

Name of the Student: _____

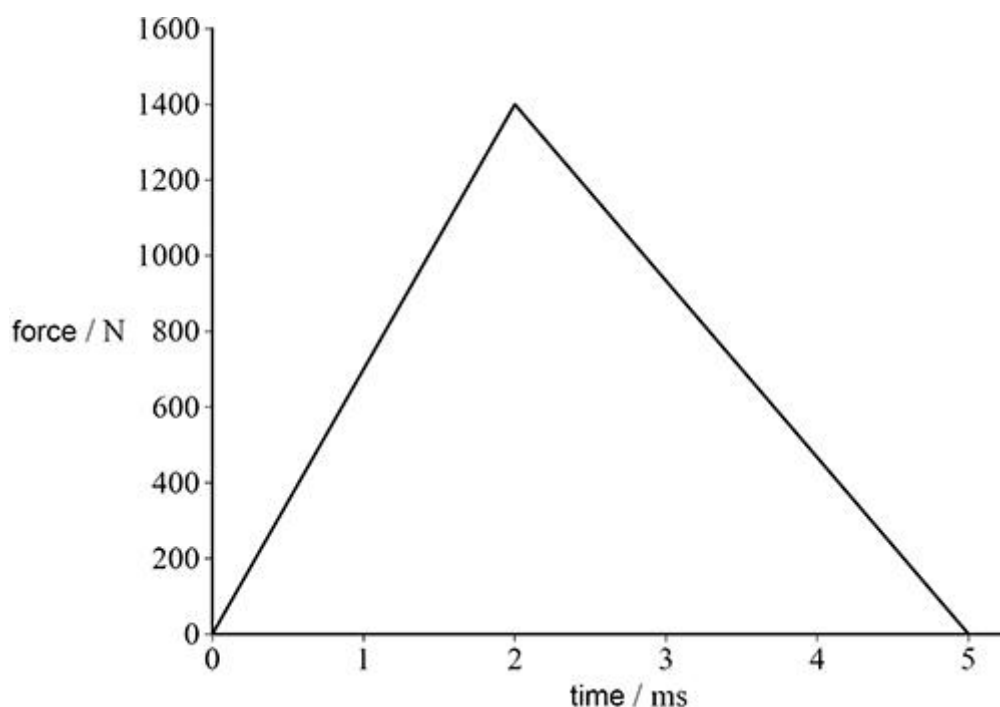
Max. Marks : 20 Marks

Time : 20 Minutes

Q1.

A stationary ball is free to move. The ball is hit with a bat.

The graph shows how the force of the bat on the ball changes with time.



The ball has a mass of 0.044 kg.

What is the speed of the ball immediately after being hit?

A 13 m s^{-1}

☐

B 60 m s^{-1}

☐

C 80 m s^{-1}

☐

D 160 m s^{-1}

☐

(Total 1 mark)

Q2.

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 .

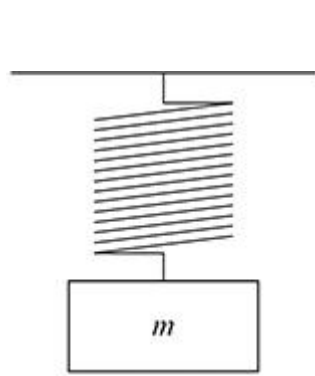


Diagram 1

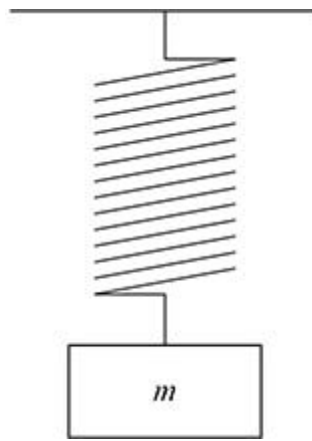


Diagram 2

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

- A $\frac{mg\Delta L}{2}$ ☐
- B $mg\Delta L$ ☐
- C $\frac{3mg\Delta L}{2}$ ☐
- D $2mg\Delta L$ ☐

(Total 1 mark)

Q3.

The question below is about three spheres X, Y and Z.

The relative mass and relative diameter of each sphere are given in the table.

	X	Y	Z
relative mass	1	5	1
relative diameter	1	1	5

Each sphere is dropped from rest and accelerates to its terminal speed.

