Equations of Motion

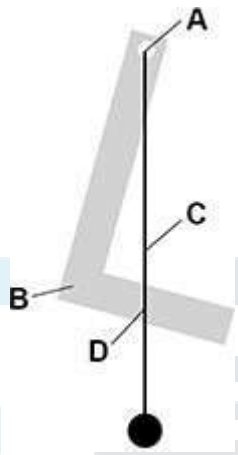
TOPIC QUESTIONS

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

Time Allowed : 30min

1. A uniform piece of card in the shape of the letter L is suspended freely from a horizontal pin.A plumb line is also suspended from the pin.

The diagram shows the card in its equilibrium position.



What is the position of the centre of mass of the piece of card?

A

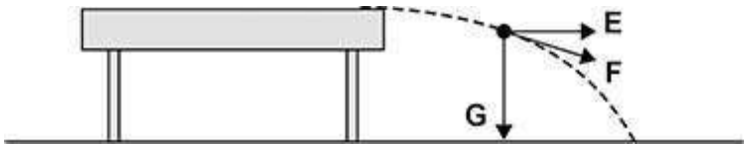
B

C

D

2. A coin is projected horizontally from the top of a desk.

The diagram shows the coin at one point in its path. The air resistance is negligible.

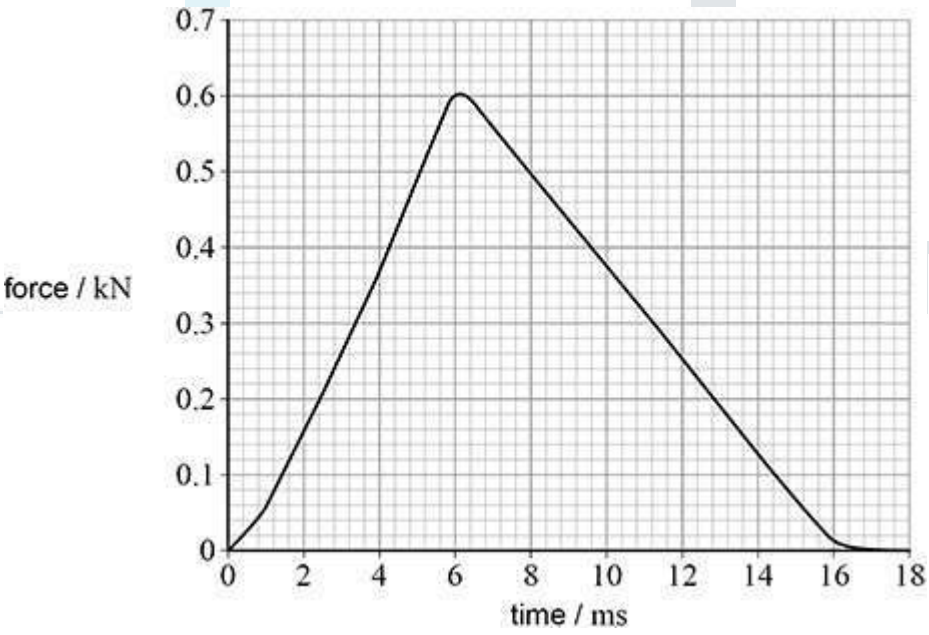


The arrows **E**, **F** and **G** represent different directions.

Which row gives the direction of the acceleration and the direction of the momentum of the coinat this point?

	Acceleration	Momentum
A	**F**	**F**
B	**F**	**E**
C	**G**	**F**
D	**G**	**E**

3. A golf ball has a mass of 46 g and is initially stationary.
The diagram shows the variation with time of the force acting on the golf ball as it is hit with a golf club.



What is an estimate of the kinetic energy of the golf ball immediately after it is hit?

A 5 J

B 50 J

C 250 J

D 500 J

4. A Formula 1 racing car uses up its fuel during the race, causing its lap times to decrease.

   The lap times decrease because

A the acceleration of the car increases.

B the drag forces on the car decrease.

C the maximum speed of the car increases.

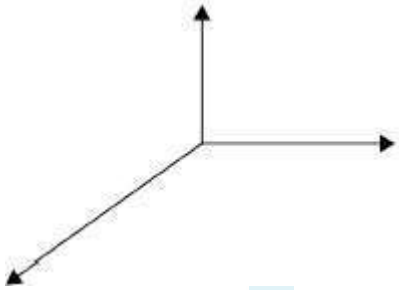
D the tyres become worn, reducing the friction with the road.

5. An object is in equilibrium when acted on by three coplanar forces.

   Which free-body diagram is correct?

