

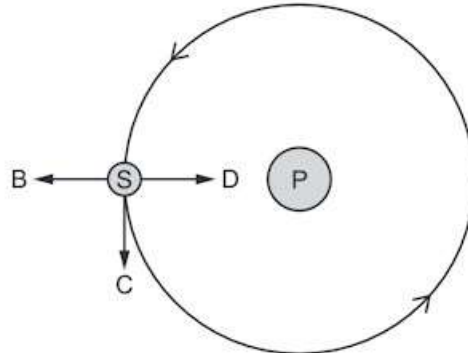
6th form final Physics 2020 assessment

UNOFFICIAL MARK SCHEME

Multiple Choice questions: There are 40 questions. All questions are worth 1 mark.

Which statement is correct:

The diagram shows a satellite S travelling at a constant speed in a circular orbit around a planet P.

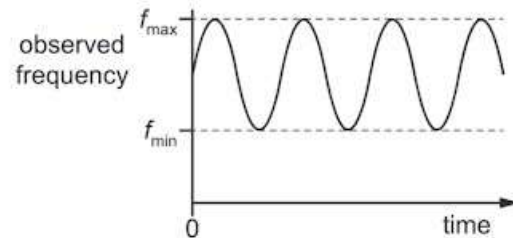


- The resultant force on the satellite is in direction B*
- The resultant force on the satellite is zero*
- The resultant force on the satellite is in direction C*
- The resultant force on the satellite is in direction D*

A binary star consists of two stars rotating around a common centre. Light from one of the stars is observed on the Earth.



The observed frequency of the light varies between a minimum frequency f_{\min} and a maximum frequency f_{\max} , as shown.



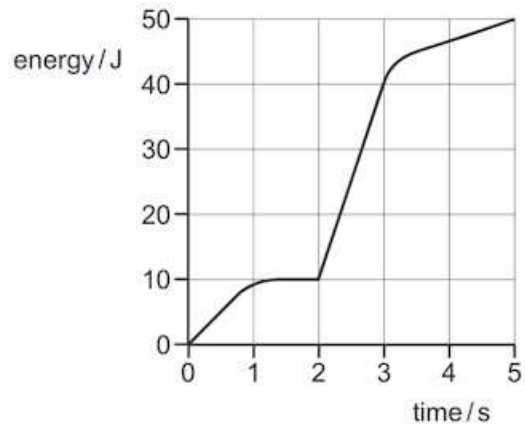
The rate of rotation of the binary star increases.

What is the change to f_{\max} and the change to f_{\min} ?

- f_{\max} : increases, f_{\min} : decreases*
- f_{\max} : increases, f_{\min} : increases*
- f_{\max} : decreases, f_{\min} : increases*
- f_{\max} : decreases, f_{\min} : decreases*

What is the maximum power that is generated at any time in the first 5 s?

An electrical generator is started at time zero. The total electrical energy generated during the first 5 seconds is shown in the graph.



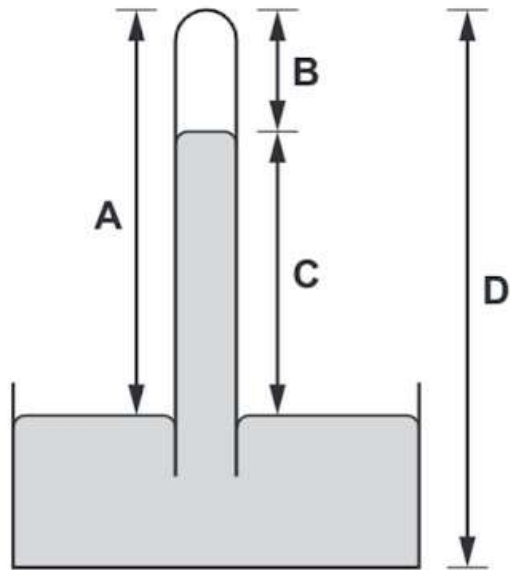
- 50 W
- 30 W
- 10 W
- 20 W

A sealed container of gas is heated and the pressure inside increases because:

- The kinetic energy of the molecules decreases*
- The molecules hit the container more frequently*
- The molecules expand*
- The molecules become heavier*

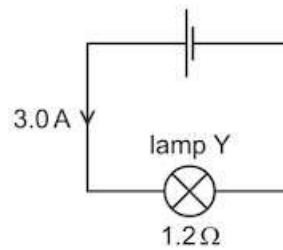
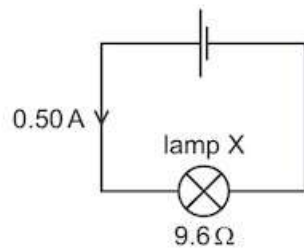
The diagram shows a simple mercury barometer.

Which height is a measure of the atmospheric pressure?



- D*
- B*
- C*
- A*

The circuit diagrams show two lamps X and Y each connected to a cell. The current in lamp X is 0.50 A and its resistance is $9.6\ \Omega$. The current in lamp Y is 3.0 A and its resistance is $1.2\ \Omega$.



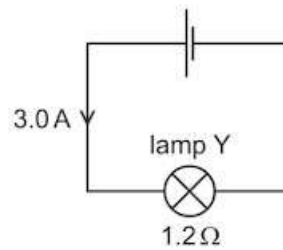
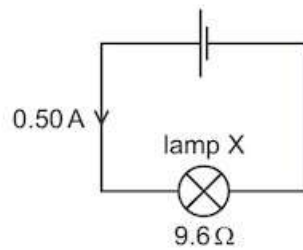
What is the ratio $\frac{\text{power in lamp X}}{\text{power in lamp Y}}$?

