2.2 Forces

Question Paper

Course	DP IB Physics
Section	2. Mechanics
Topic	2.2 Forces
Difficulty	Hard

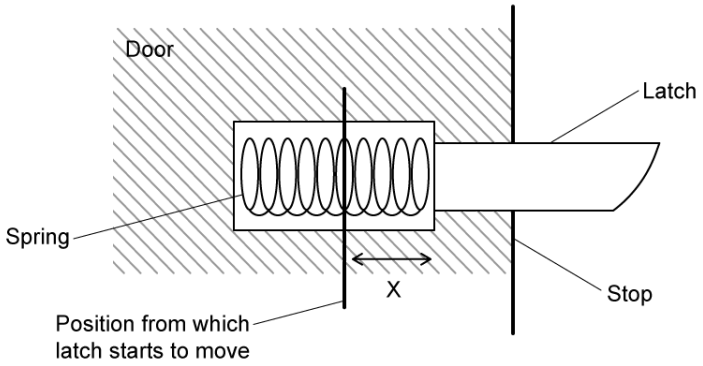
Time allowed: 20

Score: /10

Percentage: /100

Question 1

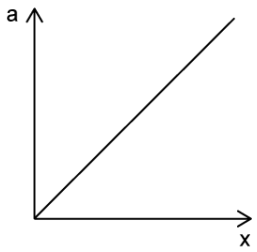
A frictionless spring-operated latched is fitted to a door.



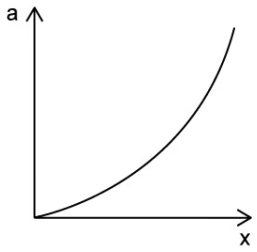
When the latch is pushed in, the spring compresses.

When the latch is released, which of the following best represents how acceleration *a* of the latch varies with the distance *x* it moves before stopping?

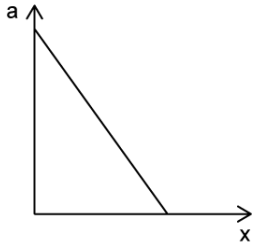
A.



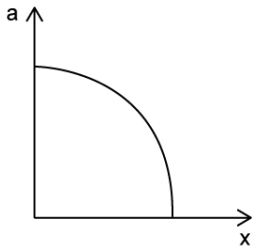
B.



C.



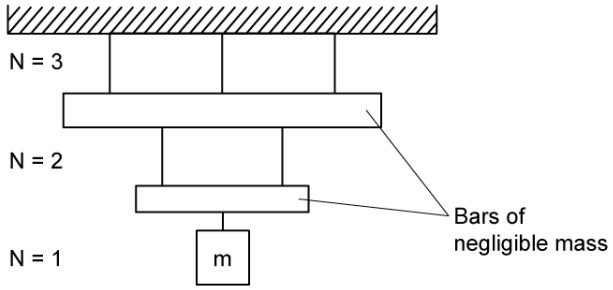
D.



[1 mark]

Question 2

Elaborate chandeliers can be modelled as layers of hanging bars. The diagram shows one such model with a mass *m* suspended from two bars of negligible mass, connected by five light strings. Each layer has *N* number of strings.



Which expression gives the tension in any single string?

A. $\frac{mg}{N}$

B. $\frac{mg}{N^2}$

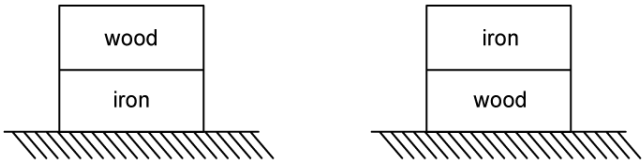
C. Nmg

D. $(N-1)mg$

[1 mark]

Question 3

Two blocks, one made of wood and the other of iron, are arranged at rest on the ground.



Which of the following statements is correct?

A. The force exerted by the ground on the iron block in (1) is greater than the force exerted by the ground on the wooden block in (2) because the iron block, being denser than the wooden block, exerts more force on the ground.

B. The force exerted by the wooden block on the iron block in (1) is equal to that exerted by the iron block on the wooden block in (2) by virtue of Newton's third law.

C. The force exerted by the iron block on the wooden block in (1) is greater than that exerted by the wooden block on the iron block in (2).

