**Mark schemes**

Q1.

(a) distance is a scalar and displacement is a vector

or

distance has magnitude only, displacement has magnitude and direction

1

(b) 37.5 km

accept any value between 37.0 and 38.0 inclusive

1

062° or N62°E

accept 62° to the right of the vertical

1

accept an angle in the range 60° −64°

accept the angle correctly measured and marked on the diagram

(c) train changes direction so velocity changes

1

acceleration is the rate of change of velocity

1

(d) number of squares below line = 17

accept any number between 16 and 18 inclusive

1

each square represents 500 m

1

distance = number of squares × value of each square correctly calculated − 8500 m

1

[8]

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) 3

gains 1 mark

m/s2

gains 1 mark

else working gains 1 mark

2

(b) 2850 ecf

gains 1 mark

N

gains 1 mark

else working

gains 1 mark

2

(c) friction/air resistance increases with speed;

till frictional = max forward force;

then force/acceleration is zero

for 1 mark each

alternative limitation for safety

gains 1 mark only

3

[7]

Q4.

(a) acceleration =

or

gains 1 mark

do not penalise if both of these present

but ‘change in’ omitted from formula

but

2.5

gains 2 marks

unit m/s2 or metres per second squared

or metres per second per second

or ms–\*

for 1 mark

3

(b) evidence of using area under graph or distance average speed × time

or

10 × 4 ×

gains 1 mark

but

20

gains 2 marks

units metres / m–2\*

for 1 mark

3

(c) force = mass × acceleration or 75 × 25

gains 1 mark

but

1875

gains 2 marks

\*NB Correct unit to be credited even if numerical answer wrong or absent.

2

[8]