Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Further Mechanics

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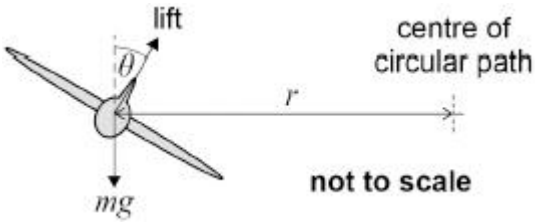
Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Q1.

When an aircraft turns in a horizontal circular path, it banks at an angle θ.



The aircraft has mass m and travels at constant speed v in a horizontal circular path of radius r. The lift force acts at the angle θ.

What is tan θ?

A $\frac{gv^2}{r}$ ⬭

B $\frac{rv^2}{g}$ ⬭

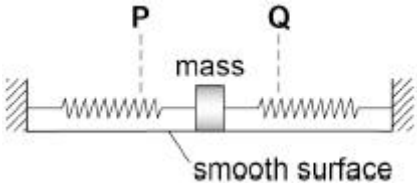
C $\frac{rg}{v^2}$ ⬭

D $\frac{v^2}{rg}$ ⬭

(Total 1 mark)

Q2.

A mass, attached to two springs, oscillates horizontally between **P** and **Q**. The motion of the system is simple harmonic.



Which quantity has its magnitude at a minimum value when the mass is at **Q**?

A the acceleration of the mass ⬭

B the kinetic energy of the mass ⬭

C the potential energy of the mass–spring system ⬭

D the resultant force of the springs on the mass ⬭

(Total 1 mark)

Q3.

A particle performs simple harmonic motion with a time period of 1.4 s and an amplitude of 12 mm.

What is the maximum speed of the particle?

A 8.6 mm s^{-1} ⬭

B 27 mm s^{-1} ⬭

C 54 mm s^{-1} ⬭

D 110 mm s^{-1} ⬭

(Total 1 mark)

Q4.

A planet has a mass M and a radius R.
Loose material at the equator only just remains in contact with the surface of the planet.
This is because the speed at which the planet rotates is very large.

What is the period of rotation of the planet?

A $2\pi\sqrt{\frac{R^2}{GM}}$ ⬭

B $2\pi\sqrt{\frac{GM}{R^2}}$ ⬭

C $2\pi\sqrt{\frac{R^3}{GM}}$ ⬭

D $2\pi\sqrt{\frac{GM}{R^3}}$ ⬭

(Total 1 mark)

Q5.

A simple pendulum and a mass−spring system each have a time period T on the Earth.

They are taken to the surface of a planet where the acceleration due to gravity is $\frac{g}{4}$.

What are the time periods of the pendulum and the mass−spring system on this planet?

Simple pendulum	Mass−spring system

A	$\frac{T}{2}$	T	⬭
B	$2T$	T	⬭
C	$\frac{T}{2}$	$2T$	⬭
D	$2T$	$2T$	⬭

(Total 1 mark)

Q6.

A particle of mass m is oscillating with simple harmonic motion.
The period of the oscillation is T and the amplitude is A.

What is the maximum kinetic energy of the particle?

A $\frac{mA^2}{2T^2}$ ⬭

B $\frac{\pi^2 mA^2}{2T^2}$ ⬭

C $\frac{2mA^2}{T^2}$ ⬭

D $\frac{2\pi^2 mA^2}{T^2}$ ⬭

(Total 1 mark)

Q7.

A particle of mass m undergoes simple harmonic motion with amplitude A and frequency f.

What is the total energy of the particle?

A $2\pi mfA^2$ ⬭

B $2\pi^2 mf^2A^2$ ⬭

C $4\pi^2 m^2 f^2 A$ ⬭

D $4\pi^2 mf^2A^2$ ⬭

(Total 1 mark)

Q8.

A mass of 0.90 kg is suspended from the lower end of a light spring of stiffness 80 N m^{-1}.

When the mass is displaced vertically and released, it undergoes vertical oscillations of small amplitude.

What is the frequency of the oscillations?

A 0.071 Hz ⬭

B 0.67 Hz ⬭

C 1.50 Hz ⬭

D 14 Hz ⬭

(Total 1 mark)

Q9.

An object of mass m moves in a circle of radius r. It completes n revolutions every second.

What is the kinetic energy of the object?

A $\frac{mn^2r^2}{8\pi^2}$ ⬭

B $\frac{mn^2r^2}{4\pi^2}$ ⬭

C $2m\pi^2n^2r^2$ ⬭

D $4m\pi^2n^2r^2$ ⬭

(Total 1 mark)

Q10.

