

BANGLADESH INTERNATIONAL TUTORIAL LIMITED

Physics Worksheet

Class XII

Subject Teacher: P.K. Saha

WEEK 02

MARKS = 26

STUDENT'S NAME: _____

DATE: 4/4/2020

Recent measurements indicate that the value of the Hubble constant is greater than previously estimated.

Which of the following statements could be a consequence of this?

- A The universe might be bigger than we thought.
- B The universe might not be as big as we thought.
- C The universe might be older than we thought.
- D The universe might not be as old as we thought.

(Total for Question 1 = 1 mark)

It is claimed on a website that the conditions in the core of a star are perfect for fusion.

Which of the following statements about the interior of a star best supports this claim?

- A The density is very high and the temperature is moderate.
- B The density is moderate and the temperature is very high.
- C The density and temperature are both very high.
- D The density and temperature are both moderate.

(Total for Question 2 = 1 mark)

A star is moving towards the Earth with a velocity of $1.2 \times 10^6 \text{ m s}^{-1}$. Light of wavelength 780 nm is emitted from the star.

What would be the wavelength of the light, in nm, recorded by an observer on the Earth?

- A $780 + \left(\frac{1.2}{300}\right) \times 780$
- B $780 + \left(\frac{300}{1.2}\right) \times 780$
- C $780 - \left(\frac{1.2}{300}\right) \times 780$
- D $780 - \left(\frac{300}{1.2}\right) \times 780$

A mass was hung from the end of spring 1 and set into vertical oscillation. Another mass was hung from the end of spring 2 and also set into vertical oscillation.

The maximum velocity, angular frequency and amplitude of the mass on each spring are summarised in the table below.

	spring 1	spring 2
Maximum velocity	v_1	v_2
Angular frequency	ω	2ω
Amplitude	A	$A/2$

Which of the following statements about the maximum velocities is correct?

- A** $v_1 = \frac{v_2}{4}$
- B** $v_1 = \frac{v_2}{2}$
- C** $v_1 = v_2$
- D** $v_1 = 2v_2$

A student used a Geiger-Müller tube and counter to measure the count near to a radioactive source for one minute. He used this value to calculate the count rate due to the source in Bq.

Which of the following would decrease the percentage uncertainty in the student's value for the activity?

- A** Add the background count to the measured count.
- B** Increase the counting time to 10 minutes.
- C** Increase the distance of the Geiger-Müller tube from the source.
- D** Subtract the background count from the calculated count rate.

A pendulum is driven into oscillation and resonance occurs.

What happens to the maximum damping force as the amplitude of oscillation increases?

- A** The maximum damping force gradually decreases.
- B** The maximum damping force gradually increases.
- C** The maximum damping force increases and then decreases.
- D** The maximum damping force stays constant.

A fixed mass of an ideal gas exerts a pressure p . The volume occupied by the gas is doubled, and the absolute temperature of the gas is halved.

What is the new pressure exerted by the gas?

- A $0.25p$
- B $0.5p$
- C $2p$
- D $4p$

Star X has a luminosity L and is a distance x from the Earth. The radiation flux received from this star is F .

Star Y has a luminosity $3L$ and is a distance $2x$ from the Earth.

What is the radiation flux received from star Y?

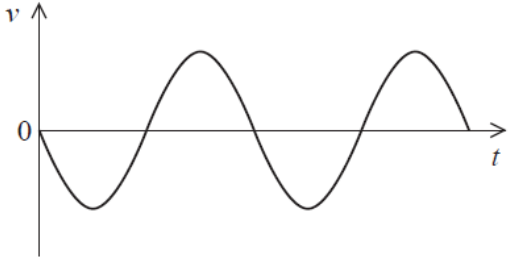
- A $3F/4$
- B $2F/3$
- C $4F/3$
- D $3F/2$

The temperature of a fixed volume of an ideal gas is increased from 300 K to 330 K.

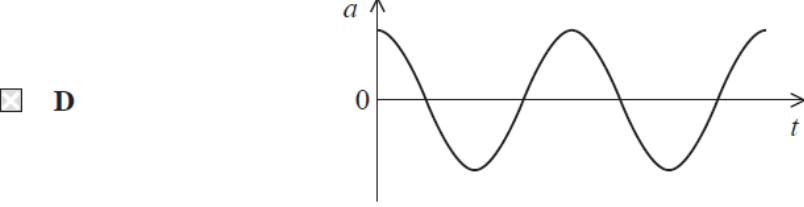
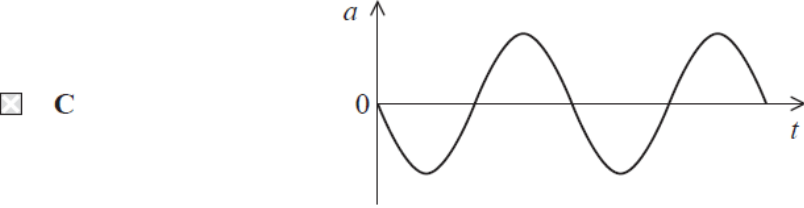
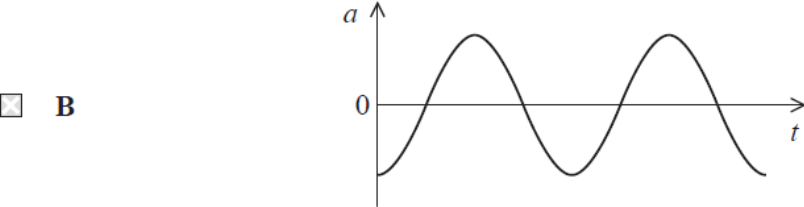
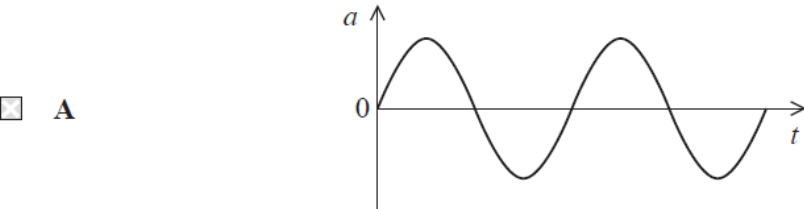
Which of the following statements is **not** true?

