

- M1.**
- (a) the distance travelled under the braking force 1
- (b) the reaction time will increase 1
- increasing the thinking distance (and so increasing stopping distance)  
*(increases stopping distance is insufficient)* 1
- (c) No, because although when the speed increases the thinking distance increases by the same factor the braking distance does not. 1
- eg
- increasing from 10 m / s to 20 m / s increases thinking distance from 6 m to 12 m  
 but the braking distance increases from 6 m to 24 m 1
- (d) If the sled accelerates the value for the constant of friction will be wrong. 1
- (e) only a (the horizontal) component of the force would be pulling the sled forward 1
- the vertical component of the force (effectively) lifts the sled reducing the force of the surface on the sled 1
- (f)  $-u^2 = 2 \times -7.2 \times 22$   
*award this mark even with  $0^2$  and / or the negative sign missing*

1

$$u = 17.7(99)$$

1

18

1

*allow 18 with no working shown for 3 marks*

*allow 17.7(99) then incorrectly rounded to 17 for 2 marks*

**[11]**

- M2.** (a) (i) 9.5  
*accept  $\pm 1$  mm* 1
- 10.5 1
- (ii) 9.5  
*ecf from (a)(i)* 1
- (iii) 190  
*20  $\times$  (a)(ii) ecf* 1
- (iv) medium  
*ecf from (a)(iii)* 1
- (b) (i) any **two** from:
- position of ball before release
  - same angle **or** height of runway
  - same ball
  - same strip of grass
- 2
- (ii) long  
**or**  
longer than in part (a)  
**or**  
uneven  
*do **not** allow reference to speed* 1
- (c) (i) as humidity increases mean distance decreases

*accept speed for distance*

1

(ii)  $71 \times 180 = 12780$   
 $79 \times 162 = 12798$   
 $87 \times 147 = 12789$

*all three calculations correct with a valid conclusion gains 3 marks*

**or**

find k from  $R = k / d$

*all three calculations correct gains 2 marks*

**or**

$87 / 71 \times 147 = 180.1 \sim 180$

$87 / 79 \times 147 = 161.9 \sim 162$

*two calculations correct with a valid conclusion gains 2 marks*

conclusion based on calculation

*one correct calculation of k gains 1 mark*

3

(iii) only three readings **or** small range for humidity

*accept not enough readings*

*accept data from Internet could be unreliable*

*ignore reference to repeats*

1

(d) distance is a scalar **or** has no direction **or** has magnitude only

*allow measurements from diagram of distance and displacement*

1

displacement is a vector **or** has direction

1

[15]