1. Description of motion:

AB: uniform acceleration OR vincreases at constant rate **(1)**

[**Not** accelerates constantly]

BC: sudden deceleration OR slows down/stops rapidly **(1)**

2

Explanation of cause of motion:

AB: Attraction to positive/power supply/the voltage/energy of supply/(electric) force from supply OR electric field (in wire) **(1)**

BC: collision with ion/atom/electron/nucleus/lattice **(1)**

2

Explanation of term *drift velocity:*

Drift velocity: average mean/net/overall velocity of electron along wire **(1)**

[**Not** speed]

Value shown on graph (allow between 1/3 and 2/3 of maximum velocity) **(1)**

[Line or mark on graph axis, label not needed if only one line/mark]

2

Explanation of why wire gets warm:

Collision makes ion/atom vibrate more vigorously

OR in collision energy is transferred to lattice **(1)**

1

[7]

2. t = 2.1s 1

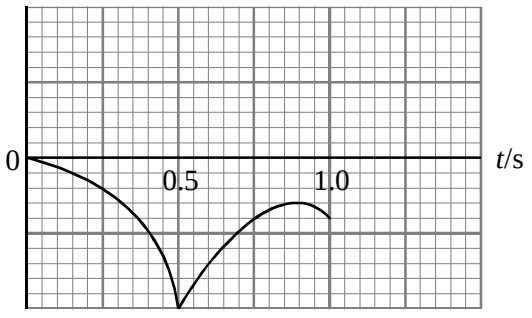
Represents acceleration of the ball

Force on ball *or* gravitational field strength
or acceleration is constant *or* uniform 2

Relevant equation *or* correct area

Substitution correct 2

Displacement /m



Displacement scale as shown above
First half of curve correct
Second half correct with reduced height 3

–1.25 m (correct magnitude *and* direction)
[Look at candidate 's displacement origin] 1

[9]

3. Gradient

Use a gradient or use of $\upsilon = u + at$ **(1)**

10 (either no unit or m s^{-2}) **(1)**

[A bare answer of 9.8 gets no marks; A bare answer of 10 gets 2 marks]

Significance

It is the acceleration (due to gravity) or close to g **(1)** 3

Ball at point A

It hit the floor/bounces/(idea of collision with floor) **(1)** 1

Calculation of height of window above ground

An area / quote an equation of motion **(1)**

Put in relevant numbers for large triangle / correct substitution
[ecf from first part, or use of 9.8] **(1)**

45 m [accept 44 to 46] **(1)** 3

[7]

4. (i) Distance travelled

Attempt to find area under curve/use of suitable equations **(1)**

Distance = 300 m **(1)**

(ii) Averape speed

Use of total distance/20 **(1)**

Average speed = 15 m s^{-1} [e.c.f. distance above] **(1)**

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5. Average deceleration

Select $\upsilon^2 = u^2 + 2ax$, ½ m $\upsilon^2 = Fx$ and $F = ma$ OR equations of motion **(1)**

Correct substitutions of 40 m and 25 m s^{-1} **(1)**

a = 7.8 m s^{-2} [If a = –7.8 m s^{-2} → 2/3] **(1)** 3

Depth of sand and stopping distance

More sand ⇒ shorter stopping distance/stops more quickly/slows down faster **Because** lorry sinks further/ bigger resisting force / bigger friction force **(1)** 1

[4]

6. Deceleration of cars

Acceleration = gradient / suitable eqn. of motion. **(1)**

Correct substitutions [0.9 for t is wrong] **(1)**

6.1 – 6.3 m s^{-2} [-ve value –1] [no ecf] **(1)** 3

Area under velocity-time graph

Distance/displacement **(1)** 1

Shaded area

6.9 – 7.5 **(1)**

m **(1)** 2

[Allow **1** mark for 5.5 – 6.1 cm^2.]

Minimum value of the initial separation

Same as above [ecf] **(1)**

Area is the extra distance car B travels/how much closer they get **(1)** 2

Graph

Both sloping lines continued down to time axis [by eye] **(1)** 1

Explanation

Area between graphs is larger/B travels faster for longer/B still moving when A stops **(1)**

Extra distance B goes is larger/ > '7.2' **(1)**

Initial separation must be greater **(1)** Max 2

[11]

7. Maximum velocity

Area = 100 m **(1)**

Attempt to find area of trapezium by correct method **(1)**

υ = 10 m s^{-1} **(1)** 3

Sketch graph

Horizontal line parallel to x axis

Some indication that acceleration becomes 0 m s^{-2}

The initial acceleration labelled to be $\upsilon_{max} \div 2$ [initial a = 5 (m s^{-2}) **(1)** (ecf)]

t = 2 (s) where graph shape changes **(1)** 4

[7]