What is true about the accelerations of the spheres at the instant they are released?

- A The acceleration of X is less than that of Y. ☐
- B The acceleration of X is greater than that of Z. ☐
- C The acceleration of X is the same as that of Y. ☐
- D The acceleration of Y is less than that of Z. ☐

(Total 1 mark)

Q4.

The question below is about three spheres **X**, **Y** and **Z**.

The relative mass and relative diameter of each sphere are given in the table.

	X	Y	Z
relative mass	1	5	1
relative diameter	1	1	5

Each sphere is dropped from rest and accelerates to its terminal speed.

What is true about the terminal speeds?

A The terminal speed of **X** is greater than that of **Y**.

☐

B The terminal speed of **X** is the same as that of **Y**.

☐

C The terminal speed of **Y** is greater than that of **Z**.

☐

D The terminal speed of **X** is less than that of **Z**.

☐

(Total 1 mark)

Q5.

Monochromatic light with a photon energy of $4.1 \times 10^{-19} \text{ J}$ is incident on a metal surface. The maximum speed of the photoelectrons released is $4.2 \times 10^5 \text{ m s}^{-1}$.

What is the work function of the metal?

A $2.5 \times 10^{-19} \text{ J}$

☐

B $3.3 \times 10^{-19} \text{ J}$

☐

C $4.1 \times 10^{-19} \text{ J}$

☐

D $4.9 \times 10^{-19} \text{ J}$

☐

(Total 1 mark)

Q6.

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 $\frac{FmL^2}{\rho\Delta L}$ ☐

(Total 1 mark)

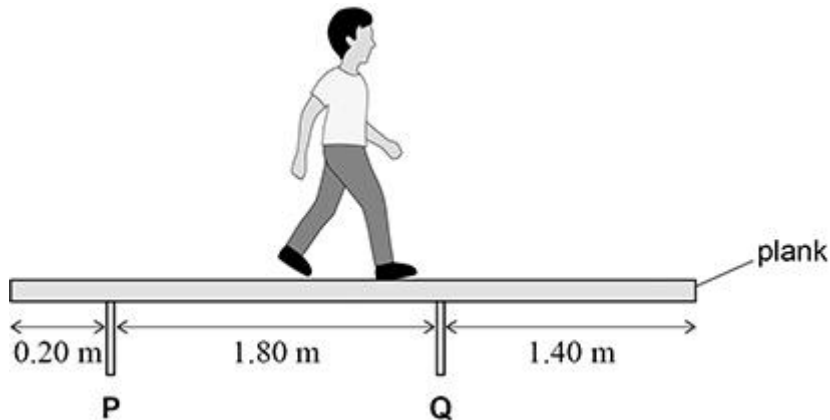
Q7.

A uniform plank weighs 1200 N and rests on two pillars **P** and **Q**.

P and **Q** are 1.80 m apart.

P is 0.20 m from one end of the plank. **Q** is 1.40 m from the other end of the plank.

A man weighs 800 N and walks along the plank away from pillar **P**.



What is the horizontal distance between pillar **P** and the centre of mass of the man when the plank starts to tip?

A 0.45 m ☐

B 2.25 m ☐

C 2.45 m ☐

D 3.15 m ☐

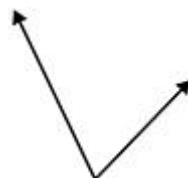
(Total 1 mark)

Q8.

The diagram shows a vector diagram of two forces acting on an object.

The diagram is drawn to scale.

The magnitude of the smaller force is 5.0 N.



What is the magnitude of the resultant force on the object?

A 3.2 N ☐

B 7.5 N ☐

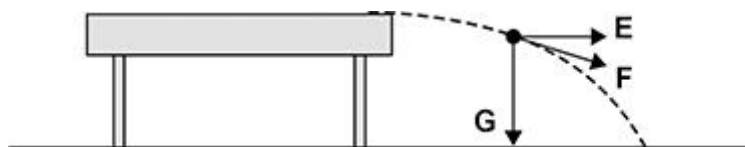
- C 8.6 N ☐
- D 9.6 N ☐

(Total 1 mark)

Q9.

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 coin at this point?

