Forced, Vibration & Resonance

TOPIC QUESTIONS

Level	A Level
Subject	Physics
Exam Board	AQA
Paper Type	Multiple Choice

Time Allowed : 30min

1. 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?

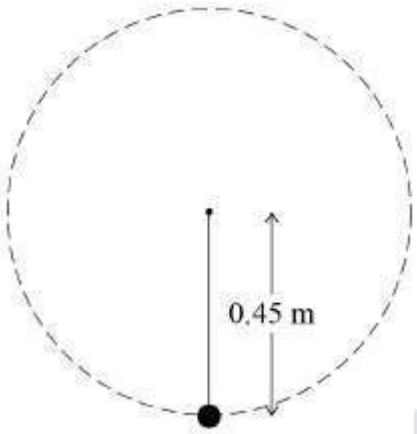
A $f \propto m^{-½}$

B $f \propto m^{-2}$

C $f \propto m^{½}$

D $f \propto m^{2}$

2. 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?

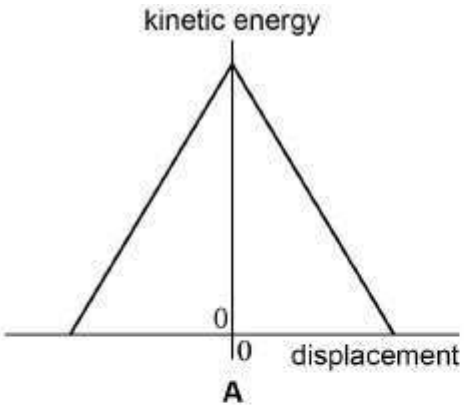
A 5.8 N

B 31 N

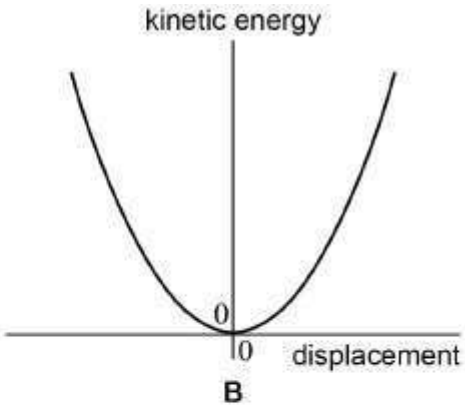
C 36 N

D 40 N

3. Which graph best shows how the kinetic energy of a simple pendulum varies with displacementfrom the equilibrium position?



A



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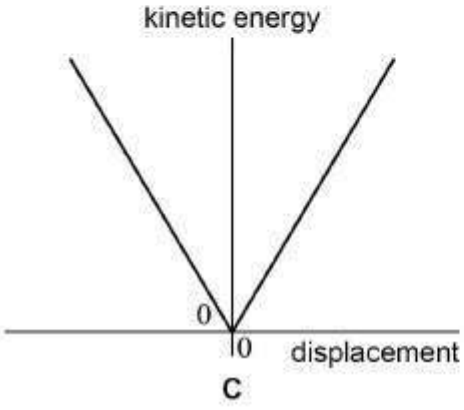

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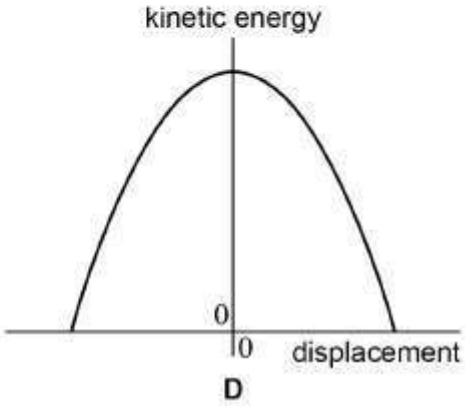
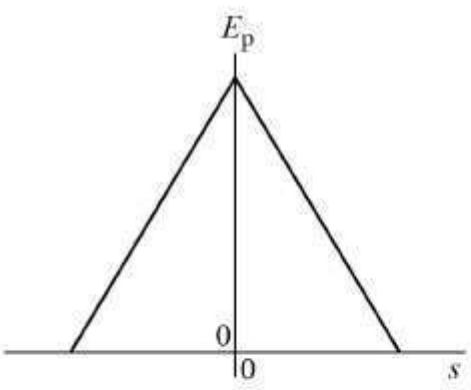


D

4. Which graph shows how the gravitational potential energy E_p of a simple pendulum varies withdisplacement s from the equilibrium position?

