Name of the Student:_____
Max. Marks : 25 Marks **Time : 25 Minutes**

Mark Schemes

Q1.

Question Number	Answer		Mark
(a)(i)	Resonance / resonating / resonates	**(1)**	**1**
(a)(ii)	Loudspeaker/driving frequency close or equal to its natural frequency	**(1)**	
	so energy transfer is maximised/large **Or** energy transfer is very efficient	**(1)**	**2**
(b)	Idea that energy would be transferred (from the glass) to the rubber band (as it deforms) **Or** work is done on the rubber band (by the glass)	**(1)**	
	Some of the (transferred) energy becomes internal energy of rubber band **Or** some of the (transferred) energy is dissipated in the rubber band	**(1)**	**2**
	Total for Question		**5**

Q2.

Question Number	Answer		Mark
	MAX 3		
	Curve A:		
	The system has a maximum amplitude at a particular frequency	(1)	
	This is an example of resonance	(1)	
	Resonance occurs when the forcing frequency is at (or near to) the natural frequency of the system	(1)	
	At resonance there is an efficient/maximum transfer of energy (to the mass-spring system)	(1)	
	MAX 3		
	Curve B:		
	B has a smaller amplitude than A (for a wide range of frequencies)	(1)	
	The modified system has (greater) damping	(1)	
	Energy is being removed from the system	(1)	
	The frequency at which resonance occurs is lower for the damped system	(1)	**4**
	Total for question		**4**

Q3.

Question Number	Acceptable answers	Additional guidance	Mark
*	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 following table shows how the marks should be awarded for indicative content.	Guidance on how the mark scheme should be applied: The mark for indicative content should be added to the mark for lines of reasoning. For example, an answer with five indicative marking points which is partially structured with some linkages and lines of reasoning scores 4 marks (3 marks for indicative content and 1 mark for partial structure and some linkages and lines of reasoning). If there are no linkages between points, the same five indicative marking points would yield an overall score of 3 marks (3 marks for indicative content and no marks for linkages).	

Number of indicative marking points seen in answer	Number of marks awarded for indicative marking points	Max linkage mark available	Max final mark
6	4	2	6
5	3	2	5
4	3	1	4
3	2	1	3
2	2	0	2
1	1	0	1
0	0	0	0

	The following table shows how the marks should be awarded for structure and lines of reasoning. **Indicative content** • 720 Hz is the natural frequency of the bowl • The generator/hand causes forced/driven oscillations • When they don't match the natural frequency they are quiet because little/less energy is transferred • The loudness (at 720 Hz) is because of resonance		6

	• (Resonance occurs when) the driving frequency is equal/similar to the natural frequency • (When resonance occurs) there is maximum transfer of energy so the amplitude is maximum **Or** (When resonance occurs) there is maximum transfer of energy so the amplitude increases	Do not accept 'resonant frequency' for 'natural frequency'	

Number of marks awarded for structure of answer and sustained line of reasoning
Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout — 2
Answer is partially structured with some linkages and lines of reasoning — 1
Answer has no linkages between points and is unstructured — 0

Q4.

Question Number	Answer		Mark
(a)	Force (or acceleration): • proportional to displacement from equilibrium/undisplaced/rest position	(1)	
	• always acting towards the equilibrium/undisplaced/rest position **Or** always in the opposite direction to the displacement	(1)	2
(b)(i)	Acceleration is a maximum at an extreme position (towards X) Acceleration decreases to zero at X	(1) (1)	2
(b)(ii)	**Max 3** Total energy remains constant	(1)	
	(Elastic) potential energy is transferred to kinetic energy as string moves towards X	(1)	
	Kinetic energy is zero at an extreme position and a maximum at X	(1)	
	(Elastic) potential energy is a maximum at an extreme position and a minimum at X	(1)	3
(c)	Use of $\lambda = 2l$ Use of $v = f\lambda$ $f = 250$ Hz	(1) (1) (1)	3
	<u>Example of calculation:</u> $\lambda = 2 \times 0.53\ m = 1.06\ m$ $f = v/\lambda = 270\ m\ s^{-1}/1.06\ m = 254.7\ Hz$		
	Total for question		10