Newton,s Laws of Motion

TOPIC QUESTIONS

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

Time Allowed : 30min

1. Which quantity is represented by the area under a force-time graph?

A average power

B elastic strain energy stored

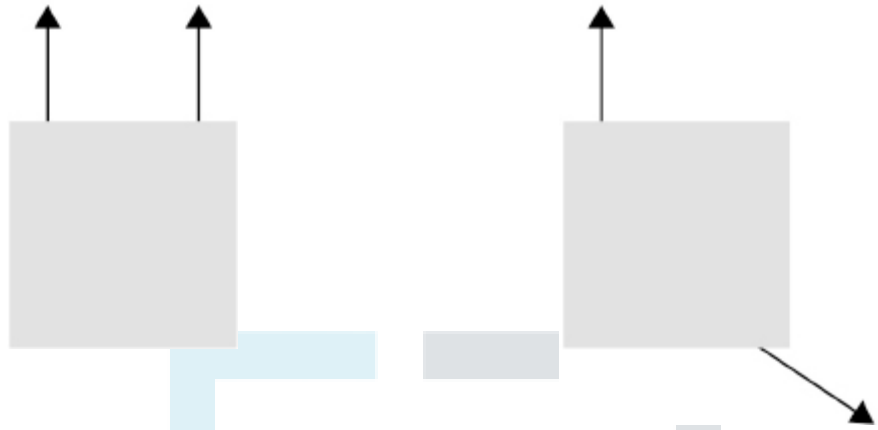
C momentum change

D work done

2. Each diagram shows two horizontal forces acting on a solid square object seen from above.All the forces have the same magnitude.

A

B



C

D

Which system produces a couple about any point inside the object?

A

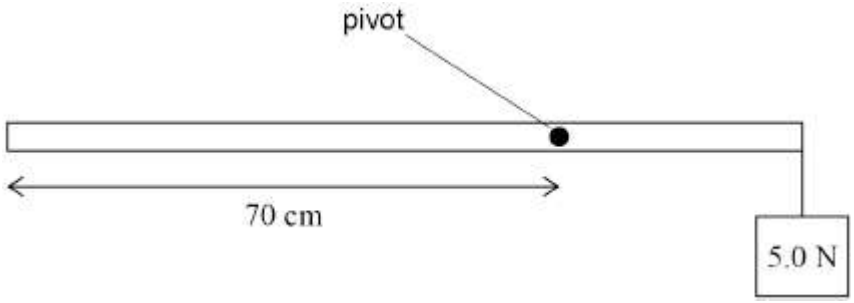
B

C

D

3. A uniform metre ruler of weight 2.0 N is freely pivoted at the 70 cm mark.

A student holds the ruler in a horizontal position and suspends a 5.0 N weight from the 100 cm end.



What is the magnitude of the resultant moment when the student releases the ruler?

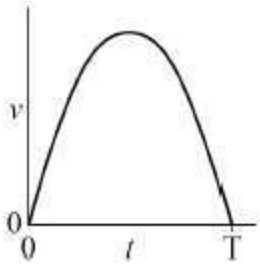
A 0.15 N m

B 0.19 N m

C 1.1 N m

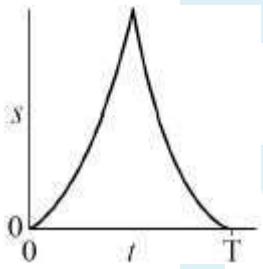
D 1.9 N m

4. The diagram shows how the speed v of an object varies with time t.

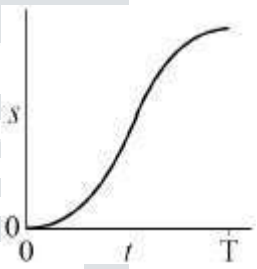


Which graph shows the variation of distance s with t for the object?

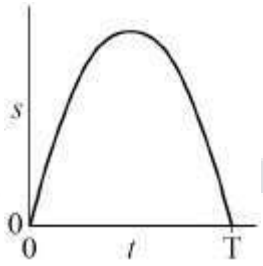
A



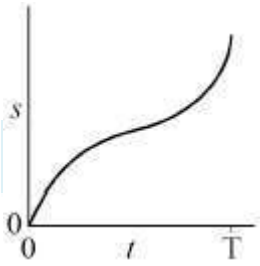
B



C



D



A

B

C

D

5. Two ball bearings **X** and **Y** are projected from horizontal ground at the same time.

X has mass $2m$ and is projected vertically upwards with speed u.

Y has mass m and is projected at 30° to the horizontal with speed $2u$.

Air resistance is negligible.

Which statement is correct?

A **X** and **Y** have the same initial momentum.

B **X** and **Y** reach their maximum heights at different times.

C The maximum height reached by **Y** is half that reached by **X**.

D **X** and **Y** reach the ground at the same time.