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

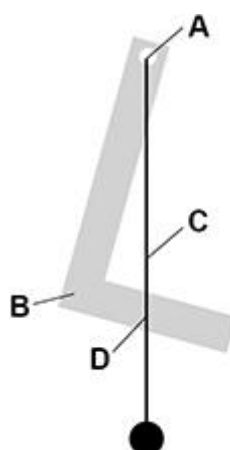
(Total 1 mark)

Q10.

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 ☐

(Total 1 mark)

Q11.

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. ☐

(Total 1 mark)

Q12.

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?

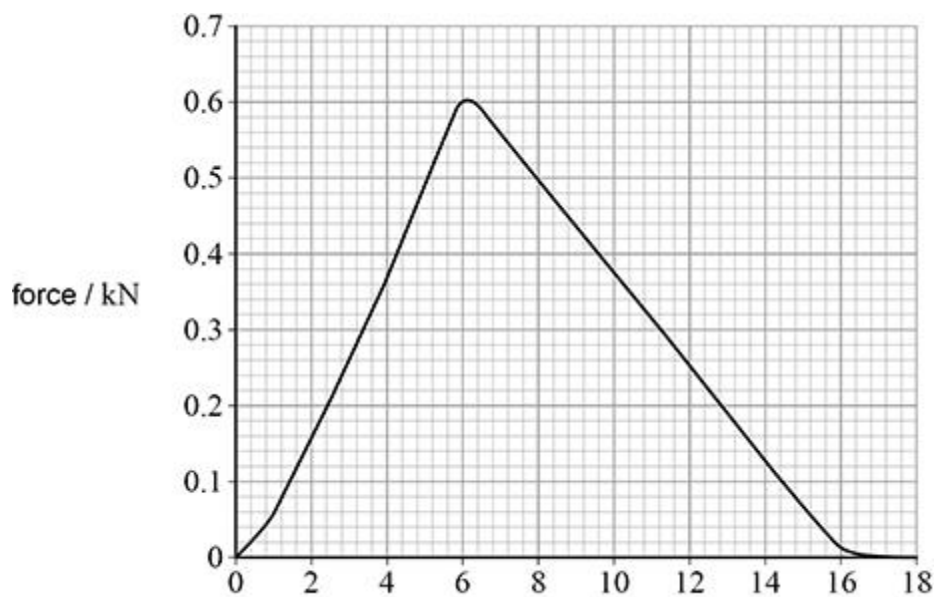
	Density	Young modulus	
A	$\frac{\rho}{2}$	$\frac{E}{4}$	☐
B	$\frac{\rho}{2}$	$4E$	☐
C	$\frac{\rho}{4}$	$\frac{E}{4}$	☐
D	$\frac{\rho}{4}$	$4E$	☐

(Total 1 mark)

Q13.

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 ☐

(Total 1 mark)

Q14.

Which row describes charge and impulse?

	Charge	Impulse	
A	scalar	scalar	☐
B	scalar	vector	☐
C	vector	scalar	☐
D	vector	vector	☐

(Total 1 mark)

Q15.

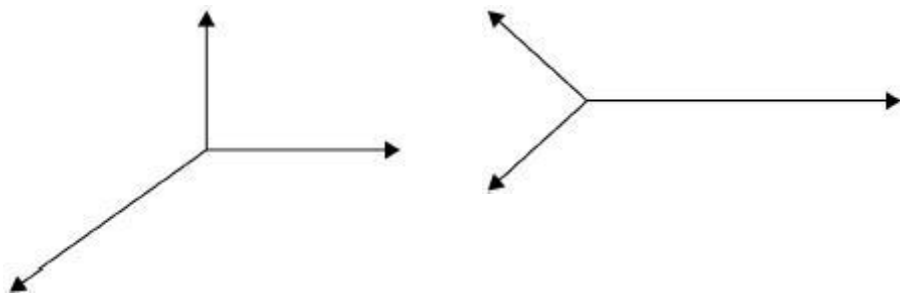
An object is in equilibrium when acted on by three coplanar forces.

Which free-body diagram is correct?

Each diagram is drawn to scale.

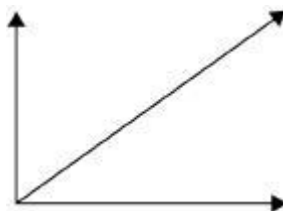
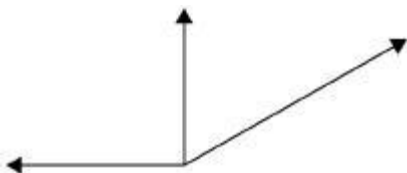
A

B



C

D



- A ☐
- B ☐
- C ☐
- D ☐

(Total 1 mark)

Q16.

