

1. (a) (i) **[1]** each for correct arrow and (any reasonable) labelling; 2

Award [1 max] for arrows in correct direction but not starting at the ball.

- (ii) no;
because the two forces on the ball can never cancel out /
there is a net force on the ball / the ball moves in a circle /
the ball has acceleration/it is changing direction;
Award [0] for correct answer with no or wrong argument. 2

- (b) $= 2.832 \text{ N};$
 $= T \sin 30^\circ;$
 $v = 1.4 \text{ m s}^{-1};$

or

$$T \cos 30^\circ = mg;$$
$$T \sin 30^\circ = mg;$$
$$T \sin 30^\circ = ;$$
$$v = 1.4 \text{ m s}^{-1};$$

3

[7]

2. B

[1]

3. A

[1]

4. D [1]
5. C [1]
6. B [1]
7. A [1]
8. B [1]
9. D [1]
10. D [1]
11. (a) $T = mg (= 770 \times 9.8) = 7500\text{N};$ 1
Accept use of $g = 10$ to yield 7.7kN.
- (b) (i) (conservation of energy) leading to $v = ;$
 $= 5.6 \text{ m s}^{-1}$ **or** $5.7 \text{ m s}^{-1};$ 2
Accept use of $g = 10$. Do not allow solutions from $v^2 = u^2 + 2as$.
- (ii) use of ;
 $= 2000(\text{N});$
 $T = (2000 + 7500 =) 9500\text{N};$ 3
- (c) (i) impulse / change in momentum; 1

- (ii) use of $F\Delta t = \Delta p$ *or* $\Delta p = 5.60 \times 770 = 4312(\text{Ns})$;
 $F_{\text{max}} \times 0.15 = 4312$;
 $F_{\text{max}} = 57\text{kN}$;

3

[10]

[1]