The period of a simple pendulum is doubled when the pendulum length is increased by 1.8 m.

What is the original length of the pendulum?

A 0.45 m ⬭

B 0.60 m ⬭

C 0.90 m ⬭

D 3.6 m ⬭

(Total 1 mark)

Q11.

Two pendulums **A** and **B** oscillate with simple harmonic motion.
The time period of **A** is 2.00 s and the time period of **B** is 1.98 s.

A and **B** are released in phase.

What is the number of oscillations of **A** before **A** and **B** are next in phase?

A 49 ⬭

B 50 ⬭

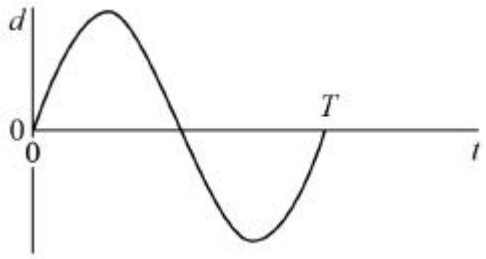
C 99 ⬭

D 100 ⬭

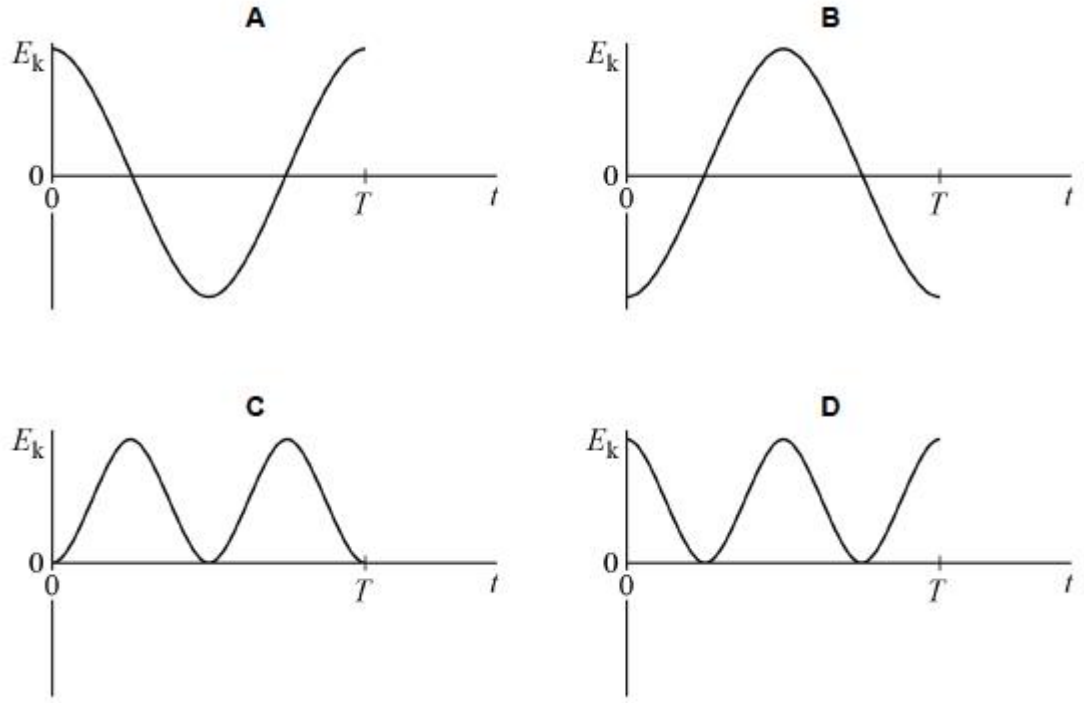
(Total 1 mark)

Q12.

The graph shows the variation of displacement d with time t for a particle moving with simple harmonic motion of period T.



Which graph shows the variation of kinetic energy E_k of the particle with time?



