

M1. (a) 450

*allow 1 mark for correct substitution,
ie $18 \times 10 \times 2.5$ provided no subsequent step shown*

2

- (b) (i) friction between child ('s clothing) and slide
*accept friction between two insulators
accept child rubs against the slide
accept when two insulators rub (together)*

1

causes electron / charge transfer (between child and slide)
*accept specific reference, eg electrons move onto / off the
child / slide
reference to positive electrons / protons / positive charge /
atoms transfer negates this mark
answers in terms of the slide being initially charged score
zero*

1

- (ii) all the charges (on the hair) are the same (polarity)
*accept (all) the charge/hair is negative / positive
accept it is positive/negative*

1

charges / hairs are repelling
both parts should be marked together

1

- (iii) charge would pass through the metal (to earth)
*accept metal is a conductor
accept metal is not an insulator
accept there is no charge / electron transfer
accept the slide is earthed
accept metals contain free electrons*

1

[7]

M2. (a) 572

allow 1 mark for correct substitution,

ie 220×2.6

allow 1 mark for

$220 \times 260 = 57\,200$

or

$220 \times 2600 = 572\,000$

but to score this mark the entire calculation must be shown

2

(b) (i) *smooth curve drawn*

accept a line that is extrapolated back to 0 degrees, but not through the origin

accept a straight line of best fit (point at 40 degrees can be treated as anomalous and line may stop at 30 degrees)

*do **not** accept straight lines drawn 'dot to dot' or directly from first to last point or a line going through the origin*

1

(ii) *increases*

accept a positive correlation

*do **not** accept proportional*

1

(iii) *long plank*

no mark for this, the marks are for the explanation

makes the angle small(er) (than a short plank)

accept increases the distance

accept small(er) slope

1

a small(er) force is needed or short plank

no mark for this, the marks are for the explanation

a large(r) force is used over a short(er) distance (1)

less work done (1)

accept less energy transfer

1

[6]

- M3.** (a) (i) 75 000
 accept correct substitution for **1** mark
 ie 7500×10 2
- newtons / N
 do **not** accept *n*
 full credit for using $g = 9.8$ **or** 9.81 1
- (ii) 60 000 000
 accept for both marks
 their (a)(i) $\times 800$ correctly calculated
 accept correct substitution for **1** mark
 ie their (a)(i) $\times 800$ 2
- (b) (i) arrow drawn parallel (to) **and** down (the) slope
 accept arrow drawn anywhere on the diagram 1
- (ii) increases 1
- GPE transformed to KE **or**
 speed increasing
 accept *is accelerating*
 however 'speed increasing' only scores if correctly linked to
 increasing kinetic energy 1
- (c) so more likely to wear one
or
 they know wearing a helmet is likely to / will reduce (risk) head injury
or
 so can make an (informed) choice (about wearing one) 1

[9]

M4. (a) (i) friction

1

- (ii) air resistance
accept drag
friction is insufficient

1

- (iii) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1–2 marks)

There is an attempt to explain in terms of forces A and B why the velocity of the cyclist changes between any two points

or

a description of how the velocity changes between any two points.

Level 2 (3–4 marks)

There is an explanation in terms of forces A and B of how the velocity changes between X and Y and between Y and Z

or

a complete description of how the velocity changes from X to Z.

or

an explanation and description of velocity change for either X to Y or Y to Z

Level 3 (5–6 marks)

There is a clear explanation in terms of forces A and B of how the velocity changes between X and Z

and

a description of the change in velocity between X and Z.

examples of the points made in the response

extra information

X to Y

- at X force A is greater than force B
- cyclist accelerates
- and velocity increases
- as cyclist moves toward Y, force B (air resistance) increases (with increasing velocity)
- resultant force decreases
- cyclist continues to accelerate but at a smaller value
- so velocity continues to increase but at a lower rate

Y to Z

- from Y to Z force B (air resistance) increases
- acceleration decreases
- force B becomes equal to force A
- resultant force is now zero
- acceleration becomes zero

- *velocity increases until...*
 - *cyclist travels at constant / terminal velocity*
- accept speed for velocity throughout*

6

(b) (i) 3360

*allow 1 mark for correct substitution,
ie 140×24 provided no subsequent step
accept 3400 for 2 marks if correct substitution is shown*

2

joule / J

*do not accept j
do not accept Nm*

1

(ii) *decreases*

*accept an alternative word / description for decrease
do not accept slows down*

1

temperature

*accept thermal energy
accept heat*

1

[13]

M5. (a) *gravitational / gravity / weight*
do not accept gravitational potential *1*

(b) *accelerating*
accept speed / velocity increases *1*

the distance between the drops increases *1*

but the time between the drops is the same
accept the time between drops is (always) 5 seconds
accept the drops fall at the same rate *1*

(c) (i) *any one from:*

- *speed / velocity*
- *(condition of) brakes / road surface / tyres*
- *weather (conditions)*
accept specific examples, eg wet / icy roads
accept mass / weight of car friction is insufficient
reference to any factor affecting thinking distance negates this answer

1

(ii) *75 000*
allow 1 mark for correct substitution, ie 3000×25 provided no subsequent step shown
or allow 1 mark for an answer 75 or allow 2 marks for 75 k(+ incorrect unit), eg 75 kN *2*

joules / J

do **not** accept *j*
an answer 75 kJ gains **3** marks
for full marks the unit and numerical answer must be
consistent

1
[8]

- M6.** (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 $80 \neq 65$ 1

*student 2 correct because average velocities similar
ecf from (c)(i)*

1

student 3 incorrect because times are different

1

[12]