6. A mass m is added to a vertical spring that is initially unextended, as shown in **Diagram 1**.

The mass is then lowered until it hangs stationary on the spring, as shown in **Diagram 2**.

The extension of the spring is now ΔL.

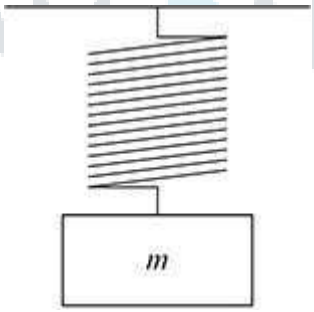


Diagram 1

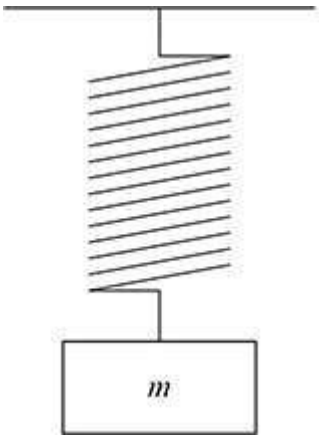


Diagram 2

How much energy is transferred from the mass-spring system?

A $\frac{mg\Delta L}{2}$

B $mg\Delta L$

C $3mg\Delta L$

D $2mg\Delta L$

7. A wire is made from a material of density ρ.
The wire has a mass m and an initial length L.
When the tensile force in the wire is F the extension of the wire is ΔL.What

is the Young modulus of the material?

A $\frac{F\rho L^2}{m\Delta L}$

B $\frac{FL^2}{m\rho\Delta L}$

C $\frac{F\rho}{m\Delta L}$

D $\frac{FmL^2}{\rho\Delta L}$

8. Two wires **X** and **Y** have the same extension for the same load.
X has a diameter d and is made of a metal of density ρ and Young modulus E.
Y has the same mass and length as **X** but its diameter is $2d$.

What are the density and the Young modulus of the metal from which **Y** is made?

	Density	Young modulus
A	$\frac{\rho}{2}$	$\frac{E}{4}$
B	$\frac{\rho}{2}$	$4E$
C	$\frac{\rho}{4}$	$\frac{E}{4}$
D	$\frac{\rho}{4}$	$4E$

9. A tensile force produces an extension ΔL in a steel wire of initial length L and diameter d.

The same steel is used to make a second wire of initial length $2L$ and diameter $\frac{d}{2}$ What is the extension when the same force is applied to the second wire?

A $\frac{\Delta L}{2}$

B 2ΔL

C 4ΔL

D 8ΔL

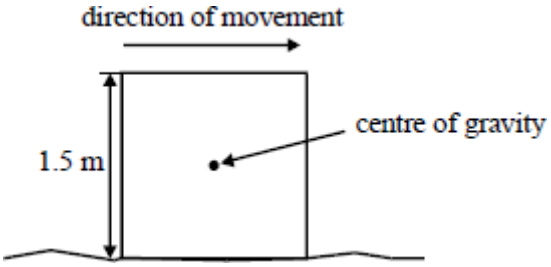
10. Which combination of properties would produce the smallest extension of a wire when the sametensile force is applied to the wire?

	Cross-sectional area	Length	Young modulus of material
A	X	$3L$	E
B	$2X$	L	E
C	X	$3L$	$4E$
D	$2X$	L	$4E$

11. Which one of the following pairs contains one vector and one scalar quantity?

A	Displacement	Acceleration
B	Force	Kinetic energy
C	Power	Speed
D	Work	Potential energy

12. A uniform square block is sliding with uniform speed along a rough surface as shown in the diagram.



The force used to move the block is 200 N. The moment of the frictional force acting on the blockabout the centre of gravity of the block is

