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	Gold Level
Booklet	Mark Scheme 1

Time Allowed: **57 minutes**

Score: **/57**

Percentage: **/100**

Grade Boundaries:

M1.(a) (i) 100 (m)

1

(ii) stationary

1

(iii) accelerating

1

(iv) tangent drawn at t = 45 s

1

attempt to determine slope

1

speed in the range 3.2 – 4.2 (m / s)
dependent on 1st marking point

1

(b) (i) 500 000 (J)
ignore negative sign

1

(ii) 20 000 (N)
ignore negative sign
*allow **1** mark for correct substitution, ie*
500 000 = F × 25
***or** their part (b)(i) = F × 25*
provided no subsequent step

2

(iii) *(kinetic) energy* transferred by heating

1

to the brakes

ignore references to sound energy

*if no other marks scored allow k.e. decreases for **1** mark*

1

[11]

M2.(a) (i) distance vehicle travels during driver's reaction time

accept distance vehicle travels while driver reacts

1

(ii) any **two** from:

- tiredness
- (drinking) alcohol
- (taking) drugs
- speed
- age

accept as an alternative factor distractions, eg using a mobile phone

2

(b) (i) 320 000

*allow **1** mark for correct substitution, ie* $\frac{1}{2} \times 1600 \times 20^2$ *provided no subsequent step shown*

2

(ii) 320000 **or** their (b)(i)

1

(iii) 40

or

$\frac{\text{their (b)(ii)}}{8000}$ correctly calculated

*allow **1** mark for statement work done = KE lost*

or

*allow **1** mark for correct substitution, ie*
*8000 × distance = 320 000 **or** their (b)(ii)*

2

(iv) any **one** from:

- icy / wet roads
  accept weather conditions
- (worn) tyres
- road surface
- mass (of car and passengers)
  accept number of passengers
- (efficiency / condition of the) brakes

1

(v) (work done by) friction
(between brakes and wheel)

*do **not** accept friction between road and tyres / wheels*

1

(causes) decrease in KE and increase in thermal energy

accept heat for thermal energy accept
KE transferred to thermal energy

1

(c) the battery needs recharging less often

accept car for battery

1

orincreases the range of the car

*accept less demand for other fuels **or** lower emissions **or***

lower fuel costs
environmentally friendly is insufficient

as the efficiency of the car is increased
accept it is energy efficient

1

the decrease in (kinetic) energy / work done charges the battery (up)
accept because not all work done / (kinetic) energy is wasted

1

[14]

M3. (a) (i) (connect) 30 (cells)

1

in series

1

(ii) current always flows in the same direction**or**current only flows one way

1

(iii) 36 000
*allow **1** mark for correctly converting 2 hours to 7200 seconds*
*answers 10 or 600 score **1** mark*

2

coulombs / C
*do **not** accept c*

1

(b) (i) 2160

*allow **1** mark for correct substitution, ie ½ × 120 × 6^2*
*answers of 1620 or 540 score **1** mark*

2

(ii) reduce it

1

*any **one** from:*

- *draws a larger current (from battery)*
- *motor draws greater power (from battery)*
  accept energy per second for power
  accept more energy needed to move the bicycle
- *greater resistance force (to motion) / air resistance / drag / friction*
  accept less streamlined
  more mass to carry is insufficient

1

[10]

M4. *(a) 47250*

*answers of 1350/ 33750/ 48600 gain **1** mark*
*allow **1** mark for correct substitution using both 18 and 3*

2

(b) (i) 47250 or their (a)

accept statement 'same as the KE (lost)'
ignore any units

1

(ii) transformed into heat/ thermal energy

sound on its own is insufficient
accept transferred/ lost/ for transformed
*do **not** accept any other form of energy included as a list*

1

[4]

M5. *(a)* *(i)* *a single force that has the same effect as all the forces combined*

accept all the forces added / the sum of the forces / overall force

1

(ii) *constant speed (in a straight line)*

*do **not** accept stationary*

***or** constant velocity*

1

(b) *3*

*allow **1** mark for correct substitution into transformed equation*
*accept answer 0.003 gains **1** mark*
*answer = 0.75 gains **1** mark*

2

m/s^2

1

(c) *as speed increases air resistance increases*

accept drag / friction for air resistance

1

reducing the resultant force

1

[7]

M6. *(a)* *concentration / tiredness / drugs / alcohol*

accept any reasonable factor that could affect a driver's

reactions

*do **not** accept speed or any physical condition unrelated to the driver*

1

(b) *31.25*

*credit for **1** mark correct attempt to calculate the area under the slope **or** for using the equation*
distance = average velocity (speed) × time

*credit for **1** mark use of correct velocity change (12.5) and correct time (5) **or** answer of 62.5*

3

(c) *2.5*

*credit for **1** mark triangle drawn on slope **or** correct equation **or** two correct pairs of coordinates*

credit for 1 mark use of correct velocity change (12.5) and correct time (5)
accept time = between 4.8 and 5.2 if used in (b)

do not accept an attempt using one pair of coordinates taken from the slope

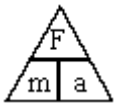
3

*metres / second / second **or** metres / second / squared **or** m/s^2 **or** ms^{-2}*

1

(d) *(i)* *force = mass × acceleration*

accept correct transformation
accept F = m × a

accept 

provided subsequent use of Δ is correct

*do **not** accept an equation in units*

1

(ii) *2250*

credit their (c) × 900 for 2 marks

*credit **1** mark for correct substitution*

2

[11]