

Forces in Action

Q1.(2018)

Which of the following forces is a non-contact force?

- A Drag
- B Electrostatic
- C Tension
- D Upthrust

Your answer

[1]

Q2.(2018)

How can mass be calculated?

- A Acceleration divided by force
- B Force divided by acceleration
- C Gravity divided by weight
- D Weight divided by force

Your answer

[1]

Q3.(2018)

A student lifts four different objects onto a set of shelves.

Object	Mass (kg)	Height lifted (m)
A	0.1	2.2
B	0.3	1.5
C	0.4	1.7
D	0.5	2.0

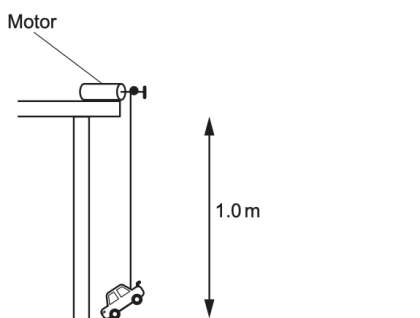
Which object gains the **most** gravitational potential energy?

Your answer

[1]

Q4.a(2018)

A student uses a small motor to lift a toy car through a vertical distance of 1.0 m.



The car has a weight of 0.05 N.

- (i) Calculate the work done when lifting the car through this distance.

Answer = J [3]

Q4.b(2018)

Calculate the power of the motor if the car takes 5.0 seconds to travel the 1.0 m distance.

State the unit.

Answer = Unit [4]

Q4.c(2018)

The motor uses 2 cells in series.

Each cell has a potential difference of 1.5 V.

- (i) Write down the total potential difference of the cells.

Answer = V [1]

Q4.d(2018)

The motor has a resistance of $6.0\ \Omega$.

Calculate the current in the circuit when the motor is in use.

Use the equation: Potential difference = Current $\times$ Resistance

Answer = A [3]

Q4.e(2018)

The student wishes to increase the time taken to lift this toy car vertically through the 1.0 m distance shown.

Suggest a change he could make to this experiment to achieve this.

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..... [1]

Q5.(2018)

Objects in freefall eventually reach terminal velocity.

Draw a labelled diagram to show the forces acting on an object when it is falling at terminal velocity.

[3]

Q6.(2019)

Which statement about gravitational fields is correct?

- A A spacecraft has a gravitational field that causes attraction.
- B Gravitational fields are attractive and repulsive.
- C Gravitational field strength is measured in newtons.
- D The larger the mass the smaller the gravitational field.

Your answer

☐

[1]

Q7.(2019)

On the Moon, a 10 kg mass has a weight of 16 N.

What is the gravitational field strength on the Moon?

- A 1.6 N/kg
- B 6.0 N/kg
- C 26 N/kg
- D 160 N/kg

Your answer

[1]

Q8.(2019)

Which statement describes Newton's **third** law?

- A Action and reaction are equal, opposite and act on the same object.
- B Action and reaction are equal, opposite and act on separate objects.
- C The rate of change of momentum is equal and opposite to resultant force.
- D The rate of change of momentum is proportional to resultant force.

Your answer

[1]

Q9.a(2019)

Student **A** does an experiment to find out if force is related to acceleration.

Fig. 15.1 is a diagram of her experiment.

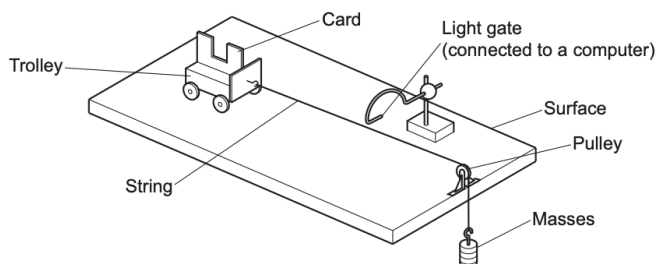


Fig. 15.1

- (a) She hangs a 400 g mass over the pulley.

How can she work out the accelerating force on the trolley?

Use an equation to help explain your answer.

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..... [2]

Q9.b(2019)

(b) The tall parts of the card on the trolley labelled **X** and **Y** pass through the light gate, as shown in Fig. 15.2.

The light gate can measure:

- the time it takes for **Y** to go through
- the time it takes for **X** to go through
- the time between **Y** and **X** going through.

