4.1 Newton's Laws of Motion

Question Paper

| Course	CIE A Level Physics (9702) 2019-2021
Section	4. Dynamics
Topic	4.1 Newton's Laws of Motion
Difficulty	Hard

Time allowed: 10

Score: /10

Percentage: /100

Question 1

A skydiver falls vertically from a stationary balloon.

She leaves the balloon at time $t = 0$. At time $t = T$, she reaches terminal velocity. Beyond the time shown in the graphs, she opens her parachute

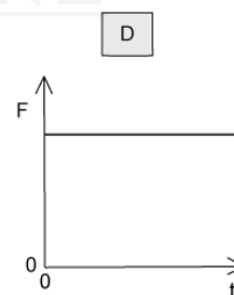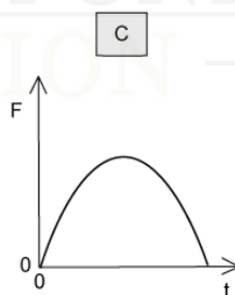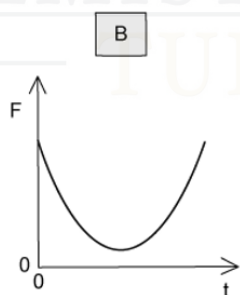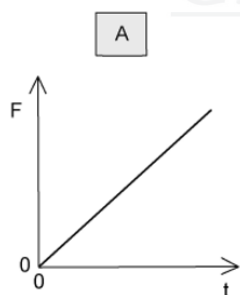Which graph shows the variation with time t of the force F due to air resistance?
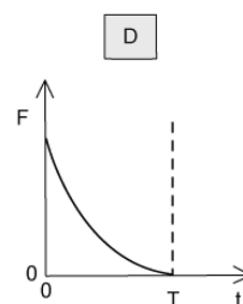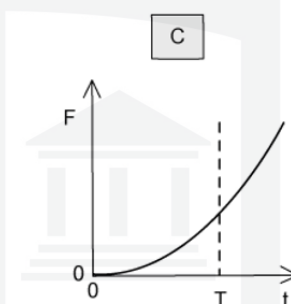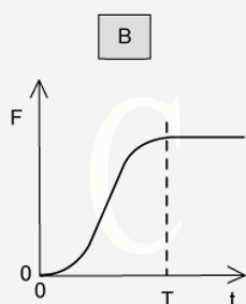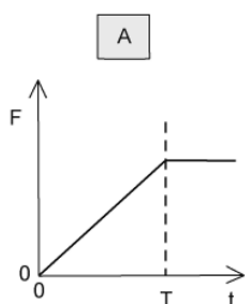
[1 mark]

Question 2

A tennis ball is dropped onto a table and bounces back up. The table exerts a force F on the ball.

Which graph best shows the variation with time t of the force F while the ball is in contact with the table?

[1 mark]

Question 3

A ship of mass 6.7×10^7 kg is approaching a harbour with speed 18.9 m s^{-1}

By using reverse thrust it can maintain a constant total stopping force of 880,000 N

How long will it take to stop?

    A   14 seconds

    B   140 seconds

    C   24 minutes

    D   240 minutes

[1 mark]

Question 4

The three forces acting on a hot-air balloon that is moving vertically are its weight, the force due to air resistance and the upthrust force.

The hot air balloon descends vertically at constant speed. The force of air resistance on the balloon is F.

Which weight of material must be released from the balloon so that it ascends vertically at the same constant speed?

A ½ F **B** F **C** $2F$ **D** $4F$

[1 mark]

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Question 5

The graph shows the variation with time of the momentum of a ball as it is kicked in a straight line.
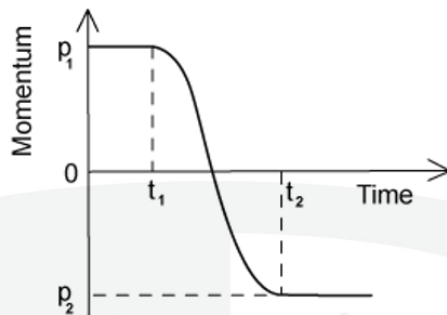
Initially, the momentum is p_1 at time t_1. At time t_2 the momentum is p_2.

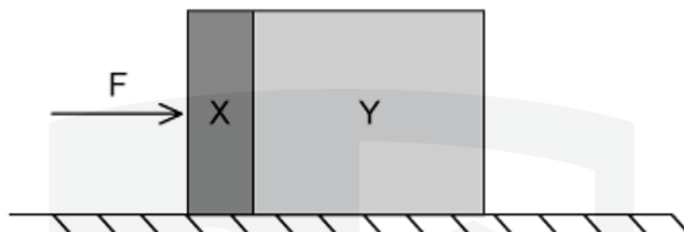What is the magnitude of the average force acting on the ball between times t_1 and t_2?

A $\quad \dfrac{p_1 - p_2}{t_1 - t_2}$
B $\quad \dfrac{p_2 - p_1}{t_2 - t_1}$
C $\quad \dfrac{p_2 - p_1}{t_1 - t_2}$
D $\quad \dfrac{p_1 - p_2}{t_2 - t_1}$

[1 mark]

Question 6

Two blocks X and Y, of masses m and $4m$ respectively, are accelerated along a smooth horizontal surface by a force F applied to block X as shown

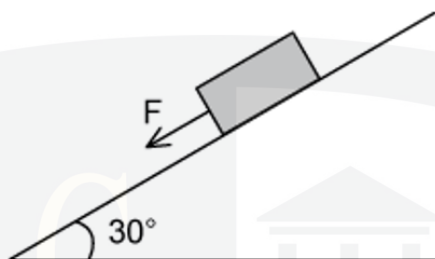What is the magnitude of the force exerted on block Y by block X during this acceleration?

