

3 (a) State what is meant by

- (i) *free oscillations*,

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[1]

- (ii) *damped oscillations*, and

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[1]

- (ii) *forced oscillations*.

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[1]

(b) Passenger cars consist of many components attached to a main chassis. A particular component of mass 0.046 kg rattles when the car is in operation. Fig. 3.1 shows the variation of the amplitude of the rattle with external frequency.

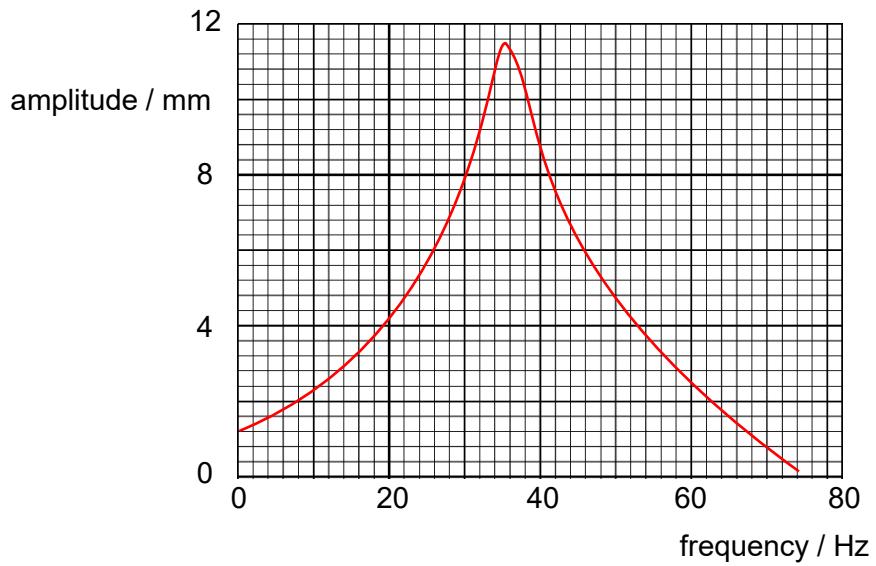


Fig. 3.1

- (i) Explain why there is a *resonance* peak at 35 Hz frequency.

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..... [2]

- (ii) Determine the total energy stored in the component when it is rattling at 35 Hz frequency.

total energy = J [2]

- (iii) On Fig. 3.1, sketch the variation of the amplitude of rattle with frequency if the component is attached to the main car chassis through a rubber mount.

Label your sketch P. [1]

- (c) Modern vehicles deploy suspension systems to reduce the discomfort experienced by passengers as the vehicles drive over vertical irregularities on the road. The suspension systems typically provide near-critical damping.

- (i) Explain what is meant by *critical damping*.

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..... [1]

- (ii) On Fig. 3.1, sketch the variation of the amplitude of rattle with frequency if the

component

is critically damped.

Label your sketch Q.

[1]

[Total: 10]