A ⬭

B ⬭

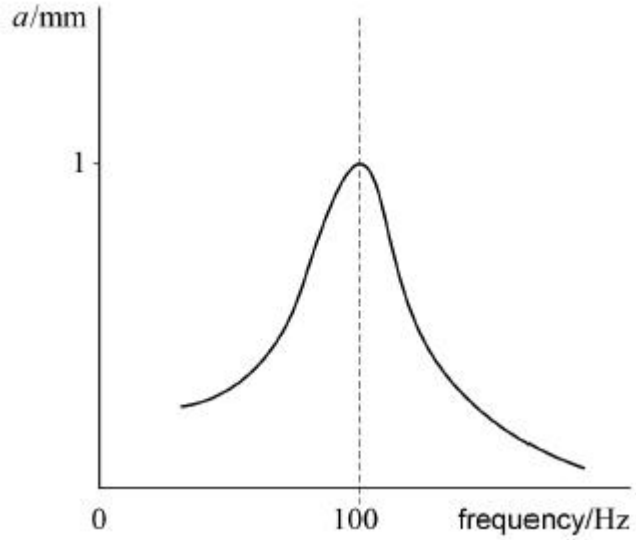
C ⬭

D ⬭

(Total 1 mark)

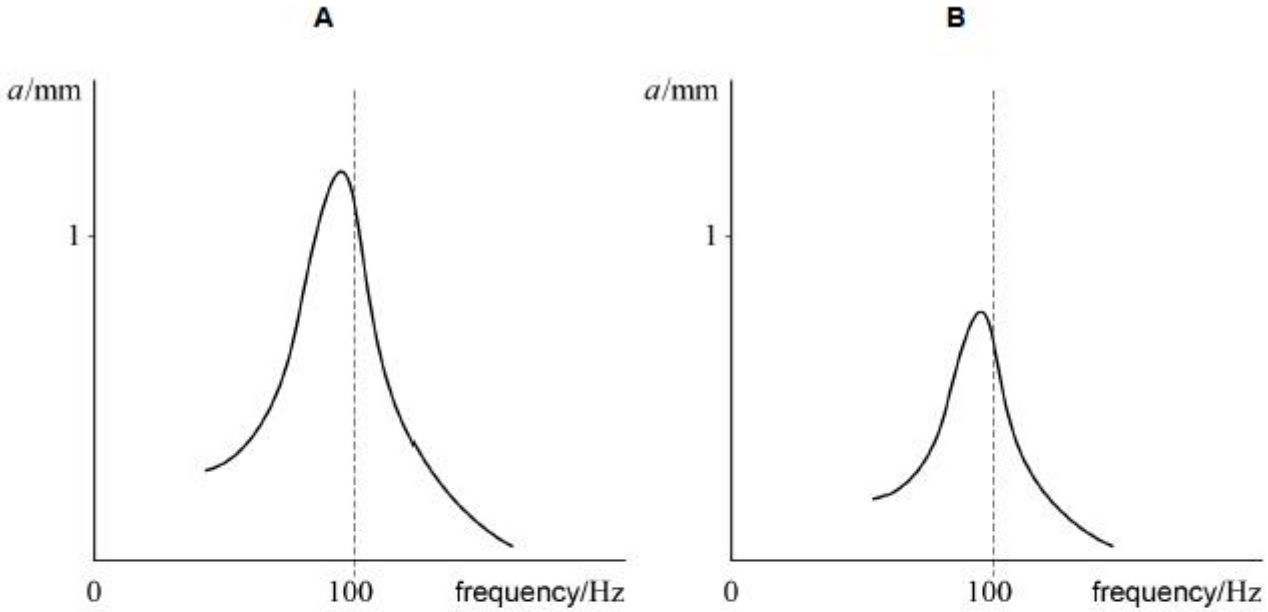
Q13.

