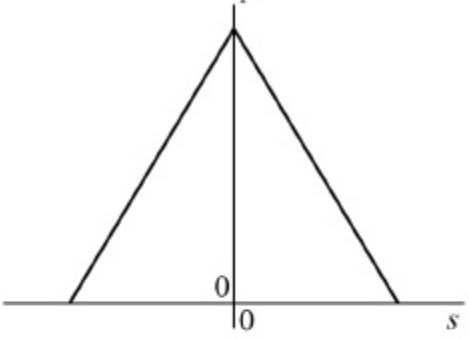
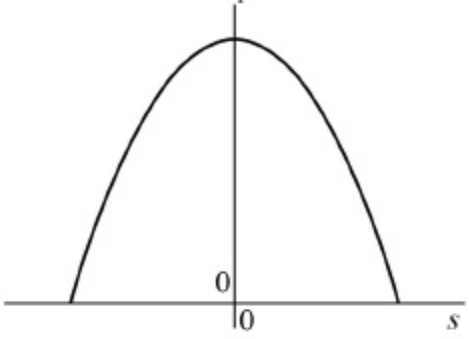
1 Which graph shows how the gravitational potential energy E_p of a simple pendulum varies with displacement s from the equilibrium position?

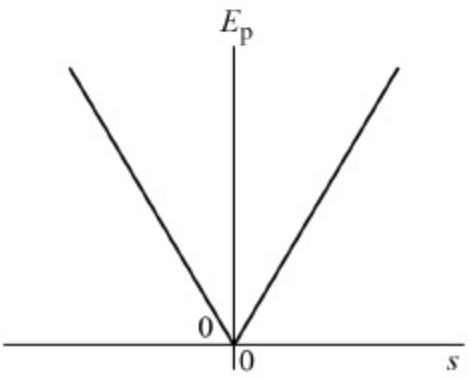
A



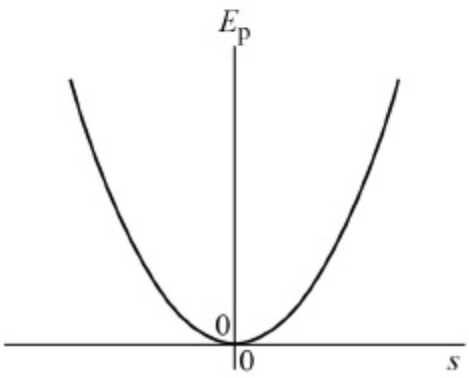
B



C



D



A ⬭

B ⬭

C ⬭

D ⬭

(Total 1 mark)

2 An object of mass 0.15 kg performs simple harmonic motion. It oscillates with amplitude 55 mm and frequency 0.80 Hz

What is the maximum value of its kinetic energy?

A 5.7×10^{-3} J ⬭

B 11×10^{-3} J ⬭

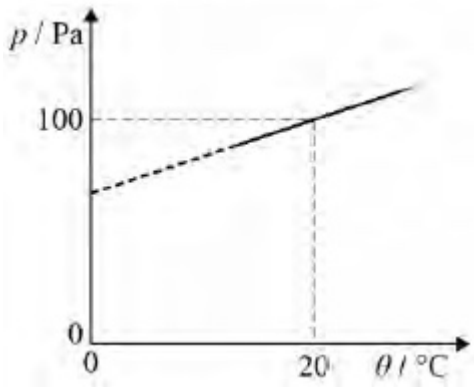
C 0.57 J ⬭

D 11 J ⬭

(Total 1 mark)

3 The graph shows the variation of pressure p with temperature θ for a fixed mass of an ideal gas at constant volume.

What is the gradient of the graph?



A 0.341 ⬭

B 0.395 ⬭

C 2.93 ⬭

D 5.00 ⬭

(Total 1 mark)

4 A body performs simple harmonic motion.

What is the phase difference between the variation of displacement with time and the variation of acceleration with time for the body?

A 0 ⬭

B $\frac{\pi}{4}$ rad ⬭

C $\frac{\pi}{2}$ rad ⬭

D π rad ⬭

(Total 1 mark)

5 Two flasks **X** and **Y** are filled with an ideal gas and are connected by a tube of negligible volume compared to that of the flasks. The volume of **X** is twice the volume of **Y**.
X is held at a temperature of 150 K and **Y** is held at a temperature of 300 K

What is the ratio $\frac{\text{mass of gas in } \mathbf{X}}{\text{mass of gas in } \mathbf{Y}}$?

