SL Paper 1

A force that varies sinusoidally is applied to a system that is lightly damped. Which of the following must be true of the force for resonance to occur?

A. It must always be in anti-phase with the oscillations of the system.

B. Its direction must always be in the direction of motion of the oscillations of the system.

C. Its frequency must be equal to the frequency of oscillation of the system.

D. Its amplitude must be equal to the amplitude of oscillation of the system.

Markscheme

C

Examiners report

[N/A]

The effects of resonance should be avoided in

A. quartz oscillators.

B. vibrations in machinery.

C. microwave generators.

D. musical instruments.

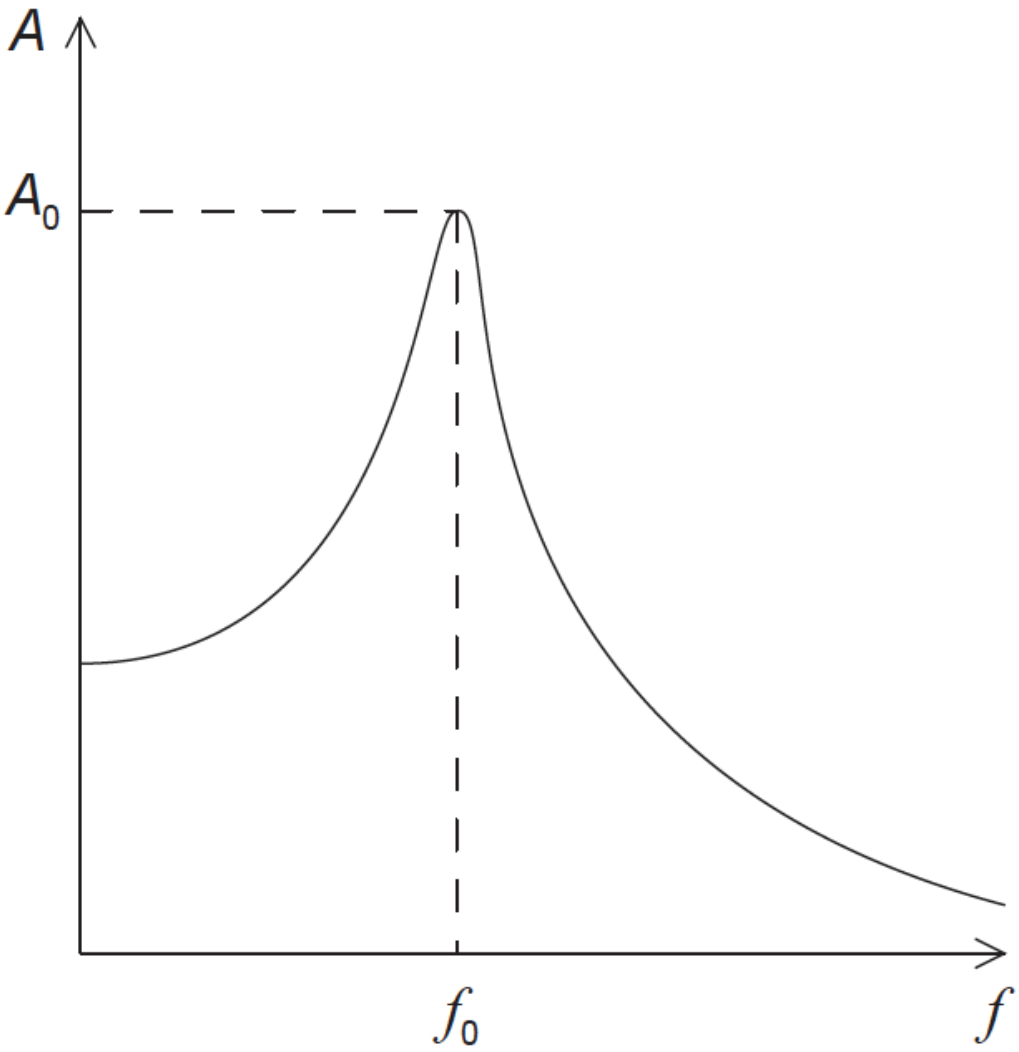
Markscheme

B

Examiners report

[N/A]

A periodic driving force of frequency f acts on a system which undergoes forced oscillations of amplitude A. The graph below shows the variation with f of A. The maximum amplitude A_0 of the oscillations occurs at frequency f_0.



