Circular Motion

TOPIC QUESTIONS

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

Time Allowed : 30min

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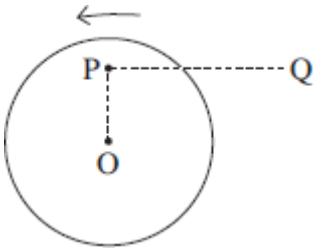
1. A small mass is placed at P on a horizontal disc which has its centre at O. The disc rotatesanti-clockwise about a vertical axis through O with constant angular speed.



Which one of the following describes the force which keeps the mass at rest relative to the discwhen in the position shown?

A the weight of the mass

B a frictional force from P to Q

C a frictional force directed away from O

D a frictional force directed towards O

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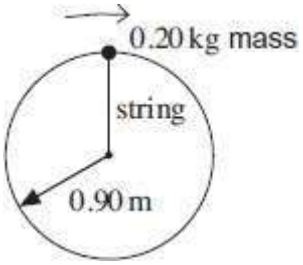
2. A 0.20 kg mass is whirled round in a vertical circle on the end of a light string of length 0.90 m.



At the top point of the circle the speed of the mass is 8.2 m s^{-1}. What is the tension in the string atthis point?

A 10 N

B 13 N

C 17 N

D 20 N

3. Which line, **A** to **D**, in the table gives the amplitude and frequency of a body performing simpleharmonic motion whose displacement x at time t is given by the equation $x = P \cos Qt$?

	Amplitude	Frequenc y
A	$\frac{P}{2}$	$\frac{Q}{2\pi}$
B	P	$2\pi Q$
C	P	$\frac{Q}{2\pi}$
D	$2P$	$\frac{Q}{2\pi}$

4. The tip of each prong of a tuning fork emitting a note of 320 Hz vibrates in simple harmonic motionwith an amplitude of 0.50 mm.
   What is the speed of each tip when its displacement is zero?

   A zero

   B 0.32π mm s^{-1}

   C 160π mm s^{-1}

   D 320π mm s^{-1}

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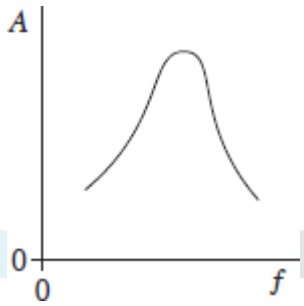
5. A periodic force is applied to a lightly-damped object causing the object to oscillate. The graph shows how the amplitude A of the oscillations varies with the frequency f of the periodic force.



Which one of the following statements best describes how the shape of the curve would differ if the damping had been greater?

A the curve would be lower at all frequencies

B the curve would be higher at all frequencies

C the curve would be unchanged except at frequencies above the resonant frequency where it would be lower

D the curve would be unchanged except at frequencies above the resonant frequency where it would be higher

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6. What is the angular speed of a point on the Earth's equator?

A 7.3×10^{-5} rad s^{-1}

B 4.2×10^{-3} rad s^{-1}

C 2.6×10^{-1} rad s^{-1}

D 15 rad s^{-1}

7. Which one of the following does **not** involve a centripetal force?

A an electron in orbit around a nucleus

B a car going round a bend

C an α particle in a magnetic field, travelling at right angles to the field

D an α particle in a electric field, travelling at right angles to the field

8. Which one of the following gives the phase difference between the particle velocity and the particle displacement in simple harmonic motion?

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

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

C $\frac{3\pi}{4}$ rad

D 2π rad

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9. A mass *M* hangs in equilibrium on a spring. *M* is made to oscillate about the equilibrium position by pulling it down 10 cm and releasing it. The time for *M* to travel back to the equilibriumposition for the first time is 0.50 s. Which row, **A** to **D**, in the table is correct for these oscillations?

	amplitude / cm	period / s
A	10	1.0
B	10	2.0
C	20	2.0
D	20	1.0

10. Which one of the following statements concerning forced vibrations and resonance is correct?

A An oscillating body that is not resonating will return to its natural frequency when the forcing vibration is removed.

B At resonance, the displacement of the oscillating body is 180° out of phase with the forcing vibration.

C A pendulum with a dense bob is more heavily damped than one with a less dense bob of the same size.

D Resonance can only occur in mechanical systems

11. A body moves with simple harmonic motion of amplitude A and frequency

What is the magnitude of the acceleration when the body is at maximum displacement?

A zero

B $4\pi^2Ab^2$

C Ab^2

D $\frac{4\pi^2 A}{b^2}$

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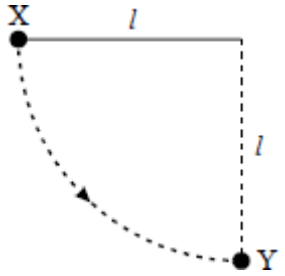
12.