A 0.125 ⬭

B 0.25 ⬭

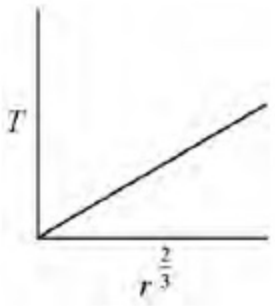
C 4 ⬭

D 8 ⬭

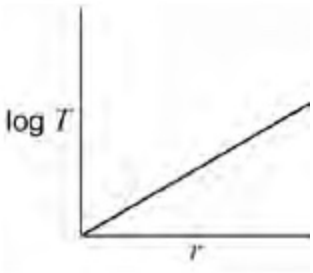
(Total 1 mark)

6 Which graph shows the relationship between the time period T and the orbital radius r of a planet in orbit around the Sun?

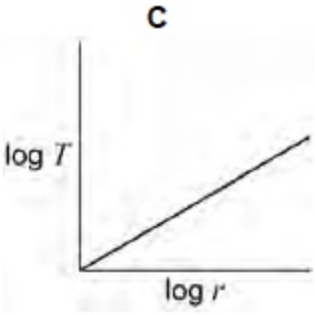
A



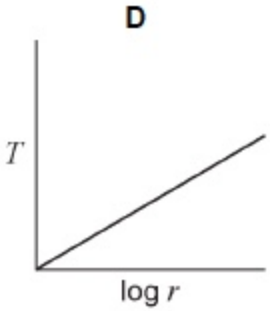
B



C



D



A ⬭

B ⬭

C ⬭

D ⬭

(Total 1 mark)

7 The Earth can be assumed to be a uniform sphere of radius R.

What is the mean density of the Earth?

A $\frac{3g}{4\pi RG}$ ⬭

B $\frac{3RG}{4\pi g}$ ⬭

C $\frac{3G}{4\pi Rg}$ ⬭

D $\frac{3Rg}{4\pi G}$ ⬭

(Total 1 mark)

8 The average mass of an air molecule is 4.8×10^{-26} kg

What is the mean square speed of an air molecule at 750 K?

A 3.3×10^5 m^2 s^{-2} ⬭

B 4.3×10^5 m^2 s^{-2} ⬭

C 6.5×10^5 m^2 s^{-2} ⬭

D 8.7×10^5 m^2 s^{-2} ⬭

(Total 1 mark)

9 A spacecraft of mass 1.0×10^6 kg is in orbit around the Sun at a radius of 1.1×10^{11} m
The spacecraft moves into a new orbit of radius 2.5×10^{11} m around the Sun.

What is the total change in gravitational potential energy of the spacecraft?

A -6.76×10^{14} J ⬭

B -3.38×10^{14} J ⬭

C 3.38×10^{14} J ⬭

D 6.76×10^{14} J ⬭

(Total 1 mark)

10 A transparent illuminated box contains small smoke particles and air.
The smoke particles are observed to move randomly when viewed through a microscope.

What is the cause of this observation of Brownian motion?

A Smoke particles gaining kinetic energy by the absorption of light. ⬭

B Collisions between smoke particles and air molecules. ⬭

C Smoke particles moving in convection currents caused by the air being heated by the light. ⬭

D The smoke particles moving randomly due to their temperature. ⬭

(Total 1 mark)

11 Planet **N** has a gravitational potential $-V$ at its surface. Planet **M** has double the density and double the radius of planet **N**. Both planets are spherical and have uniform density.

What is the gravitational potential at the surface of planet **M**?

A $-16V$ ⬭

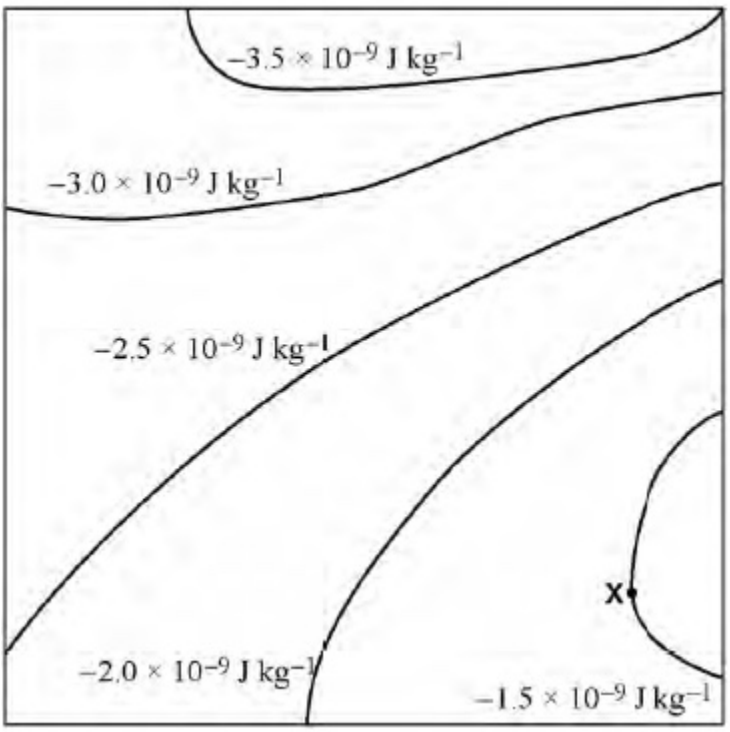
B $-8V$ ⬭

C $-4V$ ⬭

D $-0.2V$ ⬭

(Total 1 mark)

12 The diagram shows equipotential lines near a group of asteroids.



Which arrow shows the direction of the gravitational field at **X**?