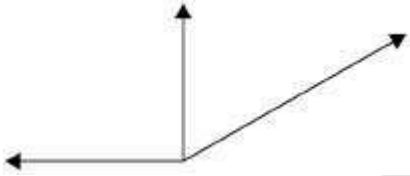
Each diagram is drawn to scale.

A

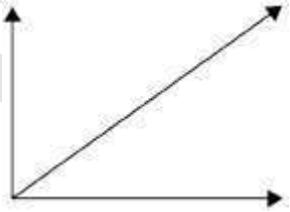


B

C



D



A

B

C

D

6. The table contains information on four wires. It shows the stiffness of each wire and the maximum strain energy stored in the wire when extended to the breaking point.

Assume each wire has the same initial dimensions and obeys Hooke's law.

Which wire extends the least before reaching the breaking point?

	Stiffness / N m^{-1}	Maximum strain energy / J	
A	4.0	1	⬭
B	9.0	1	⬭
C	16	3	⬭
D	25	3	⬭

7. A steel wire **W** has a length l and a circular cross-section of radius r. When **W** hangs verticallyand a load is attached to the bottom end, it extends by e.

Another wire **X** made from the same material has the same load attached to it.

Which length and radius for **X** will produce an extension of $\frac{e}{4}$?

	Length of X	Radius of X	
A	$0.5l$	$2r$	⬭
B	l	$4r$	⬭
C	$2l$	$2r$	⬭
D	$4l$	$4r$	⬭

8. What is the name given to a material that breaks without deformation when a force is applied toit?

A Plastic

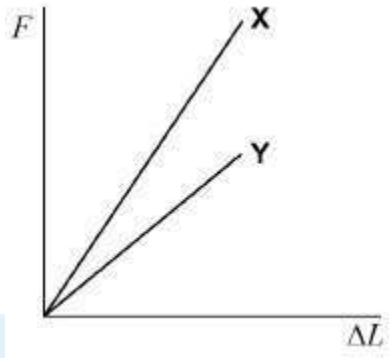
B Brittle

C Stiff

D Elastic

9. Two separate wires **X** and **Y** have the same original length and cross-sectional area.

The graph shows the extension ΔL produced in **X** and **Y** when the tensile force F applied to the wires is increased up to the point where they break.



Which statement is **incorrect**?

A For a given extension more energy is stored in **X** than in **Y**.

B The Young modulus of the material of wire **Y** is greater than that of wire **X**.

C Both wire **X** and wire **Y** obey Hooke's law.

D Wire **X** has a greater breaking stress than wire **Y**.

10. What **cannot** be used as a unit for the Young modulus?

A N m^{-2}

B Pa

C kg m^{-2} s^{-2}

D kg m^{-1} s^{-2}

11. A lunar landing module is descending to the Moon's surface at a steady velocity of 10.0 m s^{-1}. At a height of 120 m a small object falls from its landing gear. Assuming that the Moon's gravitational acceleration is 1.60 m s^{-2}, at what speed, in m s^{-1} does the object strike the Moon?

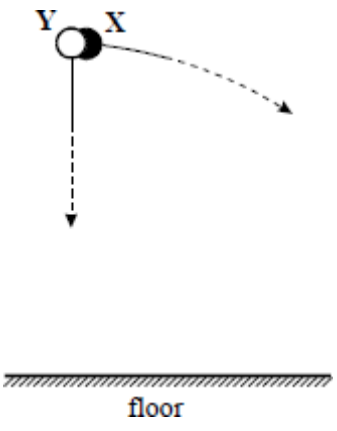
A 22.0

B 19.6

C 16.8

D 10.0

12. A ball **X** is projected horizontally from a certain point at the same time as a ball **Y** of the same diameter but twice the mass is released from rest and allowed to fall vertically from the samelevel. Air resistance is negligible. Which one of the following will occur?



A **Y** will hit the floor just before

X

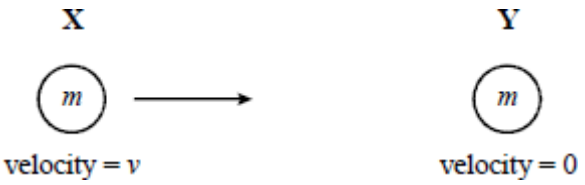
B **X** will hit the floor just before

Y

C **X** and **Y** will hit the floor at the same time

D **Y** hits the floor while **X** is half way to the floor

13. A body **X**, moving with a velocity *v*, collides elastically with a stationary body **Y** of equal mass.



Which one of the following correctly describes the velocities of the two bodies after the collision?