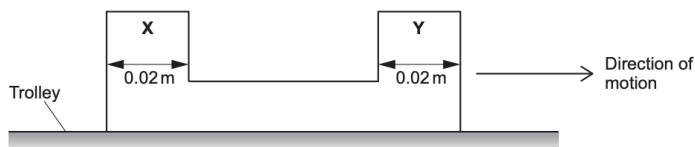


Fig. 15.2

How can student **A** use the **light gate** and **card** to measure the acceleration of the trolley?

Use an equation to help explain your answer.

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..... [2]

Q9.c(2019)

Describe **one** way this experiment could be improved.

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..... [1]

Q9.d(2019)

(d)* Student **A** records some measurements. She plots the data points and draws a line of best fit on the graph in Fig. 15.3.

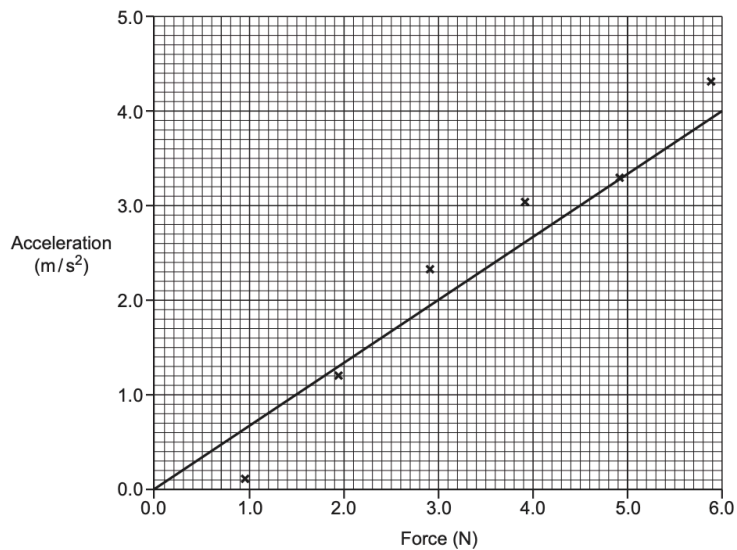


Fig. 15.3

You are **not** expected to include a calculation.

[6]

(e) Student **B** does the same experiment.

A graph showing the relationship between Force (N) on the x-axis and Acceleration (m/s^2) on the y-axis. The x-axis ranges from 0 to 6 with major grid lines every 1 unit and minor grid lines every 0.2 units. The y-axis ranges from -2.0 to 5.0 with major grid lines every 1.0 unit and minor grid lines every 0.2 units. A series of data points are plotted, showing a linear relationship. A straight line of best fit is drawn through the points, starting at approximately (0, -0.5) and ending at (6, 5.0).

Force (N)	Acceleration (m/s^2)
0.8	0.2
1.9	1.2
2.9	2.1
3.9	3.1
5.0	4.1
6.0	5.0

(i) Calculate the gradient of the graph in **Fig. 15.4**.

Q9.f(2019)

Student **B**'s graph in **Fig. 15.4** can be described by an equation.

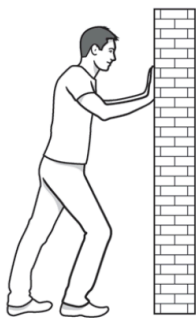
Write this equation in the form: $y = mx + c$

Use your answer to **15(e)(i)** and student **B**'s graph in **Fig. 15.4** to help you.

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..... **[2]**

Q11.(2020)

A man stands next to a wall. He exerts a force on the wall by pushing against the wall with both hands. His feet remain in the same place



Which statement is correct?

- A** Force of wall on man = 0.
- B** Force of wall on man < Force of man on wall.
- C** Force of wall on man = Force of man on wall.
- D** Force of wall on man > Force of man on wall.

Your answer

☐

[1]

Q12.(2020)

A man weighs 700 N on Earth.

Estimate the weight of the man on the Moon.

Use the equation: gravity force = mass $\times$ gravitational field strength

The gravitational field strength on the Moon = 1.6 N/kg.

- A** 112 N
- B** 438 N
- C** 700 N
- D** 1120 N

Your answer

☐

[1]

Q13.(2020)

Which row of the table describes **inertia** and **mass**?