- 4.5
- 0.75
- 0.22
- 1.3

Which of the following lists the electromagnetic spectrum in order of INCREASING frequency

- Ultra violet < Infra red < Radio < Gamma*
- Radio < Infra red < Ultra violet < Gamma*
- Ultra violet < Gamma < Radio < Infra red*
- Radio < Gamma < Ultra Violet < Infra Red*

The circuit diagrams show two lamps X and Y each connected to a cell. The current in lamp X is 0.50 A and its resistance is $9.6\ \Omega$. The current in lamp Y is 3.0 A and its resistance is $1.2\ \Omega$.



What is the ratio $\frac{\text{power in lamp X}}{\text{power in lamp Y}}$?

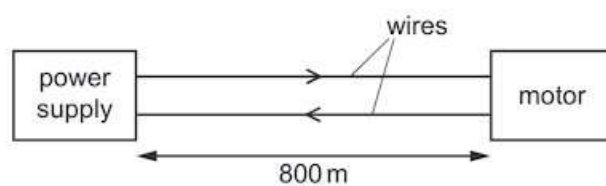
- 0.22
- 4.5
- 0.75
- 1.3

Which region of the electromagnetic spectrum includes waves with a frequency of 10^7 MHz?

- X-ray
- infra-red
- ultra-violet
- radio

A motor is required to operate at a distance of 800 m from its power supply. The motor requires a potential difference (p.d.) of 16.0 V and a current of 0.60 A to operate.

Two wires are used to supply power to the motor as shown.

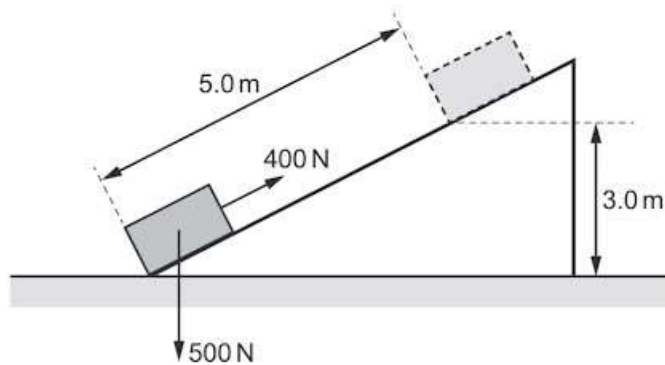


The resistance of each of these wires is 0.0050Ω per metre.

What is the minimum output p.d. of the power supply?

- 11.2 V
- 16 V
- 20.8 V
- 18.4 V

Work is done when a force of 400 N pulls a crate of weight 500 N at a constant speed along a ramp, as shown.



Part of the work done increases the gravitational potential energy E of the crate and the rest is work done W against friction.

What are the values of E and W ?

- $E: 1500 \text{ J}, W 500 \text{ J}$
- $E: 2000 \text{ J}, W 2500 \text{ J}$
- $E: 1500 \text{ J}, W 2000 \text{ J}$
- $E: 3500 \text{ J}, W 500 \text{ J}$

Liquids X and Y are stored in large open tanks. Liquid X has a density of 800 kg m^{-3} and liquid Y has a density of 1200 kg m^{-3} .

At which depths are the pressures equal?

- Depth X/m 15, Depth Y/m 10*
- Depth X/m 20, Depth Y/m 8*
- Depth X/m 10, Depth Y/m 15*
- Depth X/m 8, Depth Y/m 20*

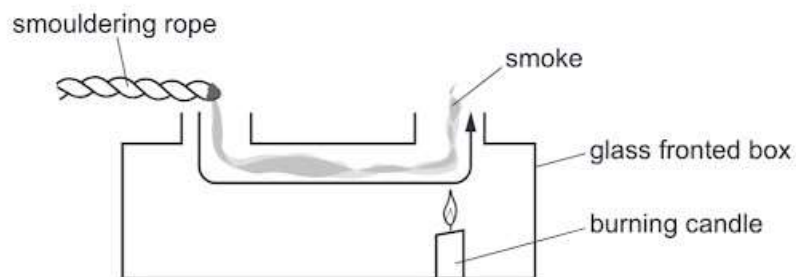
A car travelling in a straight line at a speed of 30 m s^{-1} passes near a stationary observer while sounding its horn. The true frequency of sound from the horn is 400 Hz .

The speed of sound in air is 336 m s^{-1} .

What is the change in the frequency of the sound heard by the observer as the car passes?

- 78 Hz
- 39 Hz
- 71 Hz
- 66 Hz

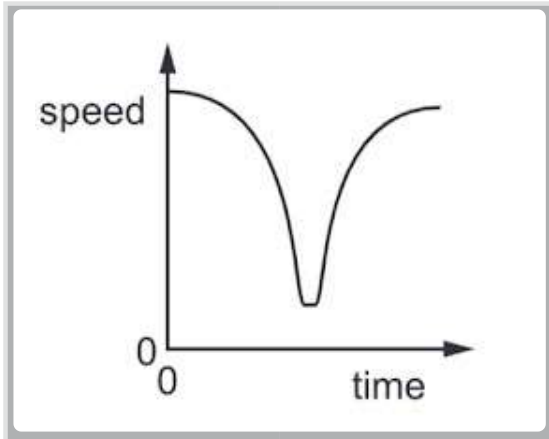
When a piece of smouldering rope is held at the opening of the box in the diagram, smoke moves in the direction indicated.