	velocity of **X**	velocity of **Y**
A	$\frac{v}{2}$	$\frac{v}{2}$
B	$-\frac{v}{2}$	$\frac{v}{2}$
C	$-v$	0
D	0	v

14. A car of mass M travelling at speed V comes to rest using its brakes. Energy is dissipated in the brakediscs 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 $\frac{2mc}{MV^2}$

15. Which of the following does **not** give a value in seconds?

A capacitance × resistance

B $\frac{1}{\text{frequency}}$

C half-life

D $\frac{\text{power}}{\text{work}}$

16. Which one of the following has the same unit as the rate of change of momentum?

A work

B energy

C acceleration

D weight

17. The nucleus of a radioactive isotope X is at rest and decays by emitting an α particle so

that a newnuclide Y is formed.

Which one of the following statements about the decay is correct?

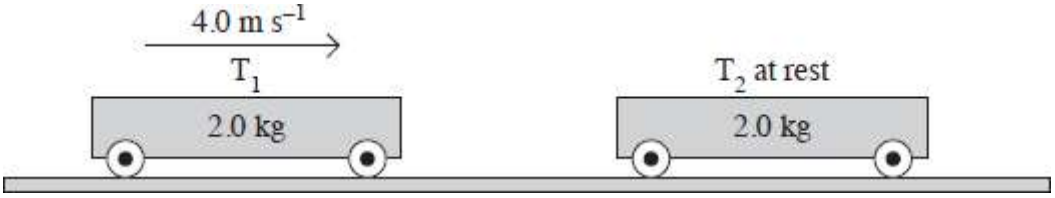
A The momentum of Y is equal and opposite to the momentum of the α particle.

B The momentum of Y is equal to the momentum of X.

C The kinetic energy of Y is equal to the kinetic energy of the α particle.

D The total kinetic energy is the same before and after the decay.

18. Trolley T_1, of mass 2.0 kg, collides on a horizontal surface with trolley T_2, which is also of mass 2.0 kg. The collision is elastic. Before the collision T_1 was moving at 4.0 m s^{-1} and T_2 was at rest.



Which one of the following statements is correct? Immediately after the collision

A T_1 is at rest and T_2 moves at 4.0 m s^{-1}.

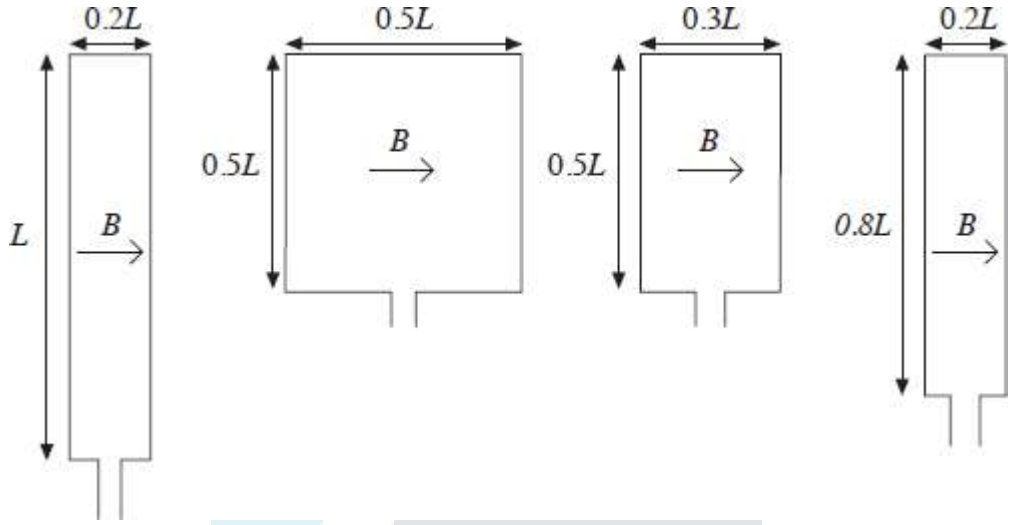
B T_1 will rebound from T_2 at 4.0 m s^{-1}.

C T_1 and T_2 will both move at 2.8 m s^{-1}.

D T_1 and T_2 will both move at 1.4 m s^{-1}.

19. Four rectangular loops of wire **A**, **B**, **C** and **D** are each placed in a uniform magnetic field of the sameflux density B. The direction of the magnetic field is parallel to the plane of the loops as shown.

When a current of 1 A is passed through each of the loops, magnetic forces act on them. Thelengths of the sides of the loops are as shown.
Which loop experiences the largest couple?



A **B** **C** **D**

20. Which of the following is a scalar quantity?

A velocity

B kinetic energy

C force

D momentum