- A The internal energy of the gas increases by 10%.
- B The kinetic energy of the molecules in the gas increases by 10%.
- C The potential energy of the molecules in the gas increases by 10%.
- D The value of $\langle c^2 \rangle$ for the molecules in the gas increases by 10%.

The graph below shows how the velocity v varies with time t for a particle undergoing simple harmonic motion.

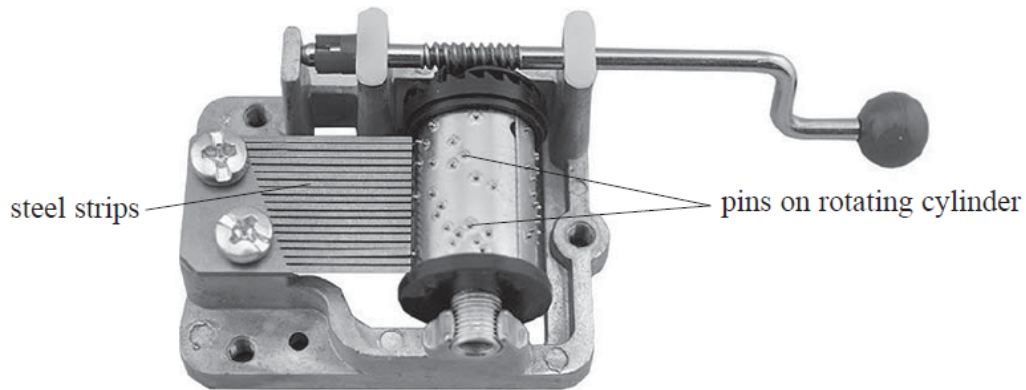


Select the graph that shows how the acceleration a varies with t over the same time interval.



(Total for Question 10 = 1 mark)

The photograph shows a musical box mechanism.



As the cylinder rotates, sound is created when pins on the cylinder strike the steel strips. One end of each strip is fixed and the other end is set into oscillation. Each strip oscillates with simple harmonic motion at a different frequency.

(a) State the condition for an oscillation to be simple harmonic.

(2)

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(b) The end of one steel strip moves through 3.0 mm from one extreme position to the other extreme position, and makes 1600 complete oscillations in 5.0 s.

Calculate the maximum acceleration of this end of the steel strip.

(3)

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Maximum acceleration =

- (c) The sound made by the musical box mechanism is quiet, but it is observed that when the mechanism is placed on a wooden table there is a large increase in the loudness of the sound.

Explain this observation.

(3)

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(Total for Question 16 = 8 marks)

Tyres for racing bicycles are often filled with nitrogen gas rather than air. The tyres are inflated using small cylinders filled with nitrogen gas at high pressure. The photograph shows such a cylinder.



- (a) The cylinder has a volume of $7.25 \times 10^{-5} \text{ m}^3$ and contains 6.85×10^{22} molecules of nitrogen gas. The temperature of the nitrogen gas is 22.0°C .
- (i) Show that the pressure exerted by the nitrogen gas in the cylinder is about $3.9 \times 10^6 \text{ Pa}$.

(3)

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- (ii) Nitrogen gas at a temperature of 22.0°C is used to fill a bicycle tyre of volume $1.17 \times 10^{-3}\text{m}^3$.

Show that 3 gas cylinders contain the amount of nitrogen gas needed to fill the tyre to a pressure of $6.55 \times 10^5\text{Pa}$.

(2)

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- (iii) In practice, more than 3 cylinders of nitrogen gas may be needed to fill the tyre to a pressure of $6.55 \times 10^5\text{Pa}$.

Suggest a reason why.

(1)

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- (b) When the bicycle is in use, the pressure in the tyre falls more slowly if nitrogen gas is used to fill the tyres instead of air.

Air is a mixture of mostly nitrogen and oxygen. Nitrogen molecules are larger than oxygen molecules.

Suggest why the pressure in the tyre falls more slowly with nitrogen gas.

(2)

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(Total for Question 18 = 8 marks)