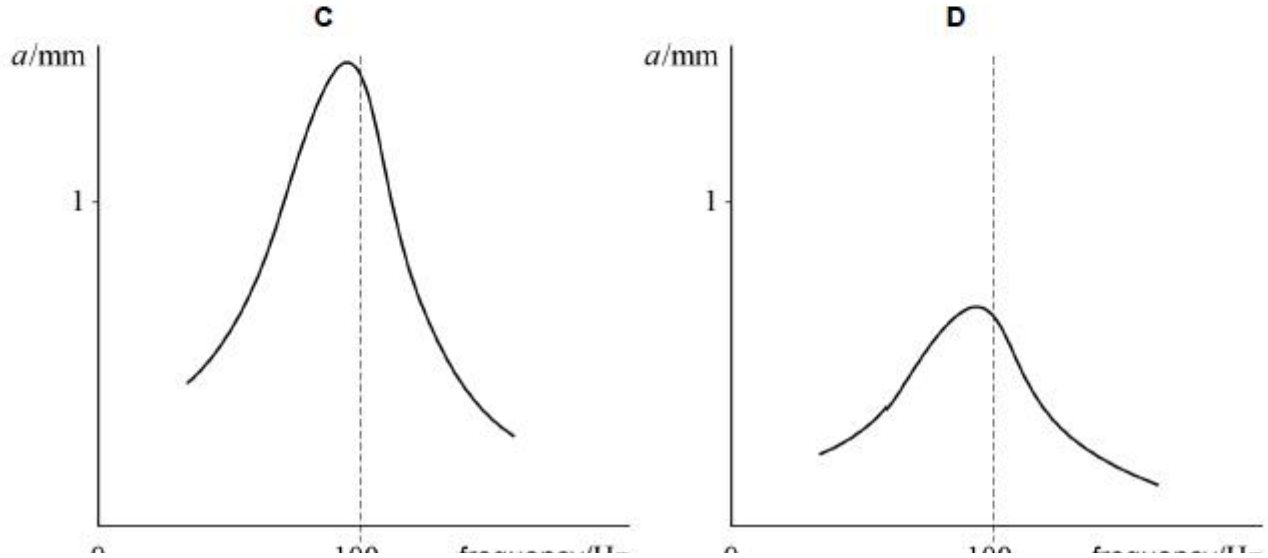
A metal panel is driven to vibrate at different frequencies. The amplitude a of the vibration is measured at each frequency. The graph shows the variation of amplitude with driven frequency.



The damping of the metal panel is increased without changing the mass of the panel.

Which graph shows the variation of a with frequency with increased damping?





A ⬭

B ⬭

C ⬭

D ⬭

(Total 1 mark)

Q14.

The frequency of oscillation of a vertical spring is f when the mass hanging from the spring is m.

What is the relationship between f and m?

A $f \propto m^{-\frac{1}{2}}$ ⬭

B $f \propto m^{-2}$ ⬭

C $f \propto m^{½}$ ⬭

D $f \propto m^{2}$ ⬭

(Total 1 mark)

Q15.

A planet of mass M and radius R rotates so quickly that material at its equator only just remains on its surface.

What is the period of rotation of the planet?

A $2\pi\sqrt{\frac{R}{GM}}$ ⬭

B $2\pi\sqrt{\frac{GM}{R}}$ ⬭

C $2\pi\sqrt{\frac{R^3}{GM}}$ ⬭

D $2\pi\sqrt{\frac{GM}{R^3}}$ ⬭

(Total 1 mark)

Q16.

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)

Q17.

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 ⬭

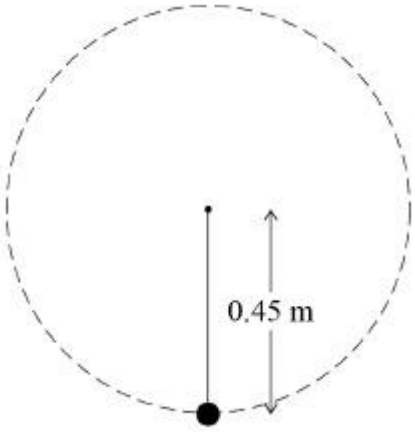
C 0.57 J ⬭

D 11 J ⬭

(Total 1 mark)

Q18.

A bob of mass 0.50 kg is suspended from the end of a piece of string 0.45 m long.
The bob is rotated in a vertical circle at a constant rate of 120 revolutions per minute.



What is the tension in the string when the bob is at the bottom of the circle?

A 5.8 N ⬭

B 31 N ⬭

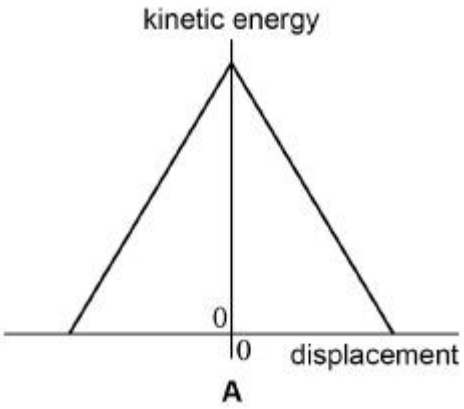
C 36 N ⬭

D 40 N ⬭

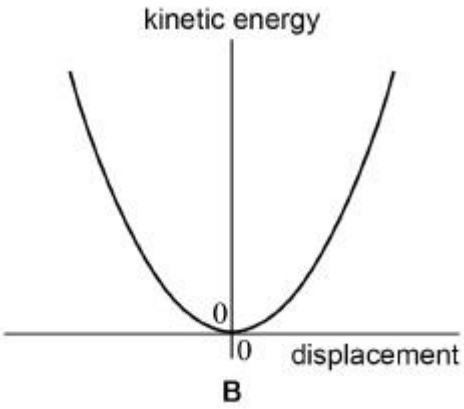
(Total 1 mark)

Q19.