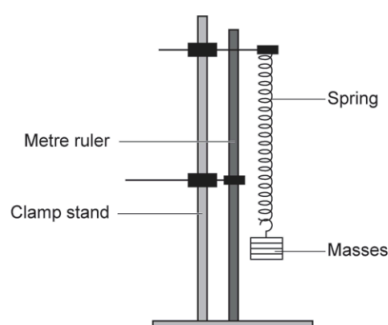
	Inertia	Mass
A	How difficult it is to change the velocity of an object.	Force $\div$ acceleration
B	The momentum of an object at high speed.	Force $\times$ acceleration
C	The opposition of a circuit to a flow of charge.	Force $\div$ acceleration
D	Using a force to transfer energy between stores.	Force $\times$ acceleration

Your answer

[1]

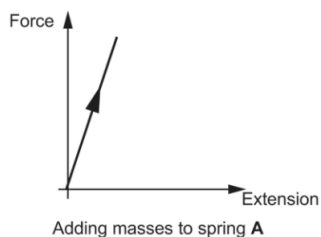
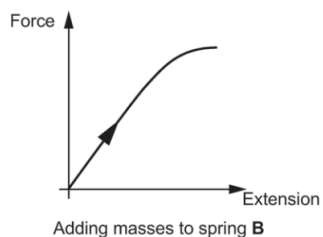
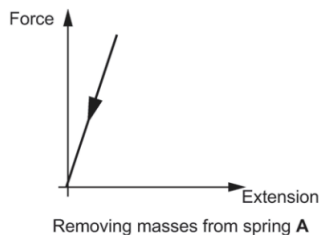
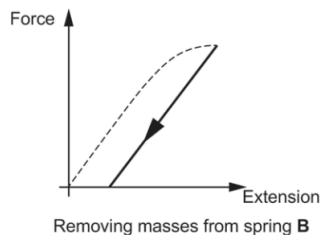
Q14.(2020)

A student is doing an experiment by hanging some masses on two springs, **A** and **B**, and recording the extension.



She measures the extension of each spring, after adding 100 g masses one by one. She then measures the extension of each spring after removing the 100 g masses one by one.

Here are the graphs of her results.



Give reasons for your answers.

[6]

This question is about the motion of objects.

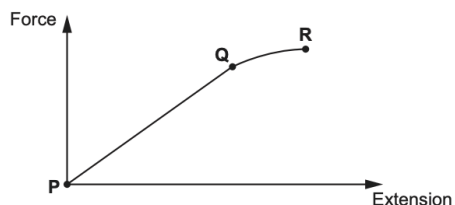
- The table describes the motion of the skydiver at different times.

Situation	Free-body force diagram	Explanation
Skydiver steps out of plane and accelerates towards Earth.	 <p>Force of Earth on skydiver</p>	
Acceleration of the skydiver decreases.		Air resistance increases with increasing velocity.
	 <p>Air resistance</p> <p>Force of Earth on skydiver</p>	Air resistance equals force of Earth on skydiver so there is no resultant force.

[3]

Q16.(2021)

This is a force-extension graph for a spring.



Which statement is correct?

- A Between P and Q, the graph is linear and obeys Hooke's law.
- B Between Q and R, the graph is linear and obeys Hooke's law.
- C The spring obeys Hooke's law and the graph is linear.
- D The spring only obeys Hooke's law between Q and R.

Your answer

☐

[1]

Q17.(2021)

Explain in words what is meant by **power**.

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..... [1]

Q18.a(2021)

A weightlifter lifts a 200 pound (200 lb) mass.

1 lb = 0.454 kg.

Calculate the weight of the mass in Newtons.

Use the equation: gravitational force = mass $\times$ gravitational field strength

Gravitational field strength = 10 N/kg.

Weight = N [3]

Q18.b(2021)

This is some data for a weightlifter.

Weight lifted	=	620 N
Height of the lift	=	1.6 m
Time taken to complete lift	=	4.0 s

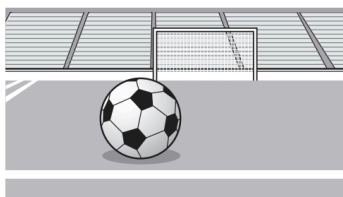
Calculate the power generated by the weightlifter.