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 ☐

(Total 1 mark)

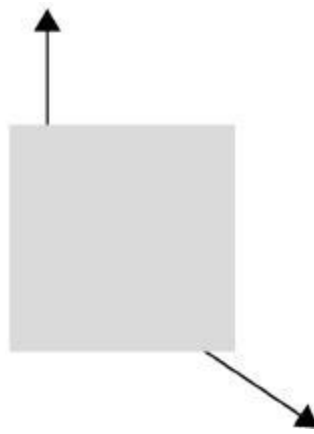
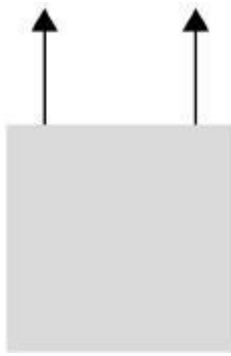
Q17.

Each diagram shows two horizontal forces acting on a solid square object seen from above.

All the forces have the same magnitude.

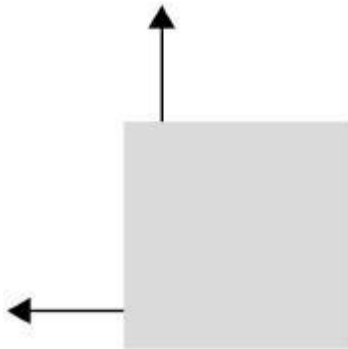
A

B



C

D



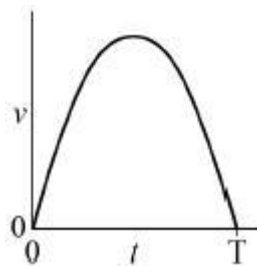
Which system produces a couple about any point inside the object?

- A ☐
- B ☐
- C ☐
- D ☐

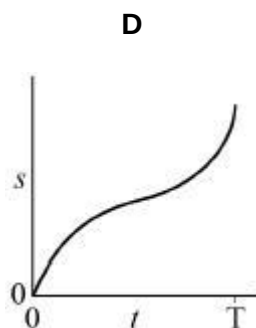
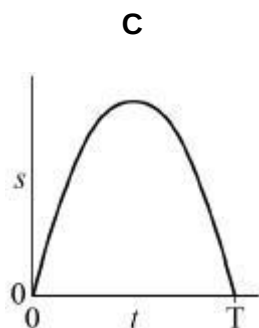
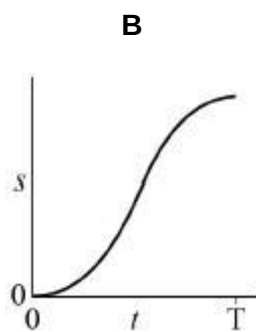
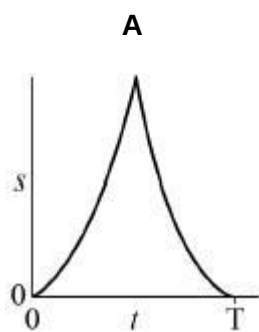
(Total 1 mark)

Q18.

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?



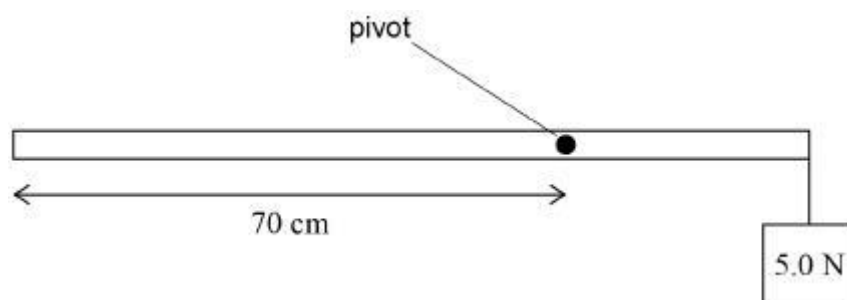
- A ☐
- B ☐
- C ☐
- D ☐

(Total 1 mark)

Q19.

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 ☐

(Total 1 mark)

Q20.

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. | ☐ |

(Total 1 mark)