Two coherent point sources $S_1$ and $S_2$ emit spherical waves.

Which of the following best describes the intensity of the waves at $P$ and $Q$?

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>maximum</td>
<td>minimum</td>
</tr>
<tr>
<td>B.</td>
<td>minimum</td>
<td>maximum</td>
</tr>
<tr>
<td>C.</td>
<td>maximum</td>
<td>maximum</td>
</tr>
<tr>
<td>D.</td>
<td>minimum</td>
<td>minimum</td>
</tr>
</tbody>
</table>
Which of the following electromagnetic waves has a frequency greater than that of visible light?

A. Ultraviolet
B. Radio
C. Microwaves
D. Infrared
Waves emitted from sources X and Y have equal wavelengths and are initially in phase. The waves interfere destructively at point P, where the path difference is 0.60 m.

What is a possible value for the wavelength of the waves?

A. 0.20 m
B. 0.30 m
C. 0.40 m
D. 0.60 m
Light travels from air into glass as shown below.

The refractive index of the glass is

A. $\frac{\sin 30^\circ}{\sin 80^\circ}$

B. $\frac{\sin 80^\circ}{\sin 30^\circ}$

C. $\frac{\sin 60^\circ}{\sin 10^\circ}$

D. $\frac{\sin 10^\circ}{\sin 60^\circ}$
Two waves meet at a point in space. Which of the following properties always add together?

A. Displacement
B. Amplitude
C. Speed
D. Frequency
Which of the following statements is true for a standing wave on a string?

A. No energy is transferred along the string.

B. The maximum kinetic energy of each segment of the string is proportional to the amplitude of the segment.

C. Each segment of the string oscillates with different phase and frequency.

D. The amplitude along the string varies with time.
A wave pulse is travelling to the right along a string.

Which of the following best represents the direction of the velocity of the point P?

A. ↑
B. ↓
C. →
D. ←
An orchestra playing on boat X can be heard by tourists on boat Y, which is situated out of sight of boat X around a headland.

The sound from X can be heard on Y due to

A. refraction.
B. reflection.
C. diffraction.
D. transmission.
The shock absorbers of a car, in good working condition, ensure that the vertical oscillations of the car are
A. undamped.
B. lightly damped.
C. moderately damped.
D. critically damped.
The two graphs show the variation with time of the individual displacements of two waves as they pass through the same point.

The displacement of the resultant wave at the point at time $T$ is equal to

A. $x_1 + x_2$.
B. $x_1 - x_2$.
C. $A_1 + A_2$.
D. $A_1 - A_2$. 
The graphs show how the acceleration $a$ of four different particles varies with their displacement $x$.

Which of the particles is executing simple harmonic motion?
A body is displaced from equilibrium. State the **two** conditions necessary for the body to execute simple harmonic motion.

- The force acting/accelerating (on the body) is directed towards equilibrium (position);
- And is proportional to its/the body's displacement from equilibrium;
A wave is travelling along a string. The string can be modelled as a single line of particles and each particle executes simple harmonic motion. The period of oscillation of the particles is 0.80 s.

The graph shows the displacement $y$ of part of the string at time $t = 0$. The distance along the string is $d$.

$$y_0 = 0.050 \text{(m)} \text{ and } y = 0.030 \text{(m)};$$

$$\omega = \left( \frac{2\pi}{0.80} \right) = 7.85 \text{ (rad s}^{-1});$$

$$v = 7.85 \sqrt{(0.05)^2 - (0.03)^2};$$

$$= 0.31 \text{ m s}^{-1}; \text{ (allow working in cm to give } 31 \text{ cm s}^{-1})$$

Determine the magnitude of the velocity of particle P.
Monochromatic light travels from air into water. Which of the following describes the changes in wavelength and speed?

<table>
<thead>
<tr>
<th></th>
<th>Wavelength</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>increases</td>
<td>decreases</td>
</tr>
<tr>
<td>B</td>
<td>increases</td>
<td>increases</td>
</tr>
<tr>
<td>C</td>
<td>decreases</td>
<td>increases</td>
</tr>
<tr>
<td>D</td>
<td>decreases</td>
<td>decreases</td>
</tr>
</tbody>
</table>
P and Q are two points on a standing wave. R and S are two points on a progressive (travelling) wave.

Which of the following gives the relationship between the amplitudes of each pair of points?

<table>
<thead>
<tr>
<th>Points P and Q</th>
<th>Points R and S</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. same amplitude</td>
<td>same amplitude</td>
</tr>
<tr>
<td>B. different amplitude</td>
<td>same amplitude</td>
</tr>
<tr>
<td>C. same amplitude</td>
<td>different amplitude</td>
</tr>
<tr>
<td>D. different amplitude</td>
<td>different amplitude</td>
</tr>
</tbody>
</table>
What is the best estimate for the refractive index of a medium in which light travels at a speed of $2.7 \times 10^8$ m s$^{-1}$?

A. 0.9
B. 1.0
C. 1.1
D. 2.7
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.
The diagram below is a snapshot of wave fronts of circular waves emitted by a point source S at the surface of water. The source vibrates at a frequency $f = 10.0$ Hz.

The speed of the wave front is

A. $0.15$ cm s$^{-1}$.
B. $1.5$ cm s$^{-1}$.
C. $15$ cm s$^{-1}$.
D. $30$ cm s$^{-1}$.