Use the equations: work done = force $\times$ distance
power = work done / time

Power = W [4]

Q19.a(2021)

This is a picture of a ball on a field.



(a) Draw a free-body force diagram for the **ball**.

[2]

Q19.b(2021)

The ball is stationary on the field. Explain why using Newton's laws.

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..... [1]

Q19.c(2021)

Student **A** kicks the ball with their toes.

This hurts the student's toes. Explain why using Newton's laws.

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..... [3]

Q19.d(2021)

Student **A** kicks the ball.

Their boot is in contact with the ball for 0.05 s.

The velocity of the ball increases by 25 m/s.

Calculate the acceleration of the ball.

Use the equation: acceleration = change in velocity / time

$$\text{Acceleration} = \dots\dots\dots \text{m/s}^2 \quad [2]$$

Q19.e(2021)

Student **B** kicks the ball with a force of 216 N.

The mass of the ball is 0.45 kg.

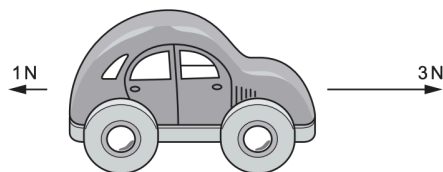
Calculate the acceleration of the ball.

Use the equation: force = mass $\times$ acceleration

$$\text{Acceleration} = \dots\dots\dots \text{m/s}^2 \quad [3]$$

Q20.(2022)

The diagram shows some forces acting on a toy car.



Which row of the table describes the motion of the toy car?

	Resultant force	Motion
A	2 N forwards	acceleration
B	2 N forwards	constant velocity
C	3 N forwards	acceleration
D	3 N forwards	constant velocity

Your answer

[1]

Q21.(2022)

A student does 20 “step ups” onto a wall.

- The total work done by the student is 3000 J.
- The time taken is 24 s.

Calculate the power of the student.

Use the equation: $\text{power} = \frac{\text{work done}}{\text{time}}$

- A 6.25 W
- B 125 W
- C 2500 W
- D 3600 W

Your answer

[1]

Q22.(2022)

Planets **X** and **Z** are the same size.

- The gravitational field strength on planet **X** is 12 N/kg.
- Planet **X** has a mass of 1×10^{25} kg.
- Planet **Z** has a mass of 4×10^{25} kg.

What is the gravitational field strength on planet **Z**?

Use the Data Sheet.

- A 0.75 N/kg
- B 3 N/kg
- C 12 N/kg
- D 48 N/kg

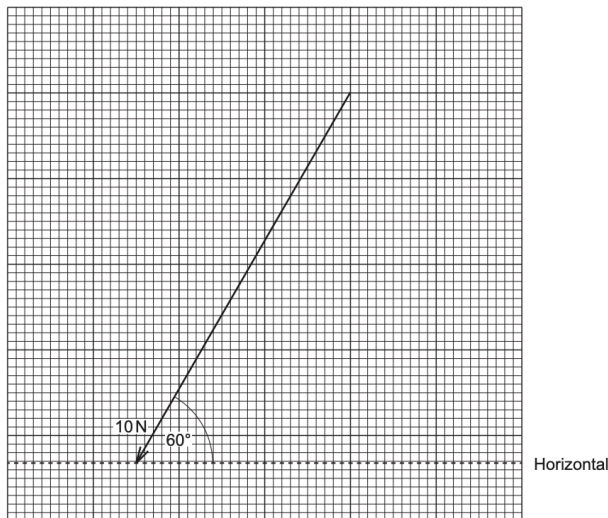
Your answer

[1]

Q23.(2022)

A child uses a force of 10 N at an angle of 60° to push a toy car.
This is a **scale diagram** of the force:

Scale:
1 cm = 1 N



What is the **horizontal** component of the force pushing the toy car?
Use the scale diagram.

- A 3.2 N
- B 5 N
- C 8.7 N
- D 10 N

Your answer

[1]

Q24.(2022)

Children often make models with clay.
Clay and springs behave differently.

(a) Draw **three** lines to match the **materials** to the **properties**.

Materials

Clay

Spring

Properties

Elastic

Obeys Hooke's law

Plastic

[3]

Q25.(2022)

Two children are squashing clay on a desk.

Child **A** says, 'Only one force is needed to squash clay.'

