M1. (a) It will have a constant speed.

1

(b) distance travelled = speed × time

1

(c) $a = \frac{18 - 9}{6}$

1

a = 1.5

*allow 1.5 with no working shown for **2** marks*

1

(d) resultant force = mass × acceleration

1

(e) F = (1120+80) × 1.5

1

F = 1800 (N)

*allow 1800 with no working shown for **2** marks*

1

*accept their 10.3 × 1200 correctly calculated for **2** marks*

(f) $18^2 - 9^2 = 2 \times 1.5 \times s$

1

$s = 18^2 - 9^2 / 2 \times 1.5$

1

s = 81 (m)

1

*allow 81 (m) with no working shown for **3** marks*

*accept answer using their 10.3 (if not 1.5) correctly calculated for **3** marks*

(g) **Level 2 (3–4 marks):**
A detailed and coherent explanation is provided. The response makes logical links between clearly identified, relevant points that include references to the numerical factor.

Level 1 (1–2 marks):
Simple statements are made. The response may fail to make logical links between the points raised.

0 marks:
No relevant content.

Indicative content

- doubling speed increase the kinetic energy
- kinetic energy increases by a factor of 4
- work done (by brakes) to stop the car increases
- work done increases by a factor of 4
- work done is force × distance and braking force is constant
- so if work done increases by 4 then the braking distance must increase by 4

4

[14]

M2. (a) (i) kinetic (energy)

allow gravitational potential (energy) / gpe

movement is insufficient

1

(ii) dissipates into the surroundings

allow warms up the surroundings / air / motor

accept lost to the surroundings

accept lost as heat

ignore reference to sound

it is lost is insufficient

1

(b) energy (required) increases with load

accept positive correlation

*do **not** accept (directly) proportional*

1

further amplification eg increases slowly at first (or up to 4 / 5 N), then increases rapidly

simply quoting figures is insufficient

an answer that only describes the shape of the line gains no marks

1

(c) (i) $E = P \times t$

2880

*accept £28.80 for all **3** marks*

*an answer £2880 gains **2** marks*

*allow **1** mark for obtaining 48 h **or** converting to kW*

*allow **2** marks for correct substitution*

ie 4 × 48 × 15

note: this substitution may be shown as two steps

*an answer 2 880 000 gains **2** marks*

*an answer £4.80 / 480 gains **2** marks*

*an answer of 192 (ie calculation of energy without subsequent calculation of cost) gains **1** mark)*

3

(ii) any sensible suggestion eg

conserves fossil fuels

less (fossil) fuels burned

less pollutant gas (produced)
accept a named pollutant gas

less greenhouse gas (produced)
saves energy is insufficient

1

[8]