This memorandum consists of 6 pages.
QUESTION 1
1.1. B √√
1.2. B √√
1.3. A √√
1.4. A √√
1.5. B √√
1.6. C √√

QUESTION 2
2.1.1 Starts from rest/0 m·s⁻¹ ✓
Velocity increases at a constant rate ✓
until he reaches 2,5 m·s⁻¹ after 25 s. ✓
OR
Starts from rest/0 m·s⁻¹ ✓
Constant positive acceleration ✓
until he reaches 2,5 m·s⁻¹ after 25 s. ✓

2.1.2 Constant/uniform velocity ✓
for another 25 s. ✓
OR
Zero/No acceleration ✓
for another 25 s. ✓

2.2.1 acceleration = \frac{\Delta v}{\Delta t} ✓
= \frac{2.5}{100-80} ✓
= -0.0625

a = 0.063 m·s⁻² ✓ opposite to direction of motion ✓

2.2.2 Length of track = Area between the graph and the time axis ✓
= \frac{1}{2} (2.5) ✓ (35+100) ✓
= 168.75 m ✓

OR
Length of track = Area of trapezium ✓
= \frac{1}{2} (2.5) ✓ (35+100) ✓
= 168.75 m ✓

OR
Length of track = Area between the graph and the time axis
= \frac{1}{2} bh + \frac{1}{2} bh + lb
= \frac{1}{2} (2.5) ✓ + \frac{1}{2} (40)(2.5) ✓ + (35)(2.5) ✓
= 31.2 + 87.5 + 50
= 168.75 m ✓

(4)

(3)

(2)

(4)

[13]
QUESTION 3

3.1 To compensate for friction √√

Or

To ensure √ that the trolley moves at a constant acceleration √ (2)

3.2.1 Time √√ (2)
3.2.2 Displacement √√ (2)

3.3 Position – Time Graph

Graph Marking Criteria

- Suitable heading √
- Appropriate scale on both axes √
- Any three points plotted correctly √
- All six points plotted correctly √
- Curve joining the points √

(5)

3.4 Uniformly accelerated motion √
The gradient of the graph increases constantly √ OR (the velocity increases constantly each 0.2 s) √ (2)

[13]
QUESTION 4
4.1.1 Acceleration ✔ ✔ (2)
4.1.2 Straight line ✔ ✔ (2)

4.2
15 m.s\(^{-1}\) = (60) \left(\frac{3600}{1000}\right) ✔ km.h\(^{-1}\) = 54 km.h\(^{-1}\) ✔ < 60 km.h\(^{-1}\)  
No ✔ / He did not

Or

60 km.h\(^{-1}\) = (60) \left(\frac{1000}{3600}\right) ✔ m.s\(^{-1}\) = 16.67 m.s\(^{-1}\) ✔ > 15 m.s\(^{-1}\)  
No ✔ / he did not (3)

4.3

<table>
<thead>
<tr>
<th>Option 1</th>
</tr>
</thead>
</table>
| \(\Delta x = v_i \Delta t\) ✔  
| = 15(1) ✔  
| = 15 m.s\(^{-1}\) ✔  |

<table>
<thead>
<tr>
<th>Option 2</th>
</tr>
</thead>
</table>
| \(\Delta x = v_i \Delta t + \frac{1}{2}a\Delta t^2\) ✔  
| \(\Delta x = 15(1) + \frac{1}{2}(0)(1)^2\) ✔  
| = 15 m ✔  |

<table>
<thead>
<tr>
<th>Option 3</th>
</tr>
</thead>
</table>
| \(\Delta x = \frac{(v_f+v_i)}{2} \Delta t\) ✔  
| \(\Delta x = \frac{(15+15)}{2}(1)\) ✔  
| = 15 m.s\(^{-1}\) ✔  |

4.4. Braking distance

\[\Delta x = \frac{(v_f+v_i)}{2} \Delta t\] ✔
\[\Delta x = \frac{(0+15)}{2}\] ✔ (3) ✔
\[= 22.5 m\]

Total stopping distance = 22.5 + 15 ✔
\[= 37.5 m\] ✔

Yes ✔ / he will stop the pedestrian crossing. (6)

4.5. Increases ✔, for the same change in velocity ✔ the stopping time will increase ✔

[17]
QUESTION 5 (Start on a new page.)

5.1 No free electrons √√
5.2 Electrolyte √√
5.3 \( NH_4^+ \) and \( NO_3^- \) √√

<table>
<thead>
<tr>
<th>OPTION 1</th>
<th>OPTION 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n(NH_4NO_3) = \frac{m}{M} = \frac{15}{80} = 0.19 \text{ mol} )</td>
<td>( c(NH_4NO_3) = \frac{m}{MV} = \frac{15}{80(250 \times 10^{-3})} = 0.75 \text{ mol dm}^{-3} )</td>
</tr>
<tr>
<td>( c(NH_4NO_3) = \frac{n}{V} = \frac{0.19}{250 \times 10^{-3}} = 0.75 \text{ mol dm}^{-3} )</td>
<td>(5)</td>
</tr>
</tbody>
</table>

[11]

QUESTION 6 (Start on a new page.)

6.1
6.1.1 Barium sulphate √; \( BaSO_4 \) √
6.1.2 To ensure that the precipitate is indeed a sulphate √√/ Barium sulphate is insoluble in nitric acid √√
6.1.3 B √√

6.2
6.2.1 \( BaCl_2(aq) + MgSO_4(aq) \rightarrow BaSO_4(s) + MgCl_2(aq) \) bal √ phases √
6.2.2 Precipitation reaction √√

QUESTION 7 (Start on a new page.)

7.1
7.1.1 \( n(Mg) = \frac{m}{M} \)
\[ = \frac{15}{24} = 0.625 \text{ mol} \]
\[ n(H_2) = nMg = 0.0625 \text{ mol} \]
\[ m(H_2) = nM \]
\[ = (0.0625)(2) = 0.125 \text{ g} \]

Page 5 of 6
7.1.2 \( n(H_2) = \frac{V}{V_m} \)

\[ 0.0625 \checkmark = \frac{V}{22.4} \checkmark \]

\[ V = 1.4 \, dm^{-3} \checkmark \] \hfill (3)

7.1.3 \( n(MgCl_2) = \frac{m}{M} \checkmark \)

\[ 0.0625 \checkmark = \frac{m}{95} \checkmark \]

\[ m = 5.95 \, g \checkmark \] \hfill (4)

7.1.4 \( n(Cl) = \frac{N}{N_A} \checkmark \)

\[ 2(0.0625) = \frac{N}{6.02 \times 10^{23}} \checkmark \]

\[ N \ (Cl \ atoms) = 7.53 \times 10^{22} \checkmark \] \hfill (3)

7.2

7.2.1 The formula which gives the simplest whole number ratio in the compound \( \checkmark \checkmark \) \hfill (2)

7.2.2 In 100 g of compound

\[ 71.65 \, g \ Cl, \ 24.27 \, g \ C \ and \ 4.07 \, g \ H \]

\[ n(Cl) = \frac{71.65}{35.5} = 2.02 \, mol \checkmark \]

\[ n(C) = \frac{24.27}{12} = 2.02 \, mol \checkmark \]

\[ n(H) = \frac{4.07}{1} = 4.07 \, mol \checkmark \]

Whole number ratio

\[ \frac{2.02}{2.02} : \frac{2.02}{2.02} : \frac{4.07}{2.02} \checkmark \]

\[ C : Cl : H = 1:2:1 \]

Empirical formula is \( CH_2Cl \) \checkmark \hfill (5)

[22]

TOTAL MARKS: 100