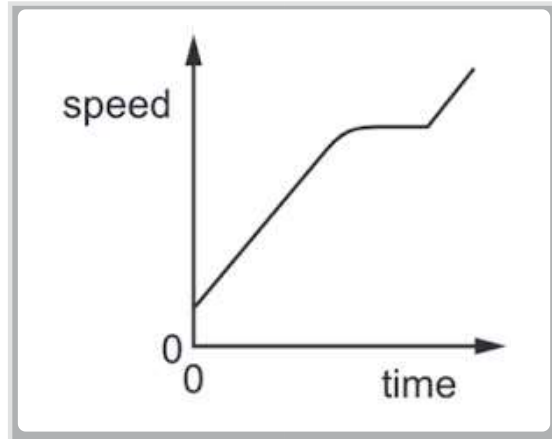
What is responsible for the movement of the smoke?

- Radiation
- Evaporation
- Conduction
- Convection

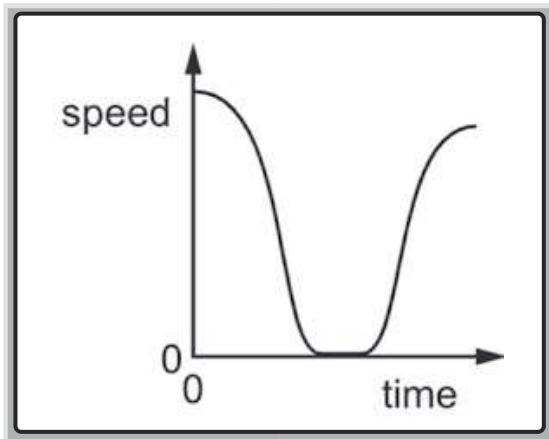
Which speed-time graph represents the motion of a railway train making a short stop at a station?



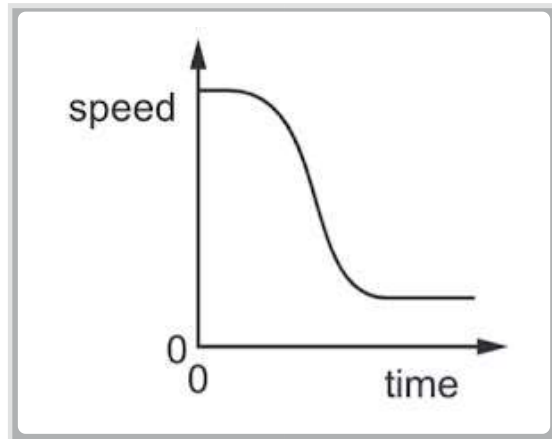
.Option.



Option.



Option..

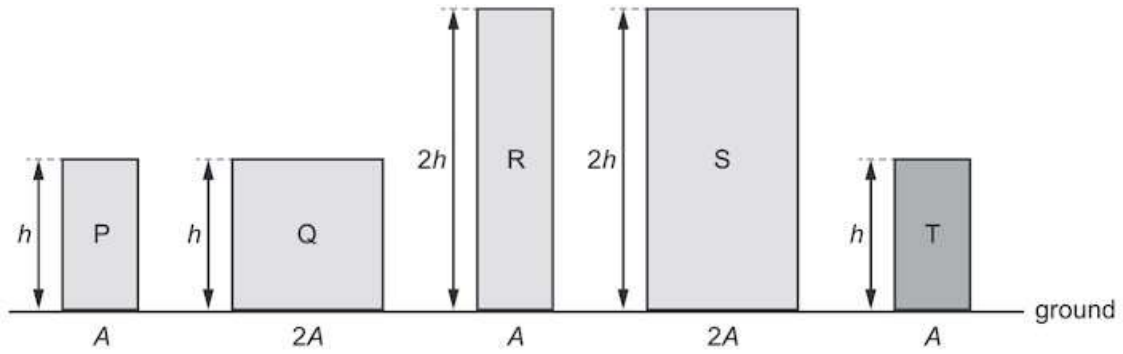


Option

Which of the following 2 blocks exert the same pressure on the ground:

Blocks P, Q, R and S are made from material of the same density. Block T is made from a material of twice the density of the material of the other blocks.

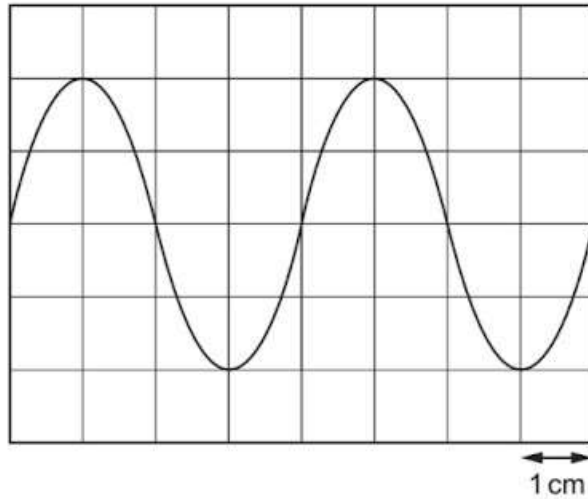
The cross-sectional area and height of each of the blocks are shown.



- S and T*
- Q and S*
- P and T*
- Q and R*

The time base on the CRO is 2.5 ms for each 1 cm division: What is the frequency of the wave?

A sound wave is displayed on the screen of a cathode-ray oscilloscope (c.r.o.) as shown.



