

## Appendix A

### Pendulum Questions

Question 1:

The mass of a pendulum is referred to as the?

- A. lead
- B. metal
- C. weight
- D. bob

Question 2:

The \_\_\_\_\_ is measured from the point of suspension to the center of gravity of the pendulum?

- A. frequency
- B. period
- C. cycle
- D. length

Question 3: Single Correct

The amplitude is the displacement from the \_\_\_\_\_?

- A. Resting point to the top of the swing
- B. Pivot Point to the Mass
- C. Top of the swing on one side to the top of the swing on the other side
- D. Resting Point to the tabletop

Question 4:

Given that 45 cycles were completed in 46.31 seconds what is the period of this pendulum?

- A. 1.33s
- B. 0.326s
- C. 1.03s

- D. 0.972s

Question 5:

What do you think would happen to the period if you doubled the mass of a pendulum?

- A. The period would double
- B. The period would increase but not double
- C. The period would be half
- D. The period would not change

Question 6:

If the periods of two trials are supposed to be the same, but your data shows that they are different, what would your rationale be for the difference?

- A. Counted the cycles wrong
- B. Wrong amplitude
- C. Measured the length wrong
- D. All of these due to human error

Question 7:

What would happen to the period if you changed the amplitude of the pendulum?

- A. The period will be longer with a higher amplitude
- B. The period will be shorter with a higher amplitude
- C. The period will be longer with a smaller amplitude
- D. The period will be shorter with a smaller amplitude
- E. The period will remain the same

Question 8:

Calculate the period of a pendulum of length 75 cm if the gravitational constant is 980 cm/s<sup>2</sup>.

**( $T = 2\pi \sqrt{\text{length} / \text{gravity}}$ )**

- A. 1.74s
- B. 0.481s
- C. 22.71s
- D. 0.056s

Question 9:

If you wanted a grandfather clock (with a pendulum) to slow down, what change do you need to make to its pendulum?

Question 10:

Music is usually marked with a speed called a “tempo” at the top of the music. A metronome is a device used by musicians to keep their musical time. (see picture below) what would be the period of a metronome that would measure the musical tempo as 110 beats per minute. (Hint: A Metronome makes a “click” every time it passes the center of the device).



- A. 110s
- B. 55s
- C. 0.92s
- D. 1.09s
- E. 0.55s

## Reflection/Refraction Content Questions

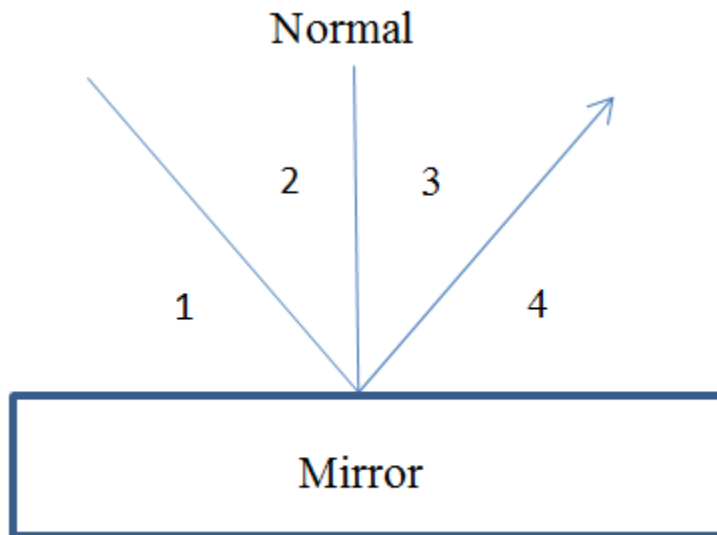
Question 1:

It is preferred to measure angles made by light rays from the Normal line because \_\_\_\_\_.

- A. It is the only way to line up the protractor with the light rays.
- B. The surface of the object (mirror, block of glass) may not be straight enough to measure from
- C. It does not matter how the angles are measured

Question 2:

Consider the following diagram of a light ray striking a mirror



The angles representing the angle of incidence and the angle of reflection respectively are

- A. 1 and 4
- B. 2 and 3
- C. 1 and 2
- D. 2 and 4
- E. 3 and 4

Question 3:

Which of the following best describes the law of reflection?

- A. Angle of Incidence = Angle of Reflection
- B. Angle of Incidence < Angle of Reflection
- C. Angle of Incidence > Angle of Reflection
- D. Angle of Incidence & Angle of Reflection have no relationship

Question 4:

When a light ray travels from one transparent material to a different transparent material, the light ray will change direction. The change in direction of the light ray is referred to as refraction. What is the cause of refraction?

- A. A change in the speed of light when the light passes through two different materials
- B. A change in the type of light ray used through the different materials
- C. A change in the degree which the light ray is entered into each different material

Question 5:

Which physical property of a transparent substance will affect the speed of light going through the substance the most?

- A. Color of the material
- B. Weight of the material
- C. Density of the material

Question 6:

In refraction, where the light source enters and exits the transparent substance can be visually seen. However; the light ray going through the transparent substance cannot be seen to the naked eye. What is this ray known as?

- A. The Exit Ray
- B. The Reflected Ray
- C. The Incident Ray
- D. The Refracted Ray
- E. The Light Ray

Question 7:

There are two basic shapes to lenses, the center either bulges out or caves in. Which type of lens bulges out in the center?

- A. Convex
- B. Concave
- C. Ocular
- D. Contact

Question 8:

If three parallel rays of light travel through a concave lens, which of the following best describes the outcome?

- A. The rays would look the same going in and out of the lens
- B. The rays would converge on the side the rays exit the lens
- C. The rays would diverge on the side of the lens the rays exit the lens
- D. The rays would converge when going in but diverge when coming out
- E. The rays would diverge going in but converge when coming out

Question 9:

If you saw a fish in water (slower speed of light than speed of light in air) which of the following best fits the situation:

- A. The fish is farther from you than what it appears to be
- B. The fish is closer to you than what it appears to be
- C. The fish is exactly where it appears to be

Question 10:

If a light ray enters substance A (slower speed of light) then goes into substance B (faster speed of light), what happens to the ray of light when it enters substance B?

- A. The light ray will bend toward the normal of substance B
- B. The light ray will bend away from the normal of Substance B
- C. The light ray will change direction but not as option A and B state
- D. The light ray will not change direction

## Appendix B

### **Attitude and Preference Survey Questions**

1. I like to learn about science. (attitude)
2. I think learning science is important. (attitude)
3. Virtual laboratories are a better way to learn material than face-to-face laboratories. (preference)
4. Face-to-face laboratories are a better way to learn material than virtual laboratories. (preference)