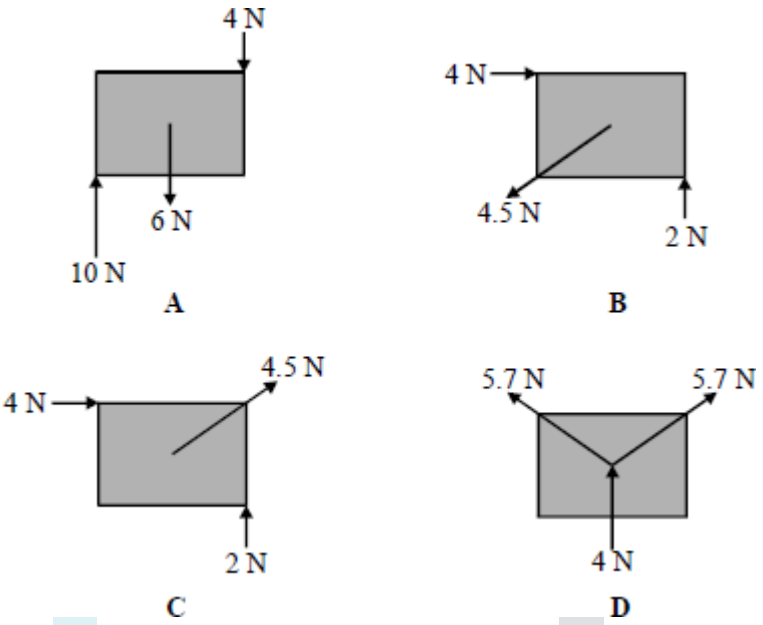
A 150 N m, clockwise

B 150 N m, anticlockwise

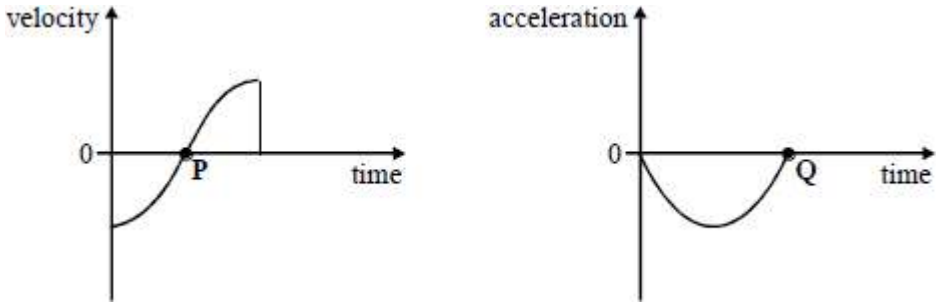
C 300 N m, clockwise

D 300 N m, anticlockwise

13. The rectangular objects, **A**, **B**, **C** and **D** are each 2 cm long and 1 cm high. Which one of the bodies is in equilibrium?



14. The diagrams show the variation of velocity and acceleration with time for a body undergoing simpleharmonic motion.



Which one of the following is proportional to the change in momentum of the body during thetime covered by the graphs?

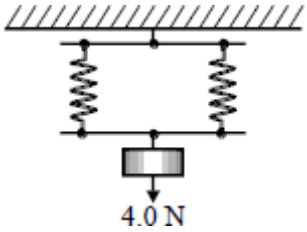
A The area enclosed by the velocity-time graph and the time axis

B The gradient of the velocity-time graph at the point **P**

C The area enclosed by the acceleration-time graph and the time axis

D The gradient of the acceleration-time graph at the point **Q**

15. A load of 4.0 N is suspended from a parallel two-spring system as shown in the diagram.



The spring constant of each spring is 20 N m^{-1}. The elastic energy, in J, stored in the system is

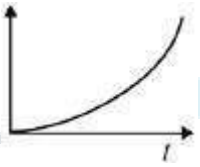
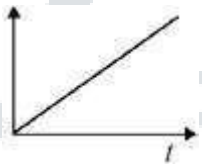
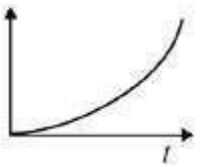
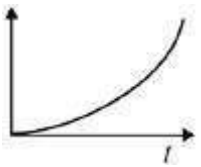
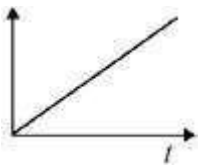
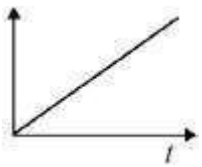
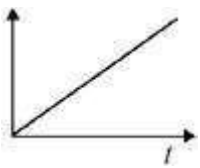
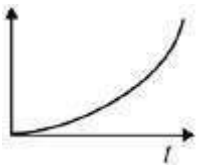
A 0.1

B 0.2

C 0.4

D 0.8

16. An object is accelerated from rest by a constant force *F* for a time *t*. Which graphs represent thevariation of time with the change in the kinetic energy and the change in momentum of the object?

	Kinetic energy	Momentum
A		
B		
C		
D		

17. An object is dropped from a cliff. How far does the object fall in the third second? Assume that g = 10 m s^{-2}.

A 10 m

B 20 m

C 25 m

D 45 m

18. A body falls freely, with negligible air resistance. What quantity of the body is its rate of change ofmomentum?

A mass

B power

C kinetic energy

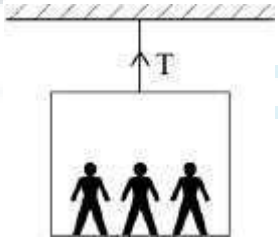
D weight

19. A firework rocket is fired vertically into the air and explodes at its highest point. What are the changes to the total kinetic energy of the rocket and the total momentum of the rocket as a resultof the explosion?

	total kinetic energy ofrocket	total momentum of rocket
A	unchanged	unchanged
B	unchanged	increased
C	increased	unchanged
D	increased	increased

20. A lift and its passengers with a total mass of 500 kg accelerates upwards at 2 m s^{-2} as shown.

Assume that g = 10 m s^{-2}.



What is the tension in the cable?

A 1000 N

B 4000 N

C 5000 N

D 6000 N