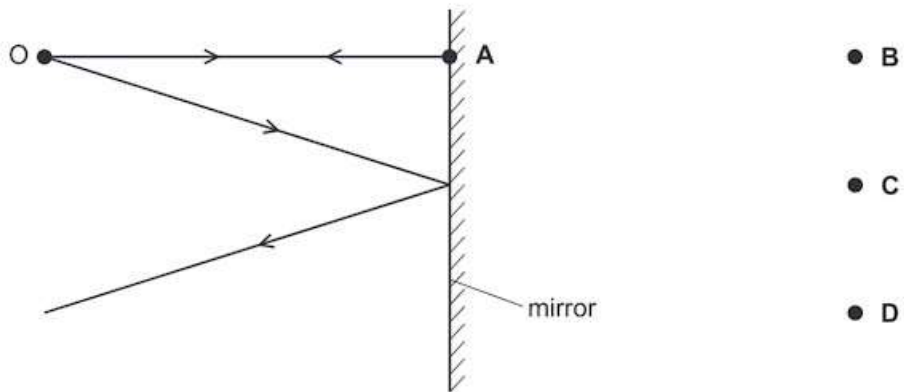
- 400 Hz
- 50 Hz
- 100 Hz
- 200 Hz

Which statement about electromagnetic (EM) waves is correct:

- EM waves travel in air almost as fast as in a vacuum*
- In air some EM waves travel faster than light*
- The shortest wavelength EM waves are in the X-ray region*
- The longest wavelength EM waves are in the infra-red region*

The diagram shows two divergent rays of light from an object O being reflected from a plane mirror.

At which position is the image formed?



- D
- C
- A
- B

A car of mass 800 kg is accelerated by a force of 1600 N, what is the car's velocity and acceleration after 4 s:

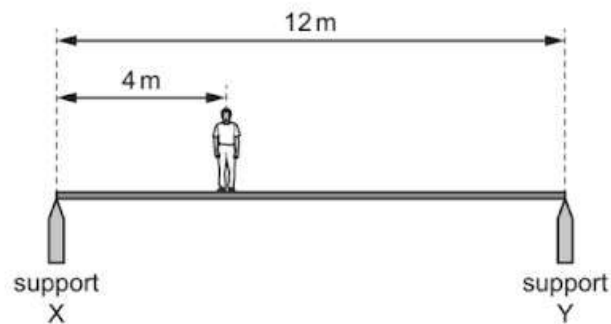
- Velocity: 0.13 m/s Acceleration 0.50 m/s/s
- Velocity: 2.0 m/s Acceleration 2.0 m/s/s
- Velocity: 8.0 m/s Acceleration 2.0 m/s/s
- Velocity: 0.50 m/s Acceleration 0.50 m/s/s

A body of mass 10 kg falling freely in the gravitational field close to the Moon's surface has an acceleration of 1.6 m/s^2 .

What is the gravitational field strength on the Moon?

- 16 N/kg
- 10 N/kg
- 1.6 N/kg
- 0 N/kg

A uniform horizontal footbridge is 12 m long and weighs 4000 N. It rests on two supports X and Y as shown.



A man of weight 600 N is a distance of 4 m from support X.

What is the upward force on the footbridge from support X?

- 2300 N
- 2400 N
- 2200 N
- 2600 N

A sealed container of gas is heated and the pressure inside increases because:

- The molecules become heavier*
- The molecules hit the container more frequently*
- The molecules expand*
- The kinetic energy of the molecules decreases*

The momentum of a car of mass m increases from p_1 to p_2 .

What is the increase in the kinetic energy of the car?

$$\frac{p_1 - p_2}{2m}$$

Option..

$$\frac{p_2 - p_1}{2m}$$

.Option.

$$\frac{(p_2 - p_1)^2}{2m}$$

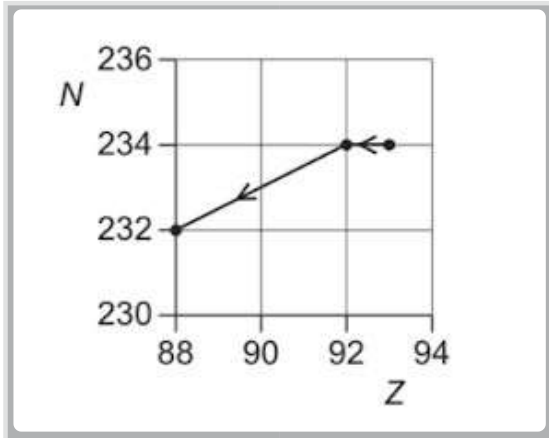
Option.

$$\frac{(p_2^2 - p_1^2)}{2m}$$

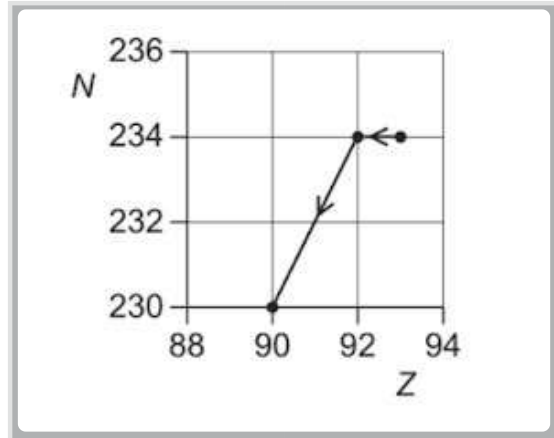
Option

A radioactive nucleus is formed by β^- decay. This nucleus then decays by α -emission.

