Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable answers	Additional guidance	Mark
	An explanation that makes reference to the following points: Observation 1 • (the fraction of alpha scattering is less for aluminium) so the force of repulsion is less (at a given distance) **(1)** • therefore the charge on an aluminium nucleus is less than on gold nucleus **(1)** Observation 2 • (the E_k is less for scattered alpha for aluminium) so recoiling nucleus must have some/more kinetic energy **(1)** • The mass of an aluminium nucleus is less than mass of a gold nucleus **(1)**		**4**

Q2.

<table>
<tr><th>Question Number</th><th>Acceptable Answer</th><th>Additional Guidance</th><th></th></tr>
<tr><td></td><td>
This question assesses a student's ability to show a coherent and logically structured answer with linkages and fully sustained reasoning.

Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning.

The table shows how the marks should be awarded for indicative content and lines of reasoning.

<table>
<tr><th>IC points</th><th>IC mark</th><th>Max linkage mark available</th><th>Max final mark</th></tr>
<tr><td>6</td><td>4</td><td>2</td><td>6</td></tr>
<tr><td>5</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td>4</td><td>3</td><td>1</td><td>4</td></tr>
<tr><td>3</td><td>2</td><td>1</td><td>3</td></tr>
<tr><td>2</td><td>2</td><td>0</td><td>2</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>
</td><td>
<table>
<tr><th></th><th>Number of marks awarded for structure of answer and sustained line of reasoning</th></tr>
<tr><td>Answer shows a coherent and logical structure with linkage and fully sustained lines of reasoning demonstrated throughout</td><td>2</td></tr>
<tr><td>Answer is partially structured with some linkages and lines of reasoning</td><td>1</td></tr>
<tr><td>Answer has no linkages between its points and is unstructured</td><td>0</td></tr>
</table>
</td><td></td></tr>
<tr><td></td><td>
Indicative content:
• (Collision takes place on an ice surface so) there is minimal friction Or External forces are negligible

• Momentum is conserved in the collision

• The momentum of stone A before the collision equals the momentum of (A and) B after the collision

• Stone A must be at rest after the collision

• All of the kinetic energy of stone A must have been transferred to stone B

• Kinetic energy is conserved in an elastic collision
</td><td></td><td>6</td></tr>
</table>

Q3.

Question Number	Answer	Mark
*	(QWC – Work must be clear and organised in a logical manner using technical wording where appropriate) statement that indicates that the conservation of momentum does apply (1) the idea that the probe and tank move in opposite directions [accept move apart] **Or** the idea that the probe and tank experience equal and opposite forces (1) Probe and tank experience equal **changes** in momentum (in opposite directions) (1) Statement that indicates that (total) energy is conserved (1) Kinetic energy of the system increases (so speed increases) (1) (Some) chemical energy converted to KE (1)	6
	Total for question	**6**

Q4.

Question number	Acceptable answers	Additional guidance	Mark
(i)	• Use of ½ $mv^2 = mgh$ **(1)** • $v = 2.43$ m s^{-1} **(1)**	Example of calculation: $v = \sqrt{2gh} = \sqrt{2 \times 9.81 \times 0.30} = 2.43$ m s^{-1}	**2**
(ii)	• Use of impulse = change in momentum **(1)** • Recognises initial velocity is zero **(1)** • Hence $F = 0.923$ N **(1)** • Use of $l = \pi d$ **(1)** • Equates calculated value of F with BIl **(1)** • Hence I = 191 A **(1)**	Example of calculation: $Ft = mv - mu$ where $u = 0$ So $F = (0.019 \text{ kg} \times 2.43 \text{ m s}^{-1})/0.05 \text{ s} = 0.923$ N $l = \pi \times 0.048 \text{ m} = 0.151$ m $I = 0.923 \text{ N}/(0.032 \text{ T} \times 0.151 \text{ m}) = 191$ A	**6**