept 'it falls quickly'*

[4]

17. (a) The tension equals the weight. ✓

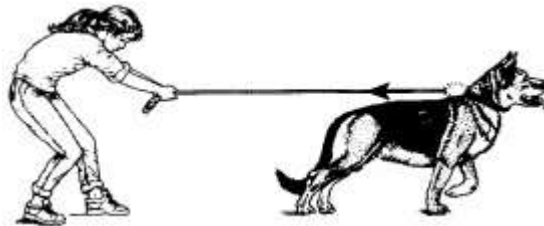
*if more than one box is ticked, award no mark*

1 (L6)

- (b) tension is greater than weight      *accept 'tension is bigger' or 'weight is less' 1 (L6)*  
*or 'the upward force is bigger' or 'the downward force is smaller'*
- (c) tension equals weight      *accept 'they are the same'      1 (L6)*
- (d) tension is less than weight      *1 (L6)*  
*accept 'tension is less' or 'weight is more'*  
*or 'the upward force is less' or 'the downward force is bigger'*

[4]

- 18. (a) B      1 (L3)
- (b) D      1 (L3)
- (c) (i)      1 (L3)



*one mark for the arrow pointing to the left*  
*the arrow may be anywhere on the diagram*  
*accept 'D' on the diagram*  
*accept arrows pointing diagonally*  
*downwards and to the left*  
*do not accept arrows pointing vertically*  
*downwards*

(ii) **answers should refer to a force pulling or the effect of pulling** any **one** from 1 (L3)

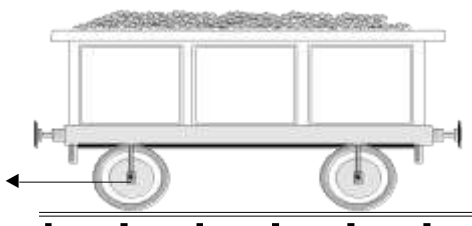
- ✓ because Megan is pulling it
- ✓ because there is a force on it
- ✓ because the force is unbalanced
- ✓ force D is still

acting

*accept 'because it was stretched' or 'because the dog isn't pulling it any more'*  
*accept answers referring to gravity, weight or falling **only** if the arrow in (c) (i) points diagonally or vertically downwards*  
*do **not** accept 'it is not attached to the dog any more'*

[4]

19. (a) (i) 1 (L5)



*the mark is for an arrow pointing to the left as shown*  
*the arrow may be anywhere on the diagram*  
*accept an arrow pointing to the left, drawn in the space beneath the question*

(ii) equal to accept 'equal' 1 (L5)

(b) (i) backwards accept 'in the opposite direction to the movement' 1 (L5)  
*or 'in the opposite direction' or 'to the left'*  
*accept an arrow drawn pointing to the left either on the diagram, if labelled clearly, or in the space beneath the question*

(ii) between 0 and 5000 N ✓ if more than one box is ticked, 1 (L5)  
*award no mark*

(c) 5000 N ✓ if more than one box is ticked 1 (L5)  
*award no mark*

[5]