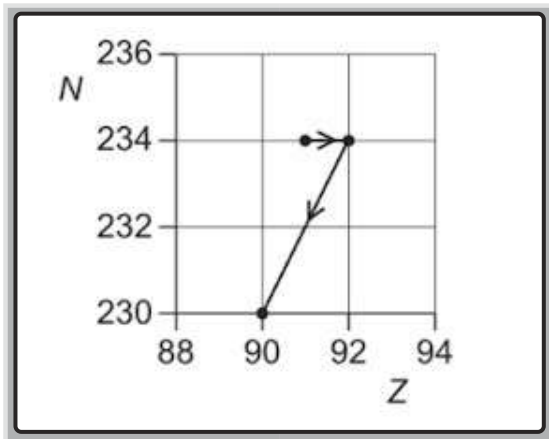
Which graph of nucleon number N plotted against proton number Z shows the β^- decay followed by the α -emission?



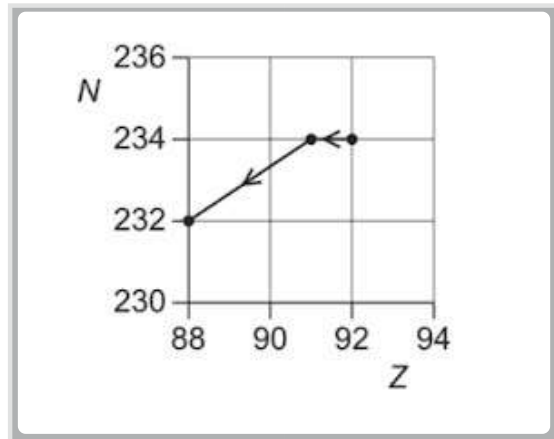
Option..



Option



Option.



.Option.

Each tyre of a car has an area of 100 cm^2 in contact with the ground.

The car has a mass of 1600 kg . The weight of the car is equally distributed amongst the four tyres.

The gravitational field strength g is 10 N/kg .

What is the pressure exerted on the ground?

$$16 \text{ N/cm}^2$$

Option.

$$4.0 \text{ N/cm}^2$$

Option

$$160 \text{ N/cm}^2$$

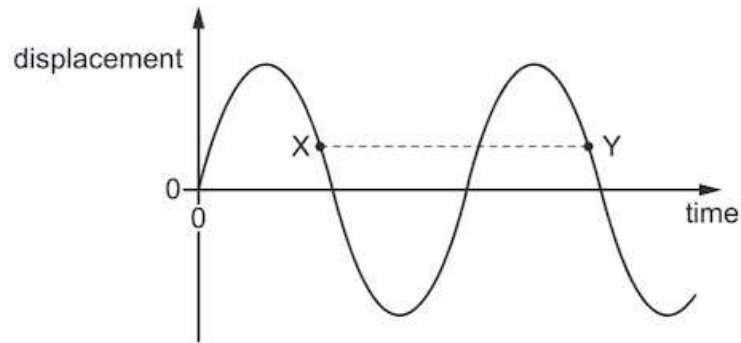
Option..

$$40 \text{ N/cm}^2$$

.Option.

A transverse progressive wave is set up on a string.

The graph shows the variation with time of displacement for a point on this string.



The separation XY on the graph represents the1..... of the wave.

X and Y have equal2..... .

Which words correctly complete gaps 1 and 2?

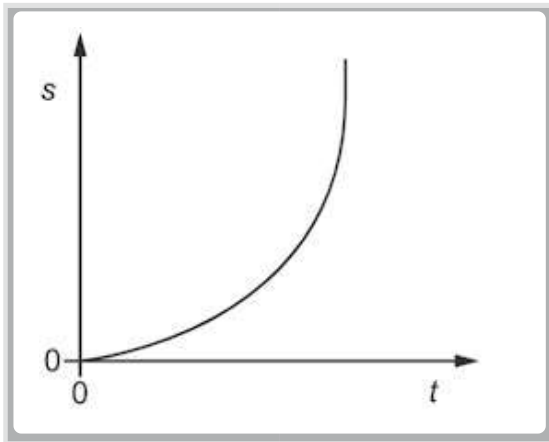
- 1: *Wavelength*, 2: *Amplitude*
- 1: *Period*, 2: *Displacement*
- 1: *Period*, 2: *Amplitude*
- 1: *Wavelength*, 2: *Displacement*

Physical quantities can be scalars or vectors, which of the following pairs are both vectors:

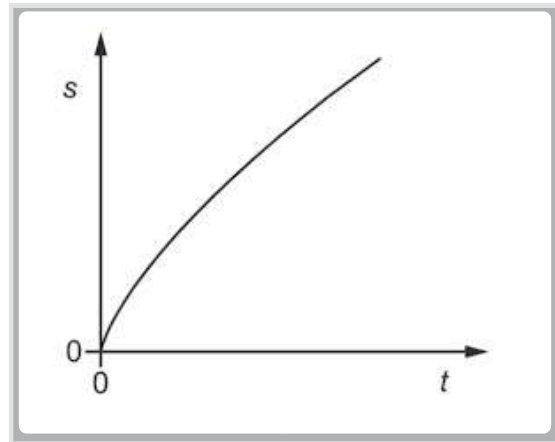
- Velocity and Distance*
- Kinetic energy and Force*
- Weight and Acceleration*
- Momentum and Time*

A tennis ball falls freely, in air, from the top of a tall building.