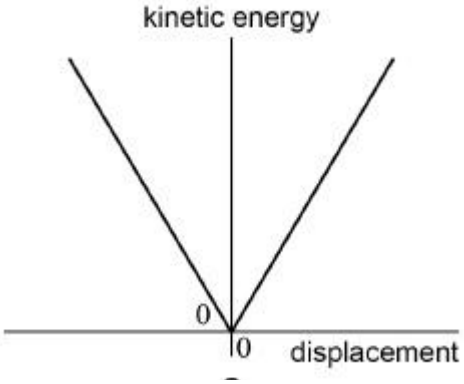
Which graph best shows how the kinetic energy of a simple pendulum varies with displacement from the equilibrium position?

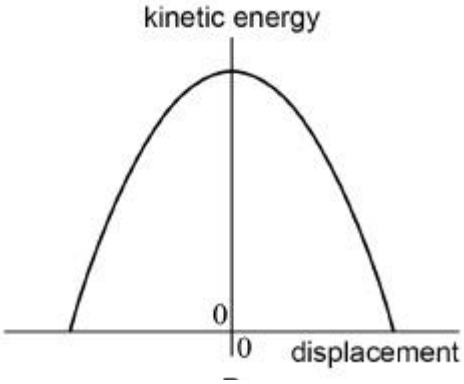


A



B





A ⬭

B ⬭

C ⬭

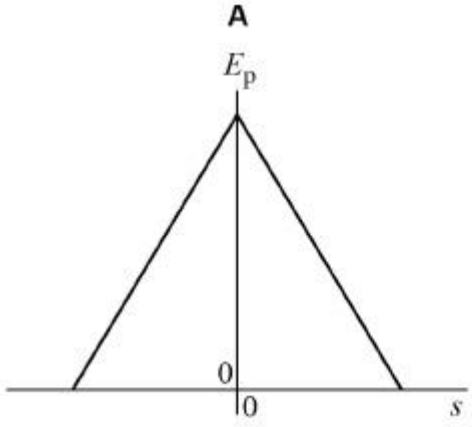
D ⬭

(Total 1 mark)

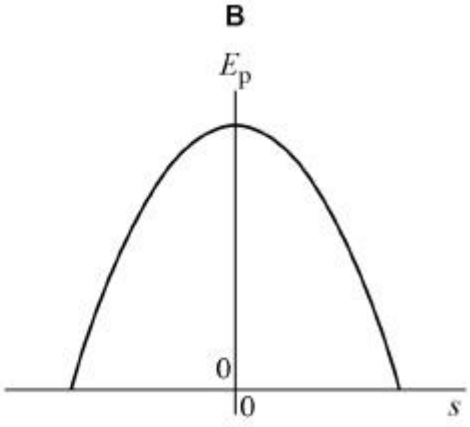
Q20.

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

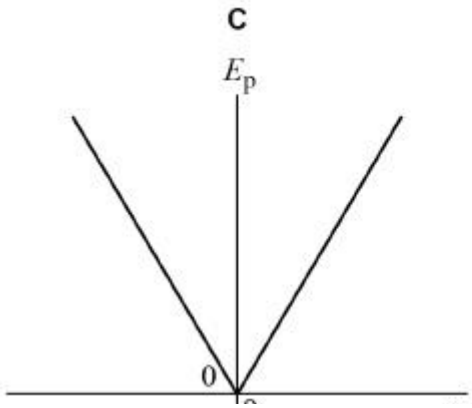
A



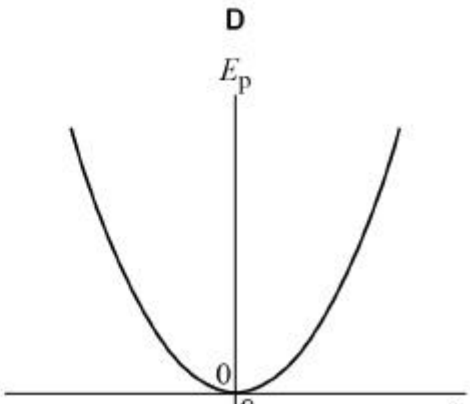
B



C



D



A ⬭

B ⬭

C ⬭

D ⬭

(Total 1 mark)