**Mark schemes**

Q1.

(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) − u2 = 2 × −7.2 × 22

award this mark even with 02 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]

Q2.

(a) (i) 9.5

accept ±1 mm

1

10.5

1

(ii) 9.5

ecf from (a)(i)

1

(iii) 190

20 × (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 × 180 = 12780

79 × 162 = 12798

87 × 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 × 147 = 180.1 ~ 180

87 / 79 × 147 = 161.9 ~ 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]

Q3.

(a) (i) gravitational potential (energy)

1

(ii) kinetic (energy)

1

(b) (i) slope or gradient

1

(ii) area (under graph)

do not accept region

1

(iii) starts at same y−intercept

1

steeper slope than original and cuts time axis before original

the entire line must be below the given line

allow curve

1

(c) (i) 31

and

31

correct answers to 2 significant figures gains 3 marks even if no working shown

both values to more than 2 significant figures gains 2 marks:

30.952…...

30.769….

65 / 2.1 and / or

80 / 2.6 gains 1 mark

if incorrect answers given but if both are to 2 significant figures allow 1 mark

3

(ii) student 1 incorrect because 80 ≠ 65

1

student 2 correct because average velocities similar

ecf from (c)(i)

1

student 3 incorrect because times are different

1

[12]

Q4.

(a) 4 N to the right

1

(b) (i) bigger than

1

equal to

1

(ii) reduces it

1

increases air resistance / drag / force C

accept parachute has large(r) (surface) area

1

[5]

Q5.

(a) 3 lines drawn

all correct

allow 1 mark for each correct line

if two or more lines are drawn from any diagram then all these lines are incorrect

3

(b) (i) horizontal arrow to the right

judge by eye

accept an arrow drawn outside the box if it is labelled correctly

1

(ii) horizontal arrow to the left

judge by eye

accept an arrow drawn outside the box if it is labelled correctly

1

(iii) equal to

1

(iv) to measure the forces exerted on the dummy during the impact

1

[7]

Q6.

(a) (i) constant

1

(ii) heat

1

(b) (i) 3 links correct

allow 1 mark for 1 correct link

if more than one line is drawn from a condition mark all lines from that condition incorrect

2

(ii) increased

1

[5]