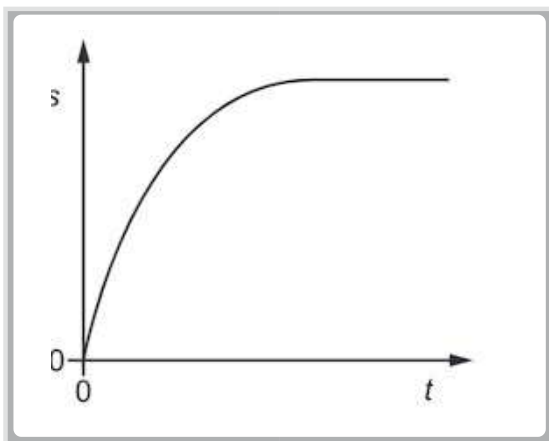
Which graph best represents the variation with time t of the distance s fallen?



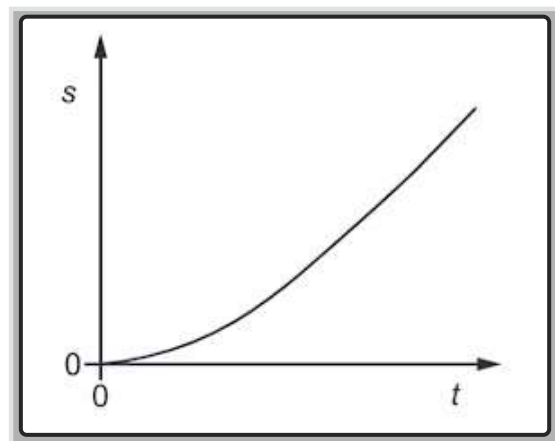
.Option.



Option..

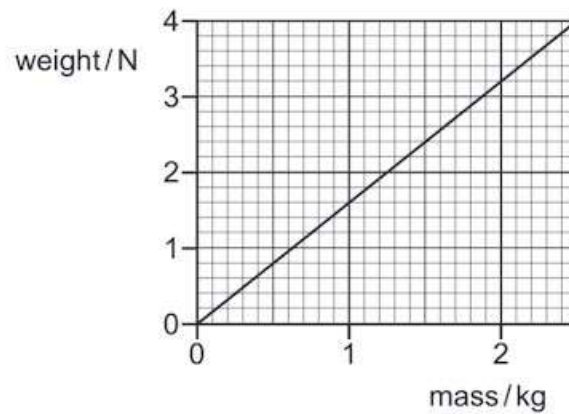


Option.



Option

The graph shows the variation with mass of the weight of objects on a particular planet.



What is the value of the acceleration of free fall on the planet?

$$0.63 \text{ ms}^{-2}$$

Option

$$1.6 \text{ ms}^{-2}$$

Option.

$$9.8 \text{ ms}^{-2}$$

Option..

$$3.2 \text{ ms}^{-2}$$

.Option.

The table lists the nucleon number and the proton number of various nuclei. The nuclei are represented by the letters L to T.

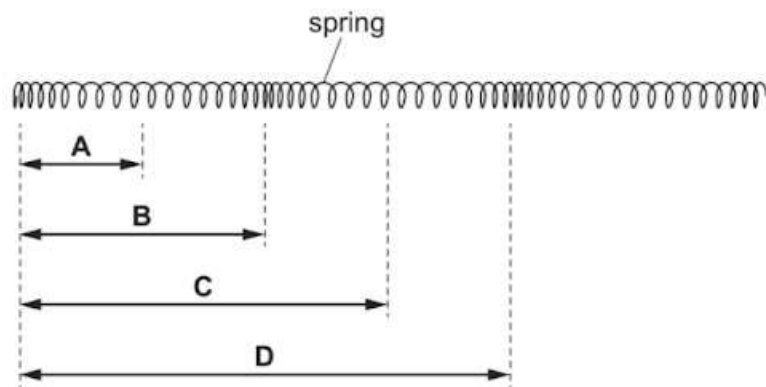
nucleus	nucleon number	proton number
L	227	89
M	226	89
N	225	89
O	227	90
P	226	90
Q	225	90
R	227	91
S	226	91
T	225	91

Which row in the following table correctly shows three nuclei of the same element, and three nuclei that have the same number of neutrons?

- Same element: L M N / Same number of neutrons R P N*
- Same element: O P Q / Same number of neutrons M P S*
- Same element: R P N / Same number of neutrons O P Q*
- Same element: M P S / Same number of neutrons R S T*

A longitudinal wave travels through a long spring. The spring is shown at one instant.

What is the wavelength of the wave?



c

A

D

B

A student calculates his power in running up a flight of stairs. He measures the vertical height of the stairs, the time taken to run up the stairs and his weight.

How does he calculate his power?

$$\frac{\text{weight}}{\text{height} \times \text{time}}$$

Option..

$$\frac{\text{height} \times \text{weight}}{\text{time}}$$

Option.

$$\frac{\text{time} \times \text{weight}}{\text{height}}$$

.Option.

$$\text{height} \times \text{time} \times \text{weight}$$

Option

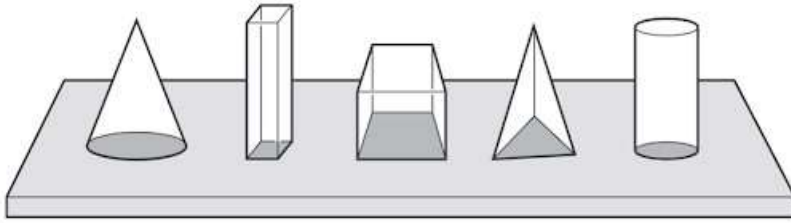
A cannon-ball of mass 3.50 kg is fired at a speed of 22.0 ms^{-1} from a gun on a ship at a height of 6.00 m above sea level.