A ↑ ⬭

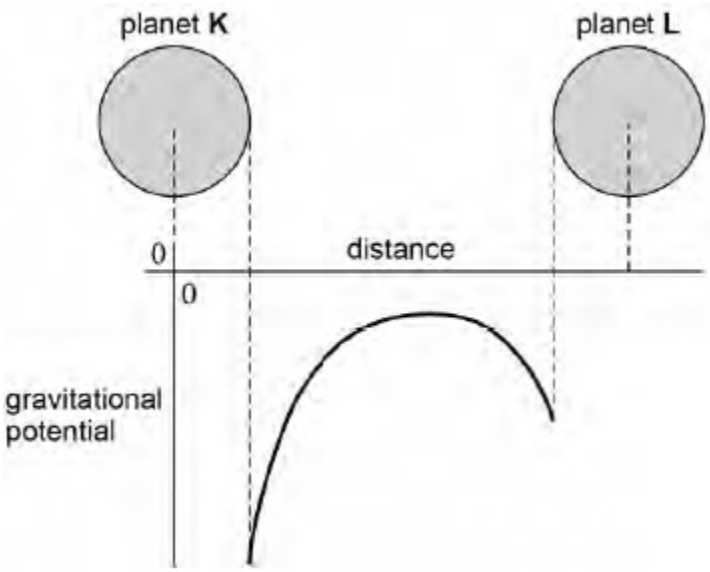
B ↓ ⬭

C ← ⬭

D → ⬭

(Total 1 mark)

13 The graph shows how the gravitational potential varies with distance between two planets, **K** and **L**, that have the same radius.



Which statement is correct?

A The mass of **L** is greater than the mass of **K**. ⬭

B The gravitational field strength at the surface of **L** is greater than that at the surface of **K**. ⬭

C The escape velocity from planet **L** is greater than that from planet **K**. ⬭

D More work must be done to move a mass of 1 kg from the surface of **K** to a distant point, than 1 kg from the surface of **L**. ⬭

(Total 1 mark)

14 The distance between the Sun and the Earth is 1.5×10^{11} m

What is the gravitational force exerted on the Sun by the Earth?

A 3.5×10^{22} N ⬭

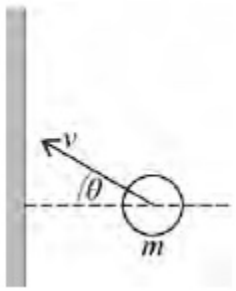
B 1.7×10^{26} N ⬭

C 5.3×10^{33} N ⬭

D 8.9×10^{50} N ⬭

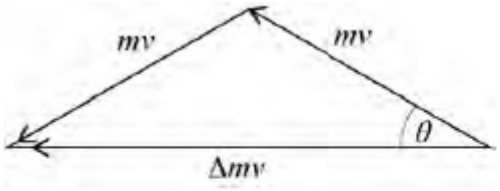
(Total 1 mark)

15 The diagram shows a gas particle about to collide elastically with a wall.

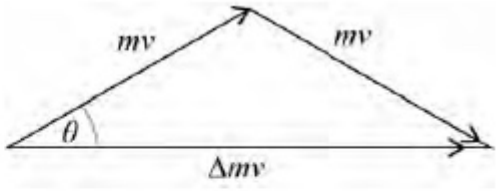


Which diagram shows the correct change in momentum Δmv that occurs during the collision?

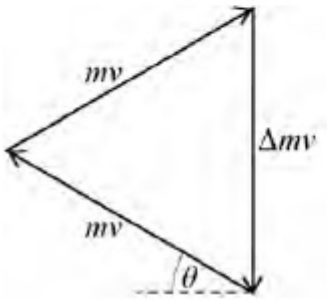
A



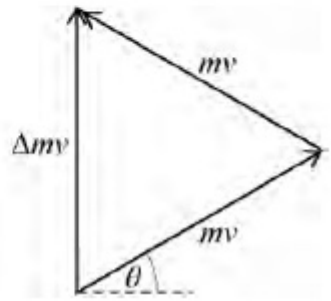
B



C



D



A ⬭

B ⬭

C ⬭

D ⬭

(Total 1 mark)