A



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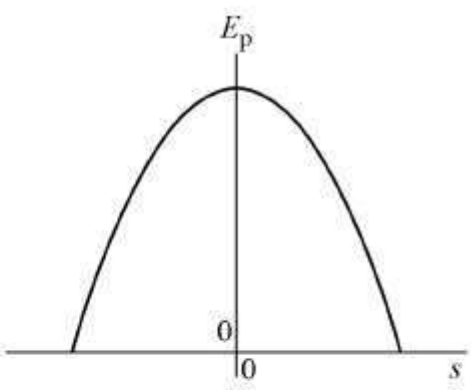

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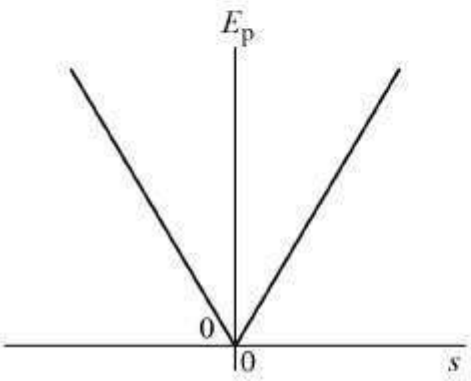

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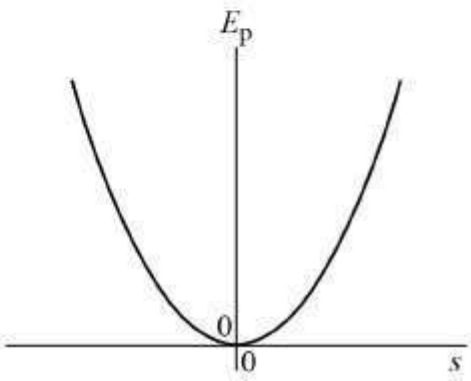


5. A body performs simple harmonic motion.

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

A 0

B $\frac{\pi}{4}$ rad

C $\frac{\pi}{2}$ rad

D π rad

6. A particle of mass m executes simple harmonic motion in a straight line with amplitude A and frequency f. Which one of the following expressions represents the total energy of the particle?

A $2\pi^2 mfA^2$

B $2\pi^2 mf^2A^2$

C $4\pi^2 m^2f^2A$

D $4\pi^2 mf^2A^2$

7. A simple pendulum and a mass-spring system both have the same time period T at the surface of the Earth. If taken to another planet where the acceleration due to gravity was half that on Earth,which line, **A-D**, in the table gives correctly the new periods?

	simple pendulum	mass-spring
A	$T\sqrt{2}$	T
B	$\frac{T}{\sqrt{2}}$	T
C	$T\sqrt{2}$	$\frac{T}{\sqrt{2}}$

D	$\frac{T}{\sqrt{2}}$	$T\sqrt{2}$

8. A body undergoes forced oscillation. Which one of the following will **not** be increasedby increasingthe amplitude of the oscillatory driving force?

A the amplitude of the driven oscillation

B the energy of the driven oscillation

C the frequency of the driven oscillation

D the power required to maintain the driven oscillation

9. Which one of the following statements is **not** true for a body vibrating in simple harmonic motionwhen damping is present?

A The damping force is always in the opposite direction to the velocity.

B The damping force is always in the opposite direction to the acceleration.

C The presence of damping gradually reduces the maximum potential energy of the system.

D The presence of damping gradually reduces the maximum kinetic energy of the system.

10. For which of the following relationships is the quantity y related to the quantity x by the relationship $x \propto \frac{1}{y}$?

	x	y
A	energy stored in a spring	extension of the spring
B	gravitational field strength	distance from a point mass
C	de Broglie wavelength of an electron	momentum of the electron
D	period of a mass-spring system	spring constant (stiffness) of the spring

11. A mass on the end of a string is whirled round in a horizontal circle at increasing speed untilthe string breaks. The subsequent path taken by the mass is

A a straight line along a radius of the circle.

B a horizontal circle.

C a parabola in a horizontal plane.

D a parabola in a vertical plane.

12. A particle of mass m moves in a circle of radius r at uniform speed, taking time T for each revolution. What is the kinetic energy of the particle?

A $\frac{\pi^2 mr}{T^2}$

B $\frac{\pi^2 mr^2}{T^2}$

C $\frac{2\pi^2 mr^2}{T}$

D $\frac{2\pi^2 mr^2}{T^2}$

13. A body moves with simple harmonic motion of amplitude 0.90 m and period 8.9 s. What is the speed of the body when its displacement is 0.70 m?