The total energy of the cannon-ball is the sum of the gravitational potential energy relative to the surface of the sea and the kinetic energy.

What is the total energy of the cannon-ball as it leaves the gun?

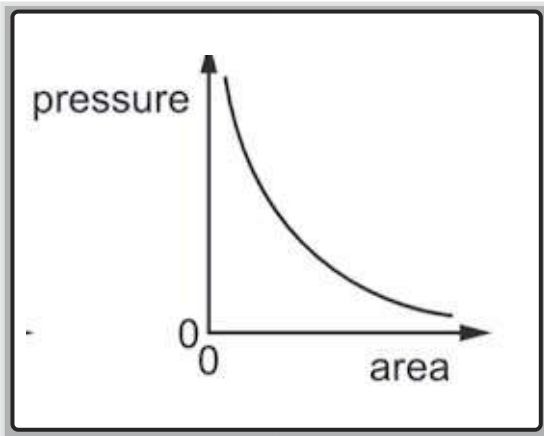
- 847 J
- 1057 J
- 641 J
- 206 J

Five blocks have the same mass but different base areas. They all rest on a horizontal table.

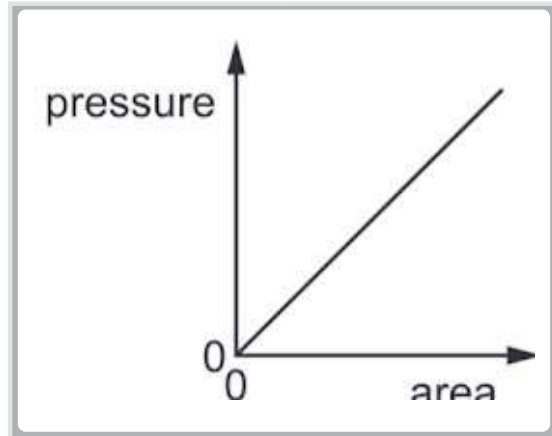


A graph is plotted to show the relationship between the pressure exerted on the table and the base area of the block.

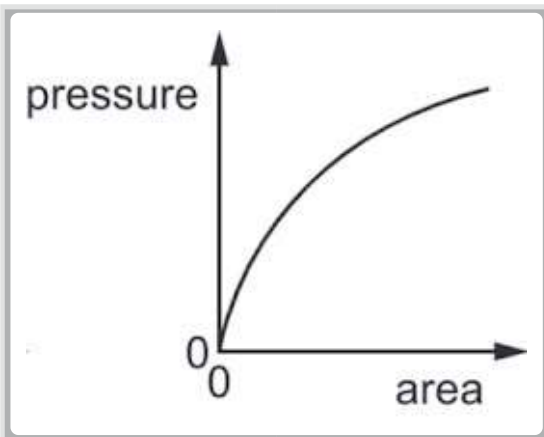
Which graph shows this relationship?



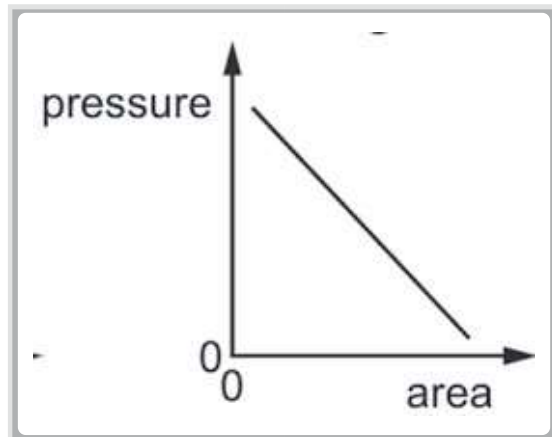
Option.



Option



.Option.



Option..

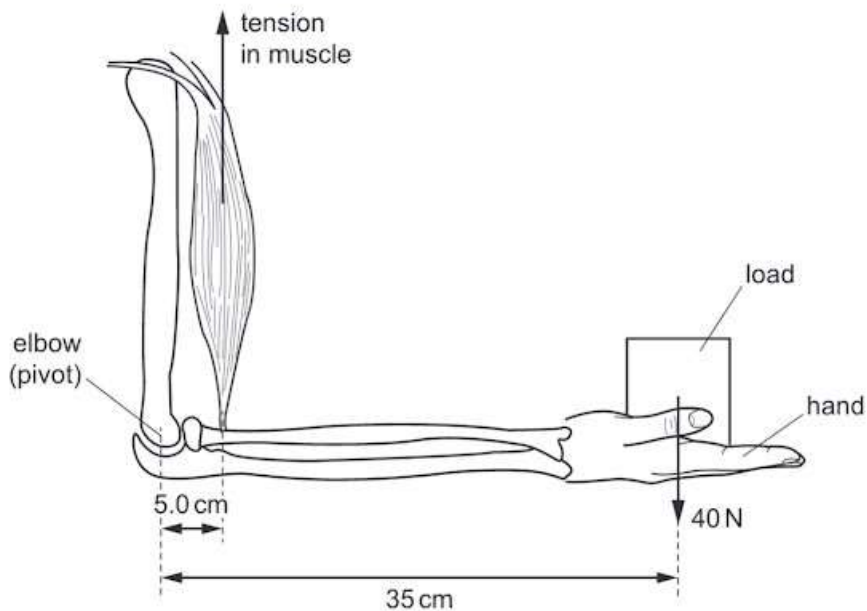
The minimum braking distance for a car is tested on a dry road.

