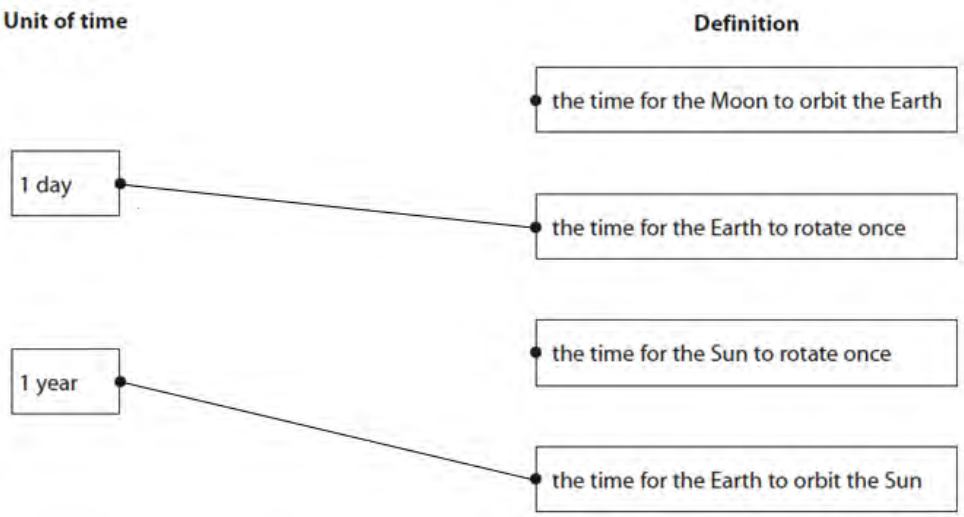
Question number	Answer	Notes	Marks
1 (a)	Universe; galaxy Solar System;	 allow named galaxy e.g. Milky Way	3
(b) (i)	A; B is incorrect because it is further from the Sun and speed decreases with distance C is incorrect because it is further from the Sun and speed decreases with distance D is incorrect because it is further from the Sun and speed decreases with distance		1
(ii)	gravity;	allow gravitational force, gravitational pull reject gravitational potential, gravitational field strength, *g*	1
(c)	one mark for each correct line;;	-1 for each additional line	2



Total for Question 1 = 7 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td>all three correct ticks = 3 marks;;;
two correct ticks = 2 marks;;
one correct tick = 1 mark;

<table><tr><th>Statement</th><th>Correct (✓)</th></tr><tr><td>uranium-235 loses a proton to become uranium-236</td><td></td></tr><tr><td>uranium-235 absorbs a neutron to become uranium-236</td><td>✓</td></tr><tr><td>daughter cells are produced when uranium-236 splits</td><td></td></tr><tr><td>the nuclear energy store of uranium-236 increases when it splits</td><td></td></tr><tr><td>two or three neutrons are typically released when uranium-236 splits</td><td>✓</td></tr><tr><td>energy is transferred to the kinetic store of the fission products when uranium-236 splits</td><td>✓</td></tr></table></td><td>-1 for 4 ticks
-2 for 5 ticks
0 marks if all ticked</td><td>3</td></tr>
<tr><td>(b)</td><td>neutron / n / neutrons;</td><td></td><td>1</td></tr>
<tr><td>(c)</td><td>B (a helium nucleus);

A is incorrect because this describes gamma radiation
C is incorrect because this describes beta radiation
D is incorrect because this describes neutron radiation</td><td></td><td>1</td></tr>
<tr><td>(d)</td><td>beta (minus);</td><td>accept β, β^-
reject beta plus</td><td>1</td></tr>
</table>

Total for Question 2 = 6 marks

Question number	Answer	Notes	Marks
3 (a) (i)	(average) speed = distance / time;	allow standard symbols and rearrangements e.g. v = s/t allow s for speed and d for distance	1
(ii)	substitution; evaluation; e.g. (speed =) 1860 / 5.6 (speed =) 330(m/s)	 allow 332.14…(m/s)	2
(iii)	light travels faster than sound; he sees explosion before hearing it;	allow idea that they travel at different speeds but not that sound travels faster Allow RA	2
(b)	vibrations (of particles) are parallel; to direction the wave travels;	allow oscillations for vibrations DOP allow direction of energy transfer	2
(c) (i)	kinetic energy = ½ × mass × speed^2;	allow standard symbols and rearrangements e.g. KE = ½ × m × v^2	1
(ii)	substitution; evaluation; e.g. (KE =) $0.5 \times 1.25 \times 10^7 \times 19200^2$ (KE =) 2.30×10^{15} (J)	 -1 for POT error allow 2.304×10^{15} (J)	2

Total for Question 3 = 10 marks

Question number	Answer	Notes	Marks
6 (a)	using a balance; suitable method to subtract mass of container;	ignore weighing scales / scales e.g. • measure mass of similar empty container and subtract • place another container on balance and press zero then pour liquid into this container	2
(b)	any two from: MP1. measuring cylinder placed on horizontal surface; MP2. reading taken from bottom of meniscus/eq; MP3. reading taken at eye level (to avoid parallax); MP4. wait for all liquid to run down the sides of the measuring cylinder; MP5. ensure measuring cylinder is empty before use;	ignore idea of 'repeat and average' condone 'flat surface'	2
(c)	use of density formula; evaluation of density of liquid; liquid is sunflower oil; e.g. density = 150 / 163 density = 0.92 (g/cm^3) closest to sunflower oil => liquid is sunflower oil	unsupported correct conclusion scores 1 mark only	3

Total for Question 6 = 7 marks

Question number	Answer	Notes	Marks
13 (a) (i)	358 (K);		1
(ii)	idea that speed / KE increases; **mean** speed / **mean** KE increases;	allow average for mean	2
(iii)	number of molecules decreases;	however expressed	1
(b)	any four from: MP1. air in flask cools; MP2. molecules in flask slow down/<u>kinetic</u> energy of molecules reduces; MP3. pressure inside flask decreases (as temperature decreases); MP4. pressure outside flask greater than inside/eq; MP5. resultant force (from air) pushes egg down the neck of the flask; MP6. volume of air in flask decreases as the egg moves down; MP7. (so) pressure inside flask increases (as volume decreases); MP8. (eventually) pressure inside and outside balance; MP9. (so) resultant force is now zero (so egg stops moving down);	allow 'stretches egg' allow higher level arguments including weight of egg, friction with neck, etc	4

Total for Question 13 = 8 marks