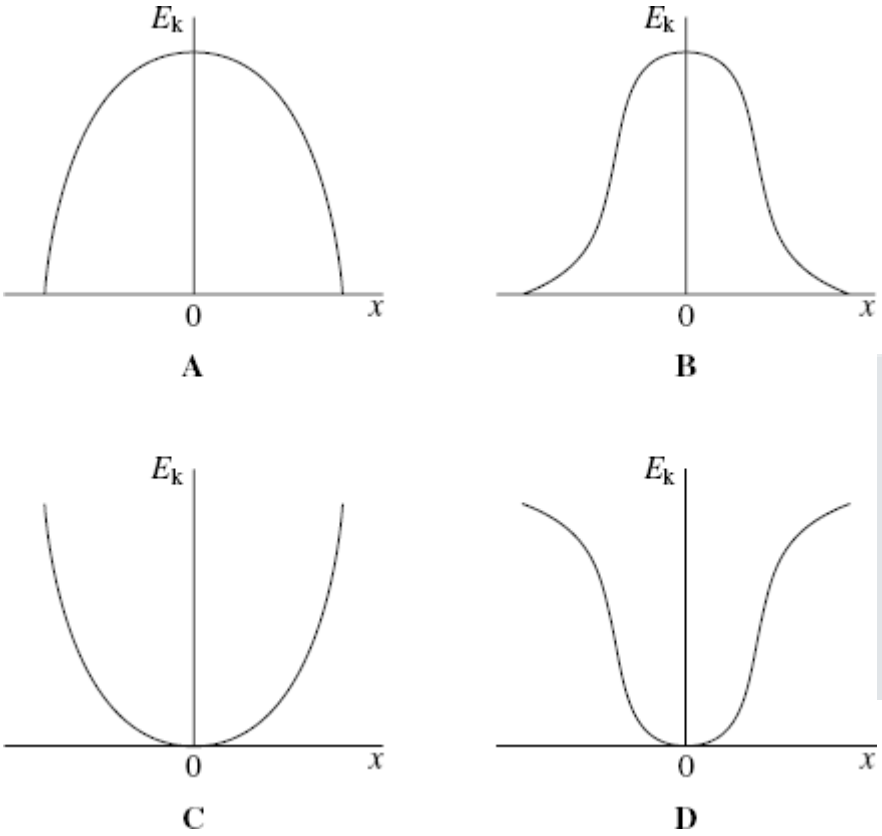
A 0.11 m s^{-1}

B 0.22 m s^{-1}

C 0.40 m s^{-1}

D 0.80 m s^{-1}

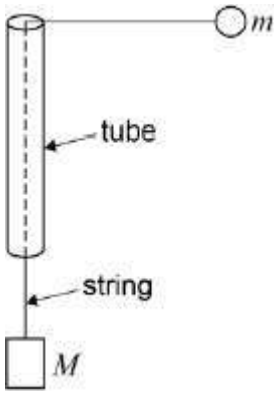
14. Which graph, **A** to **D**, shows the variation of the kinetic energy, E_k, with displacement x for a particle performing simple harmonic motion?



15. The time period of oscillation of a simple pendulum of length l is the same as the time period of oscillation of a mass M attached to a vertical spring. The length and mass are then changed.
Which row, **A** to **D**, in the table would give a simple pendulum with a time period twice that of thespring oscillations?

	new pendulum length	new mass on spring
A	$2l$	$2M$
B	$2l$	$\frac{M}{2}$
C	$\frac{l}{2}$	$2M$
D	$\frac{l}{2}$	$\frac{M}{2}$

16. A string passes through a smooth thin tube. Masses m and M are attached to the ends of the string.
The tube is moved so that the mass m travels in a horizontal circle of constant radius r and atconstant speed v.



Which of the following expressions is equal to M?

A $\frac{mv^2}{2r}$

B mv^2rg

C $\frac{mv^2}{rg}$

D $\frac{mv^2g}{r}$

17. The frequency of a body moving with simple harmonic motion is doubled. If the amplitude remainsthe same which of the following is also doubled?

A The time period.

B The total energy.

C The maximum velocity.

D The maximum acceleration.

18. A particle oscillates with undamped simple harmonic motion.

The acceleration of the particle

A is always in the opposite direction to its velocity.

B decreases as the potential energy increases.

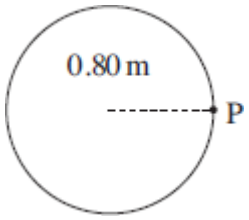
C is proportional to the frequency.

D is least when the speed is greatest.

19. A simple pendulum and a mass-spring system have the same oscillation frequency f at the surface ofthe Earth. The pendulum and the mass-spring system are taken down a mine where the acceleration due to gravity is less than at the surface. What is the change in the frequency of the simple pendulum and the change in the frequency of the mass-spring system?

	simple pendulum	mass-spring	
A	f increases	f decreases	
B	f decreases	f decreases	
C	f increases	f stays unchanged	
D	f decreases	f stays unchanged	

20. A model car moves in a circular path of radius 0.80 m at an angular speed of $\frac{\pi}{2}$ rad s^{-1}.



What is its displacement from point P 6.0 s after passing P?

A zero

B 0.4π m

C 1.6 m

D 1.6π m