

Work Done and Energy Transfer

Mark Scheme 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.5 Forces
Sub-Topic	Work Done and Energy Transfer
Difficulty Level	Silver Level
Booklet	Mark Scheme 1

Time Allowed: 60 minutes

Score: /60

Percentage: /100

Grade Boundaries:

M1.(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

	<ul style="list-style-type: none"> • 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]
M2.(a) (i)	<u>gravitational potential</u> (energy)		1
(ii)	<u>kinetic</u> (energy)		1
(b) (i)	slope or gradient		1
(ii)	<u>area</u> (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]

M3.(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]

M4. (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]

M5. (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]

M6. (a) (i) work (done) = force (applied) × distance (moved)
accept $W = F \times s$ or $W = F \times d$

accept  provided subsequent method is correct

1

(ii) 240 000

allow **1** mark for correct substitution **or** correct use of 1200
(N)

2

joules

accept J

do **not** accept j / Nm

1

(b) 800 (watts)

accept 0.8 kW

accept their (a)(ii) ÷ 300 correctly evaluated for **2** marks

allow **1** mark for correct substitution

(a)(ii) ÷ 5 correctly evaluated for **1** mark

2

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

- *needs to raise the chair / lift*
- *lifting more than one chair*
allow lifting more than 2 people
implication of a heavier weight
- *energy transfer to the surroundings*
correctly qualified
accept loss for transfer
*do **not** accept motor inefficient*
*do **not** accept motor gets hot*
*do **not** accept friction unless the location is specified as external to the motor*

1

(ii) *electrical*

accept electric

potential

***both** answers required for the mark*

1

[8]

M7. (a) *potential; bucket/pulley*
for 1 mark each

2

(b) 300

gains 2 marks

else working

gains 1 mark

2

[4]