D. The force exerted by the wooden block on the iron block is equal to the weight of the wooden block in (1) while the force exerted by the iron block on the wooden block is equal to the weight of the iron block in (2).

[1 mark]

Question 4

A child of mass *m* sits in a car seat which is accelerating horizontally at 0.2*g*, where *g* is the acceleration due to gravity.

What is the magnitude of the total force exerted by the car seat on the child?

A. mg

B. $\sqrt{mg}$

C. $\sqrt{0.2}\,mg$

D. $\sqrt{1.04}\,mg$

[1 mark]

Question 5

The following scenarios describe specific types of motion:

I. A diver equipped so that they remain at constant depth below the water surface without any effort on their part
II. An athlete clearing the bar in a high jump
III. A parachutist descending at terminal velocity with the parachute fully open

In which of the scenarios does the person concerned experience 'weightlessness'?

A. I only

B. II only

C. II and III only

D. I, II and III

[1 mark]

Question 6

A pendulum bob hangs from the ceiling in a carriage in a train and is just above a certain mark on the floor when the train is at rest. When the train is moving with a constant velocity forward, which statement best outlines the position of the bob?

A. The bob is behind the mark, so that the pendulum thread is along the resultant of the forces due to the motion of the train and gravity.

B. The bob remains over the mark because the force due to the motion of the train is balanced by the reaction of the thread on the support.

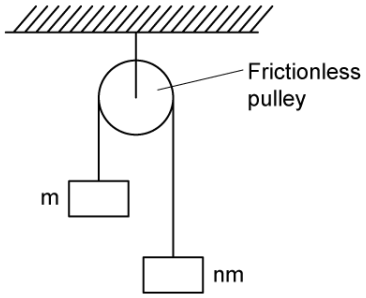
C. The bob oscillates about the mark because of the unbalanced force due to the motion of the train.

D. The bob remains over the mark because the motion of the train produces no additional force on the bob.

[1 mark]

Question 7

Two masses *m* and n*m*, where n > 1, are joined by a light string which passes over a frictionless pulley. The acceleration of free fall is *g*.



What is the acceleration of the masses *a* and the tension in the string *T*?

	a	*T*
A.	$\frac{n-1}{n+1}$	$mg\left(\frac{n-1}{n+1}\right)$
B.	$g(n+1)$	$mg\left(\frac{n-1}{n+1}-1\right)$
C.	$\frac{g(n-1)}{n+1}$	$mg\left(\frac{n-1}{n+1}+1\right)$
D.	$\frac{g(n+1)}{n-1}$	$mg\left(\frac{n+1}{n-1}+1\right)$

[1 mark]

Question 8

Two bodies, X and Y, having masses m_X and m_Y respectively, exert forces on each other and have no external forces acting on them. The force acting on X is F, which gives X an acceleration a_X.

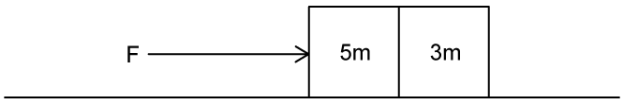
What is the magnitude of the force on Y and its acceleration?

	Magnitude of force on Y	Acceleration of Y
A.	$\frac{m_Y}{m_X}F$	a
B.	F	$\frac{m_Y}{m_X}a$
C.	$\frac{m_X}{m_Y}F$	a
D.	F	$\frac{m_X}{m_Y}a$

[1 mark]

Question 9

Two blocks with mass $5m$ and $3m$ are pushed along a smooth horizontal surface by an applied force F.



What is the magnitude of the force exerted between the blocks?

A. F

B. $\frac{2}{8}F$

C. $\frac{3}{8}F$

D. $\frac{8}{3}F$

[1 mark]

Question 10

Forces act in a variety of situations described below:

I. The centripetal force holding a satellite in orbit round the Earth and the weight of the satellite
II. Repulsive forces experienced by anti-parallel current-carrying conductors
III. Attractive forces between two gas molecules passing close to each other
IV. Attractive forces between the nucleus and orbiting electrons in an atom

Which of the situations describe pairs of forces as required by Newton's third law?

A. I and II only

B. II and III only

C. I, II and IV only

D. II, III and IV only

[1 mark]