The damping of the system is now increased.
Which describes the change in f_0 and the change in A_0?

	f_0	A_0
A.	decrease	increase
B.	decrease	decrease
C.	increase	increase
D.	increase	decrease

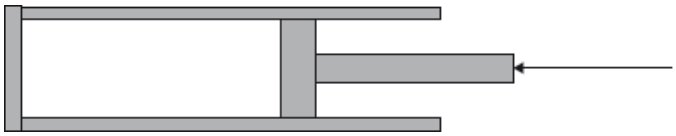
Markscheme

B

Examiners report

[N/A]

A gas is contained in a cylinder by a piston.



The gas is compressed rapidly by moving the piston in the direction shown. The best explanation for the resulting increase in temperature of the gas is that the molecules of the gas gain kinetic energy

A. from the moving piston.

B. by colliding more frequently with each other.

C. by being pushed closer together.

D. by colliding more frequently with the walls of the cylinder.

Markscheme

A

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[N/A]

In which of the following systems is it desirable that damping should be as small as possible?

A. Suspension bridge

B. Quartz oscillator

C. Car suspension

D. Airplane/aeroplane wing

Markscheme

B

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The quartz oscillator is explicitly mentioned in the guide (4.3.6). But even a holistic understanding of the role and nature of damping would lead to the elimination of A, B and C – all of which the candidates should be familiar with.

What property of a driving system must be approximately equal to that of the oscillating system for resonance to occur?

A. Amplitude
B. Displacement
C. Frequency
D. Kinetic energy

Markscheme

C

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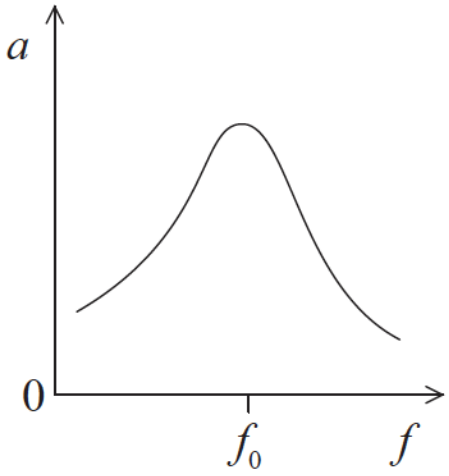
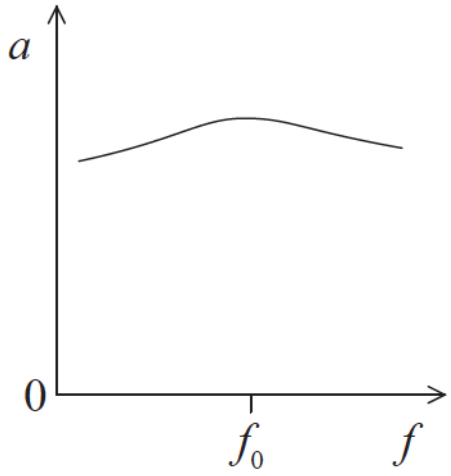
[N/A]

An object is undergoing simple harmonic motion with light damping. The natural frequency of oscillation of the object is f_0. A periodic force of frequency f is applied to the object. Which of the following graphs best shows how the amplitude a of oscillation of the object varies with f?

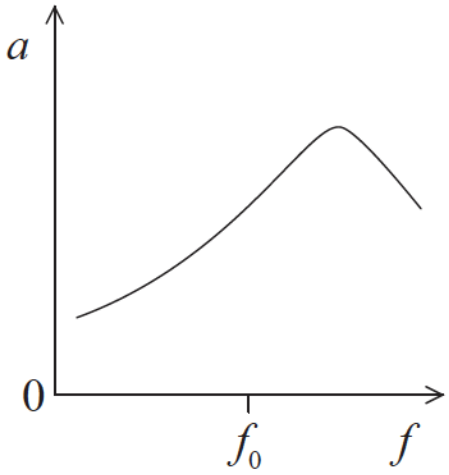
A.



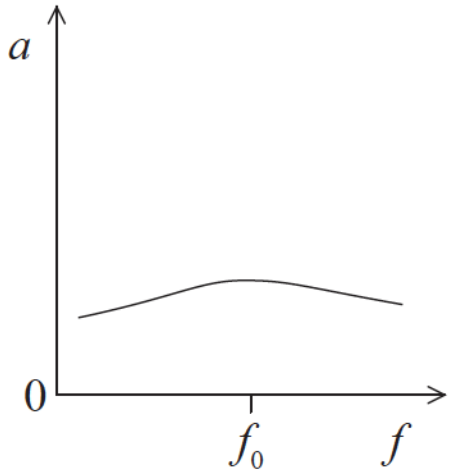
B.



C.



D.



Markscheme

A

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