Child **B** says, 'There are three forces acting on the clay when I squash the clay.'

Using ideas about forces, explain why child **B** is correct.

Use a free-body force diagram to help explain your answer.

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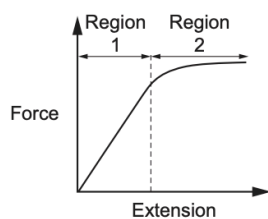
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..... [4]

Q26.(2023)

The force–extension graph is shown for a copper wire.



Which row describes the behaviour of copper in region 1 and region 2?

	Region 1	Region 2
A	elastic	elastic
B	elastic	plastic
C	plastic	elastic
D	plastic	plastic

Your answer

[1]

Q27.(2023)

A free-body diagram of a particle, represented by a small circle. Four forces are shown acting on the particle: a 5 N force pointing vertically upwards, a 14 N force pointing horizontally to the right, a 2 N force pointing horizontally to the left, and an unlabeled force pointing vertically downwards.

A 5.4 N

B 12 N

C 13 N

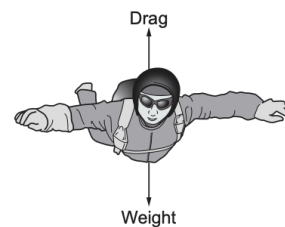
D 14.9 N

1

Q28.(2023)

Fig. 15.2 shows the free-body force diagram for the skydiver in the air.

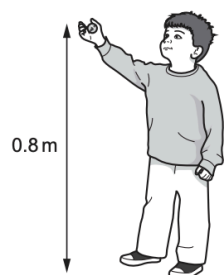
Fig. 15.2

[illegible]

.. [6]

Q29.a(2023)

A child is holding a marble at a height of 0.8 m.



The mass of the marble is 0.015 kg.

Calculate the gravitational potential energy of the marble.

Gravitational field strength = 10 N/kg.

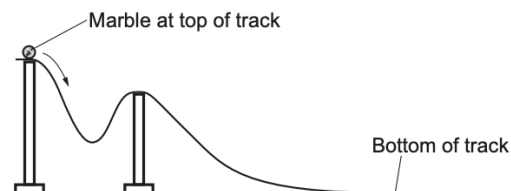
Use the equation:

gravitational potential energy = mass $\times$ gravitational field strength $\times$ height

Gravitational potential energy = J [2]

Q29.b(2023)

The child rolls the marble along a track. The diagram shows the marble and track.



- (i) The kinetic energy of the marble at the bottom of the track is less than the potential energy of the marble calculated at the top of the track.

Suggest and explain why.

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..... [2]

Q29.c(2023)

The mass of the marble is 0.015 kg.

The kinetic energy of the marble at the bottom of the track is 0.03 J.

Calculate the speed of the marble at the bottom of the track.

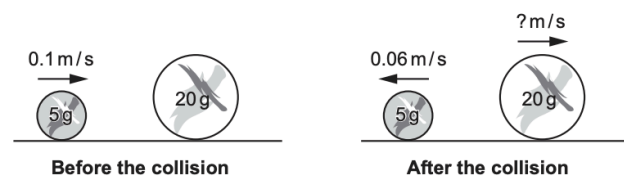
Use the equation: kinetic energy = $\frac{1}{2} \times \text{mass} \times (\text{speed})^2$

Speed of marble = m/s [3]

Q29.d(2023)

The child now has a small marble and a large marble.
The child rolls the small marble across the floor.
The small marble collides with the stationary large marble.

The diagram shows the marbles before and after the collision.



The mass of the small marble is 5 grams. The mass of the large marble is 20 grams.

Use the information in the diagram to calculate the speed of the large marble after the collision.

Use the Equation Sheet.

Speed of large marble = m/s [3]

Q30.(2024)

An astronaut has a mass of 70 kg on Earth.

The mass of the Moon is smaller than the mass of the Earth.

Which row describes the astronaut's mass and weight on the Moon compared to their mass and weight on Earth?

	Mass of astronaut	Weight of astronaut
A	smaller	larger
B	larger	stays the same
C	stays the same	smaller
D	stays the same	stays the same

Your answer

[1]

Q31.(2024)

Which two units measure the same quantity?

- A W and J
- B Nm and J
- C kg and N
- D V and A

Your answer

[1]

Q32.(2024)

A skydiver jumps from an airplane and reaches terminal velocity before the parachute opens.