A ball of mass m, which is fixed to the end of a light string of length l, is released from rest at X. It swings in a circular path, passing through the lowest point Y at speed v. If the tension in the string at Y is T, which one of the following equations represents a correct application of Newton's laws of motion to the ball at Y?

A $T = \frac{mv^2}{l} - mg$

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B $T - mg = \frac{mv^2}{l}$

C $mg - T = \frac{mv^2}{l}$

D $T + \frac{mv^2}{l} = mg$

13. A body is in simple harmonic motion of amplitude 0.50 m and period 4π seconds. What is the speedof the body when the displacement of the body is 0.30 m?

A $0.10 ms^{-1}$

B $0.15 ms^{-1}$

C $0.20 m s^{-1}$

D $0.40 m s^{-1}$

14. Which one of the following statements always applies to a damping force acting on a vibratingsystem?

A It is in the same direction as the acceleration. **B** It is in the same direction as the displacement. **C** It is in the opposite direction to the velocity.

D It is proportional to the displacement.

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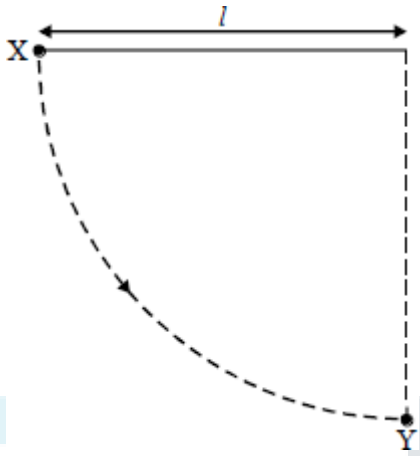
15.



A simple pendulum consists of a bob of mass m on the end of a light string of length l. The bob is released from rest at X when the string is horizontal. When the bob passes through Y its velocity is v and the tension in the string is T. Which one of the following equations gives the correct value of T?

A $T = mg$

B $T = \frac{mv^2}{l}$

C $T + mg = \frac{mv^2}{l}$

D $T - mg = \frac{mv^2}{l}$

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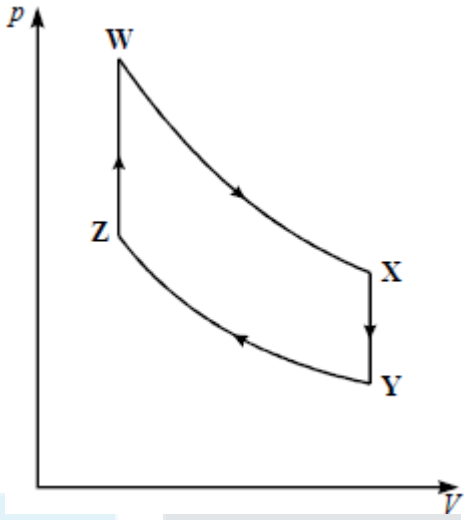
16. The diagram shows the p-V diagram of an ideal hot-air engine. **WX** and **YZ** are isothermal changes.



Which line of the table below correctly indicates the nature of the work done **on** or **by** the air ineach part of the cycle?

	WX	XY	YZ	ZW
A	zero	by	zero	on
B	by	zero	on	zero
C	zero	on	zero	by
D	on	zero	by	zero

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17. The temperature of a room increases from 283K to 293K. The r.m.s. speed of the air molecules in theroom increases by a factor of

A 1.02

B 1.04

C 1.41

D 2.00

18. A fixed mass of an ideal gas initially has a volume V and an absolute temperature T. Its initial pressure could be doubled by changing its volume and temperature to

A $V/2$ and $4T$

B $V/4$ and $T/2$

C $2V$ and $T/4$

D $4V$ and $2T$

19. A car of mass M travelling at speed V comes to rest using its brakes. Energy is dissipated in the brake discs of total mass m and specific heat capacity c. The rise in temperature of the brake discs can be estimated from

A $\frac{mV^2}{2Mc}$

B $\frac{2MV^2}{mc}$

C $\frac{MV^2}{2mc}$

D $\frac{2mc}{MV^2}$

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20. Which one of the following is **not** an assumption about the properties of particles in the simplekinetic theory?

A $^{2}>$ is the average speed of the particles

B The forces between the particles are negligible except when particles collide

C The time spent by particles in collision is negligible compared with the time spentbetween collisions

D The volume of the particles is negligible compared to the volume of the container

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