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'* / *do **not** accept '24 N'* — 1 (L5)

(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'*

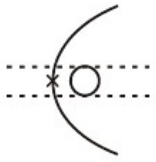
(c) *answers must be in the correct order*

- 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'* / *the greater the time for one orbit* — 1 (L5)

(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 (L6)

if more than one box is ticked, award no mark

(ii) • Force A is greater than force C. ✓ 1 (L6)

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 ± 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

(d) any **one** from — 1 (L6)

the answer must refer to the results or the pattern shown by the results

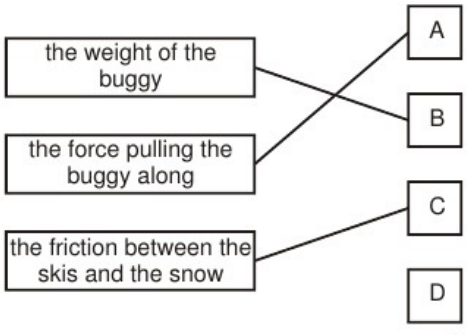
- the pattern is revealed **or** observed more easily — *accept 'it allows you to see a pattern'*
- it tells you the pattern without working it out — *accept 'you can tell the rule by looking at it'*
- it gives readings between the recorded readings — *accept 'it is easier to make predictions'*
- you 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 — *accept 'it was heavier'*
- it weighed less at the end — *accept 'it only weighed 130 at the end'*

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

accept 'more pressure'

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

- they spread out the weight

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

- they have a bigger surface **or** area
- they can slide easily

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 *accept '$\frac{400}{32}$ m/s'* 1 (L7)

*accept 'metres per second' **or** 'ms^{-1}' for m/s*
the unit is required for the mark
*do **not** accept 'mps'*

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

(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 — *accept 'upthrust'*
- air resistance — *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)

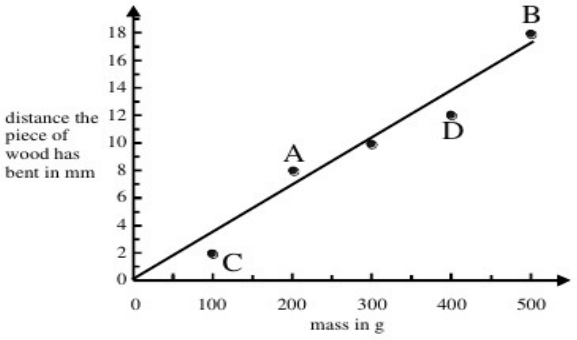
(ii) it increases — 1 (L6)
it decreases — 1 (L6)

(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'* 1
*do **not** accept 'less friction'*

(ii) put oil or water on the glass *accept a named lubricant for oil* 1
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'*

[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)

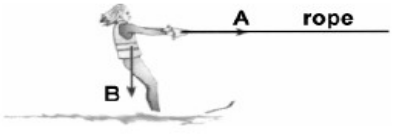
(c) any **one** from — 1 (L6)

- 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***

(b) any **two** from

- air resistance **or** wind resistance — *accept 'wind'* — 2 (L4)
- friction **or** water resistance
- upthrust — *accept 'buoyancy'*
- lift — *accept 'drag' as an alternative to wind*

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 — accept 'makes it accelerate' — 1 (L3)
- it speeds it up
- it makes it go faster

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

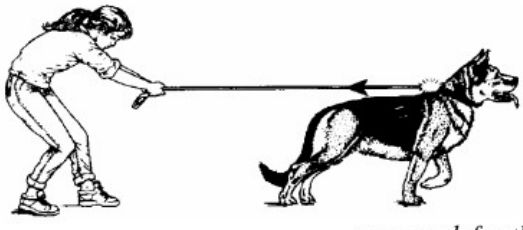
1 (L3)

(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

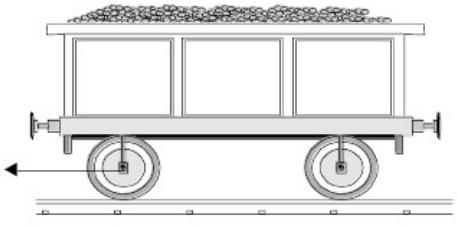
accept 'because it was stretched' **or** *'because the dog isn't pulling it any more'*

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, award no mark* 1 (L5)

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

[5]