<table>
<tr><th colspan="3">Question</th><th>Marking details</th><th>Mark</th></tr>
<tr><td>1.</td><td>(a)</td><td></td><td>correct shape with no lines crossing & 2 lines minimum (1 on the top and 1 on the bottom ignore the middle) (1) direction (1)</td><td>2</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>stronger / accept more lines / bigger / increases</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>stronger / accept more lines / bigger / increases</td><td>1</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>reverses direction / opposite direction / goes the other way</td><td>1</td></tr>
<tr><td></td><td></td><td></td><td>Question total</td><td>[5]</td></tr>
<tr><td>2.</td><td>(a)</td><td></td><td>current, primary, magnetic, core / primary, secondary. [5 x 1]</td><td>5</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>100 turns</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>IC = 100 (1) OC = 1 000 (1) (allow 1 mark for any combination that increases voltage)</td><td>2</td></tr>
<tr><td></td><td></td><td></td><td>Question total</td><td>[8]</td></tr>
<tr><td>3.</td><td>(a)</td><td>(i)</td><td>Reasonably straight line joining to C (arrowhead not required)</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>X between incident ray and normal</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><th></th><th>Medium 2</th><th>Angle of incidence</th><th>What happens to the ray of light at the boundary?</th></tr>
<tr><td></td><td>Air</td><td>35^o</td><td>Refracts (1)</td></tr>
<tr><td></td><td>Glass</td><td>42^o</td><td>Refracts (1)</td></tr>
<tr><td></td><td>Air</td><td>42^o</td><td>Travel along the boundary (1)</td></tr>
<tr><td></td><td>Air</td><td>45^o</td><td>TIR (1)</td></tr>
</table>
</td><td>4</td></tr>
<tr><td></td><td></td><td></td><td>Question total</td><td>[6]</td></tr>
<tr><td>4.</td><td>(a)</td><td>(i)</td><td>Surface waves travel on surface / P & S waves travel through Earth</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>particle vibrations / oscillations (1) parallel/same direction as travel for P wave and at right angles for S wave (1) (accept up and down / back and for)</td><td>2</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>3 (1) only P waves detected / no S waves accept longest time (1)</td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>2 (1) Y is further away/greater distance to travel (1) so waves would arrive later (1) Either mark can be awarded on its own but only award 2 marks if they are linked. (Accept middle value distance and middle time.)</td><td>3</td></tr>
<tr><td></td><td></td><td></td><td>Question total</td><td>[8]</td></tr>
</table>

Question			Marking details	Mark
5.	(a)	(i)	accept any value between 5 500 and 6 500 K inclusive	1
		(ii)	[ACB is] smaller/cooler or lower temperature/dimmer or converse if referring to Sun but must be clear referring to Sun [any 2 x 1]	2
		(iii)	Both main sequence stars (accept balanced forces)	1
	(b)	(i)	radiation pressure/outward force becomes greater than gravitational force / inward force N.B. must compare the both. Unbalanced forces must be qualified.	1
		(ii)	becomes larger / expands, brighter, cooler / redder [3 x 1] Award marks if appropriate values for the properties given.	3
	(c)		X marked near white dwarf section	1
			Question total	**[9]**
6.	(a)		If no external / outside force acts (1) the total momentum remains constant /stays the same / is conserved **or** momentum before [collison/explosion] equals momentum after (1)	2
	(b)	(i)	15 x 800 (1) = 12 000 [kg m/s] (1)	2
		(ii)	Subs 12 000 or **ecf (**1) subs 1 600 kg (1) ans = 7.5 [m/s] (1)	3
		(iii)	16 000 [N] (1) to the left (1) Award 2 marks for -16 000 **or** equal and opposite force	2
	(c)	(i)	0	1
		(ii)	equal and opposite momentum (1) so total momentum is zero (1) **Either mark can be awarded on its own but only award 2 marks if they are linked.** Award 1 mark only for momentum to the right cancels momentum to the left unless linked to 1 of the other marking points.	2
			Question total	**[12]**

Question			Marking details	Mark
7.	(a)	(i)	Plots ± ½ small square division (2), curve (1)	3
		(ii)	As the volume increases, the pressure decreases (1) in a non-linear way / decreasing rate (1) (inversely proportional / as volume doubles the pressure is halved award both marks)	2
		(iii)	Around 67 000 (**take the value that occurs from their line** ± 500)	1
	(b)		Indicative content: As the volume increases, the molecules have further to travel between collisions with the container therefore they take a longer time to travel so the rate of change of momentum is reduced. This reduces the force from any one molecule when in collision with the walls. Since pressure = force / area, the decrease in the force gives a reason for a decrease in pressure / increase in area causes pressure. **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit. **Question total**	6 **[12]**
			Foundation tier paper total	**[60]**