A $\dfrac{F}{4}$ **B** $\dfrac{F}{5}$ **C** $\dfrac{4F}{5}$ **D** $\dfrac{5F}{4}$

[1 mark]

Question 7

A brick of mass 1.8 kg rests on a plane inclined at an angle of 30˚. The weight of the brick has a component of F N parallel with the plane. The brick also experiences a frictional force of 3.0 N

What is the acceleration of the brick down the plane?

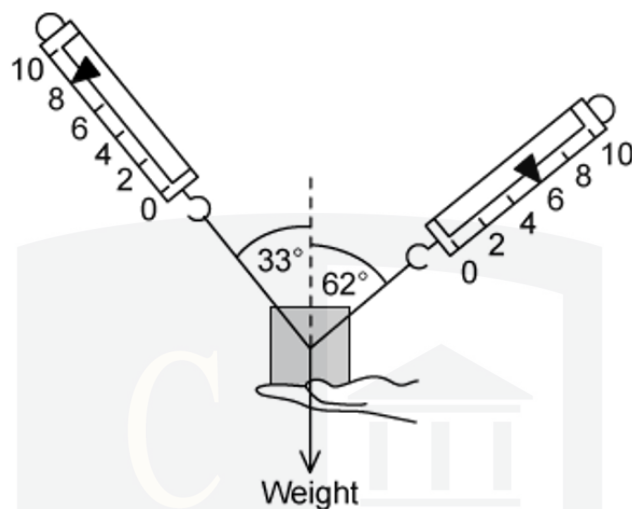**A** 3.2 m s^{-2} **B** 3.9 m s^{-2} **C** 6.6 m s^{-2} **D** 8.1 m s^{-2}

[1 mark]

Question 8

A 3.2 kg mass is supported by a person's hand and two newton-meters as shown.

When the person's hand is removed, what is the initial vertical acceleration of the mass?
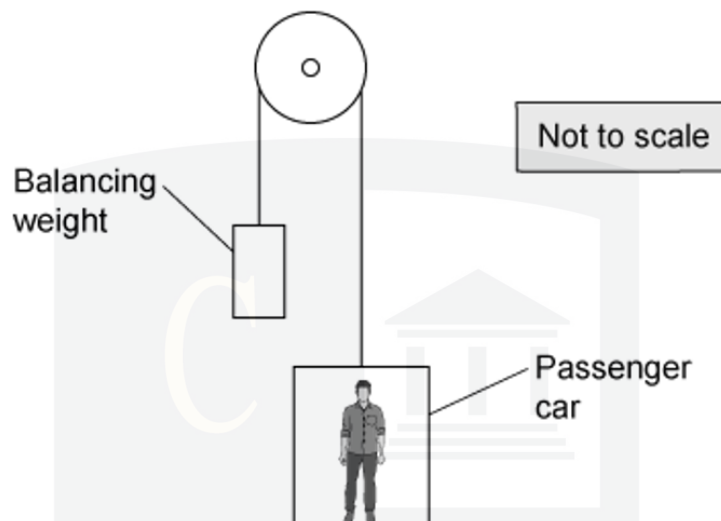
A 3.0 m s^{-2} **B** 5.4 m s^{-2} **C** 6.8 m s^{-2} **D** 12.8 m s^{-2}

[1 mark]

Question 9

A lift consists of a passenger car supported by a cable which runs over a light, frictionless pulley to a balancing weight. The balancing weight falls as the passenger car rises.

Some masses are shown in the table.

	mass / kg
passenger car	1200
balancing weight	1320
passenger	80

What is the magnitude of the acceleration of the car when carrying just one passenger and when the pulley is free to rotate?
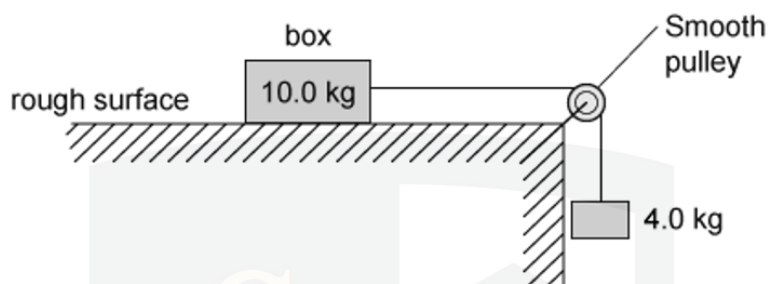
A 0.15 m s^{-2} **B** 0.30 m s^{-2} **C** 0.45 m s^{-2} **D** 0.92 m s^{-2}

[1 mark]

Question 10

A box of mass 10.0 kg rests on a horizontal rough surface. A string attached to the box passes over a smooth pulley and supports a 4.0 kg mass at its other end.

When the box is released, a frictional force of 12.0 N acts on it.
What is the acceleration of the box?

A 1.2 m s^{-2} **B** 1.9 m s^{-2} **C** 2.7 m s^{-2} **D** 3.0 m s^{-2}

[1 mark]