The test is then repeated on a wet road.

What happens to the braking distance and to the frictional force between the tyres and the road?

- Braking distance increases, frictional force increases*
- Braking distance decreases, frictional force increases*
- Braking distance decreases, frictional force decreases*
- Braking distance increases, frictional force decreases*

The diagram shows a muscle and bones in a person's arm. The hand holds a load of weight 40 N. The elbow acts as a pivot and the tension in the muscle keeps the lower part of the arm horizontal.

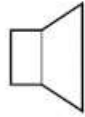


What is the tension in the muscle due to the load?

- 200 N*
- 1400 N*
- 240 N*
- 280 N*

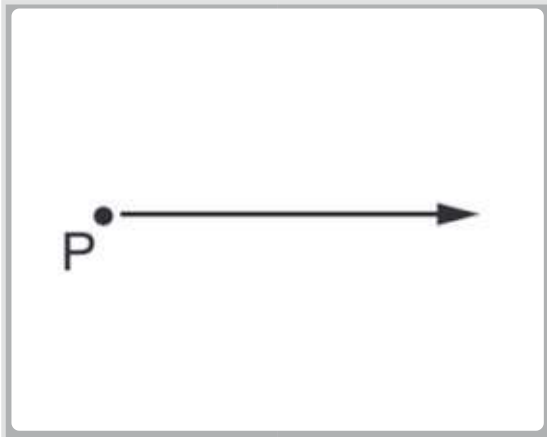
The diagram shows a loudspeaker that is producing a continuous sound wave of frequency 200 Hz in air.

loudspeaker

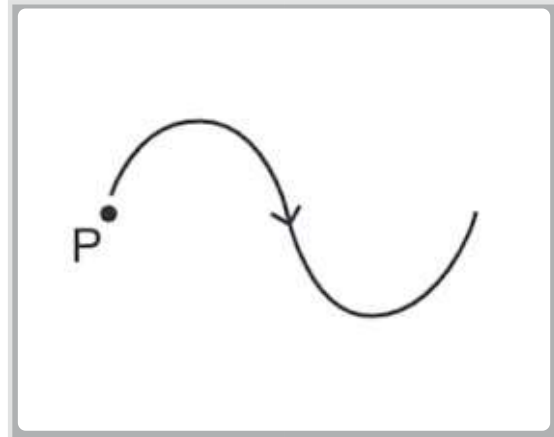


P

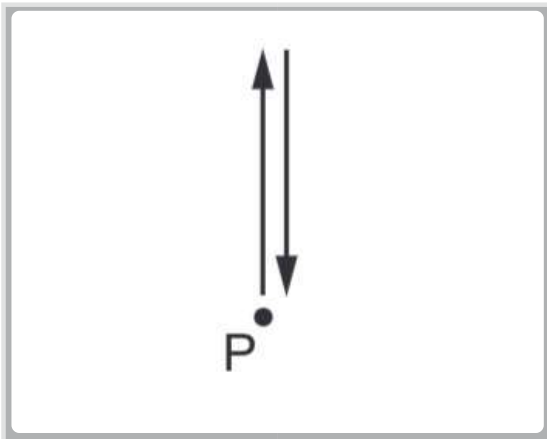
Which diagram best shows how the sound wave causes a molecule at P to move during $\frac{1}{200}$ s?



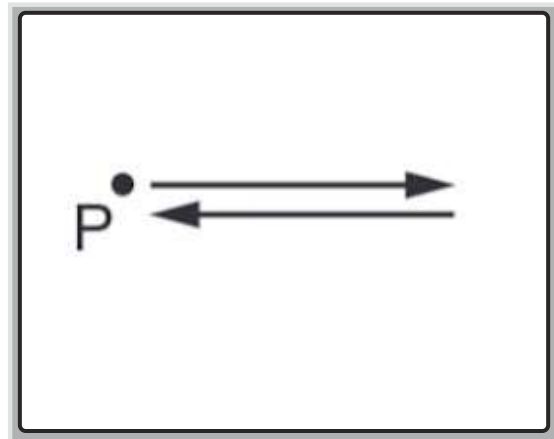
Option.



.Option.



Option..



Option

During an interval of time, fuel supplies energy X to a car.

Some of this energy is converted into kinetic energy as the car accelerates.

The rest of the energy Y is lost as thermal energy.

What is the efficiency of the car?

$$\frac{Y}{X - Y}$$

Option.

$$\frac{X - Y}{X}$$

.Option.

$$\frac{X}{X - Y}$$

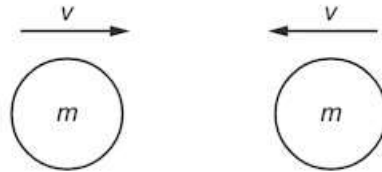
Option

$$\frac{X - Y}{Y}$$

Option..

The spheres (below) collide head on and kinetic energy is conserved, which of the following is correct

Two similar spheres, each of mass m and travelling with speed v , are moving towards each other.



The total kinetic energy after impact is mv^2 .

Option.

The spheres stick together on impact.

Option

The total kinetic energy before impact is zero.

.Option.

The total momentum before impact is $2mv$.

Option..