Which statement describes what is happening when they reach terminal velocity?

- A Air resistance equals the weight of skydiver.
- B Air resistance has no effect on the skydiver.
- C Air resistance is greater than the weight of skydiver.
- D Air resistance is less than the weight of skydiver.

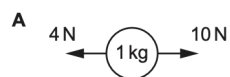
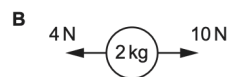
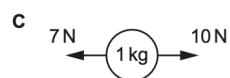
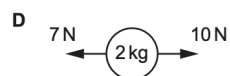
Your answer

[1]

Q33.(2024)

Four different objects are acted on by different forces.

Which object has the **highest** acceleration?



Your answer

[1]

Q34.(2024)

A spring has a spring constant of 20 N/m .

What is the extension of the spring when it is stretched by a force of 6 N ?

The spring is **not** stretched beyond its limit of proportionality.

Use the equation: force exerted by a spring = spring constant $\times$ extension

A 0.3 m

B 0.3 mm

C 3.3 m

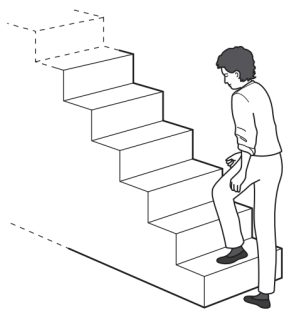
D 3.3 mm

Your answer

[1]

Q35.a(2024)

Two students do an experiment to measure their power by walking up steps.



This is the data from student **P**:

- Weight = 600 N
- Number of steps = 250
- Height of each step = 0.20 m

Calculate the work done by student **P**.

Work done = J [3]

Q35.b(2024)

This is the data from student **Q**:

- Work done = 36 000 J
- Time taken = 240 s

Calculate the power of student **Q**.

Use the equation: $\text{power} = \frac{\text{work done}}{\text{time}}$

Give your answer in kW.

Power = kW [3]

Q35.c(2024)

Describe how the students carry out this experiment. Include any equipment they need to use.

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..... [3]

Q35.d(2024)

Student **P** carries out the experiment five more times and calculates their power.

Here are student **P**'s results.

	Try 1	Try 2	Try 3	Try 4	Try 5
Power (W)	120	121	122	121	123

How can student **P**'s results be described?

Tick **one** (✓) box in each row.

	Yes	No
Precise		
Repeatable		

[1]

Q35.e(2024)

Explain your answer to (d)(i).

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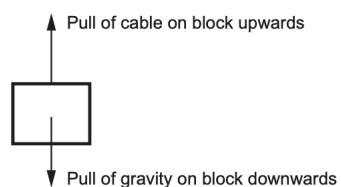
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..... [2]

Q36.(2024)

A cable is used to lift a block vertically upwards. **Fig. 12.1** shows the forces acting on the block.

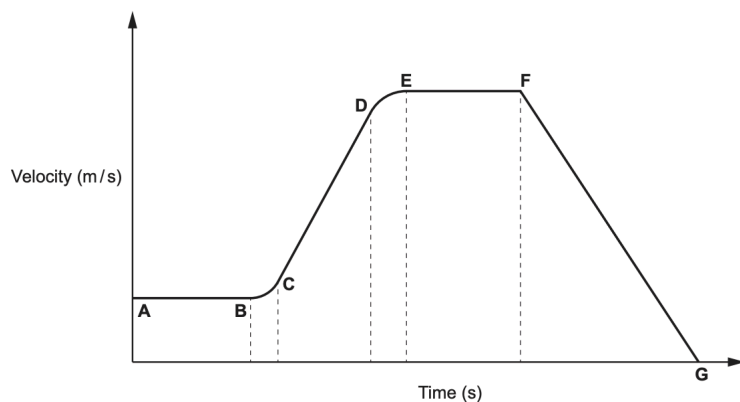
Fig. 12.1



The size of the resultant force on the block changes as the block is lifted.

Fig. 12.2 shows the velocity-time graph for the block during the time it is being lifted.

Fig. 12.2



Describe how the motion of the block **and** resultant force on the block change as the block moves from point **A** to point **G**.

Use **Fig. 12.1** and **Fig. 12.2**

[6]