OCR GCSE GATEWAY PHYSICS A · J249

PHYSICS



EXAM QUESTION PACK

P2.2 NEWTON'S LAWS

SCORE	PERCENTAGE
/213	%

STEMUP

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Gateway Physics A (9-1)

Newton's laws

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **213**.
- The total number of marks may take into account some 'either/or' question choices.

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1 Which sentence is the definition of the power of a machine?

A The amount of work done by the machine.
B The efficiency of the machine.
C The number of joules of energy the machine requires to work.
D The rate at which energy is transferred by the machine.

Your answer ☐

[1]

2 A firework rocket has a resultant force of 2 N acting on it.

It has a mass of 0.1 kg.

What is the acceleration of the firework rocket?

A 0.2 m/s^2
B 0.5 m/s^2
C 20 m/s^2
D 200 m/s^2

Your answer ☐

[1]

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3(a) Four students investigate the idea of work done.

work done = force × distance

Look at their results.

Student	Force (N)	Distance travelled (m)
A	100	5
B	50	10
C	120	12
D	40	4

Use calculations to show which student does the most work.

---

[2]

(b) Which **two** students do the same amount of work?

---

[1]

(c) State **two** reasons why it is important to repeat measurements in any experiment.

---

[2]

(d) Student **C** takes 0.5 minutes to push the trolley.

How much power do they use?

Show your working.

---

answer: _____ W **[4]**

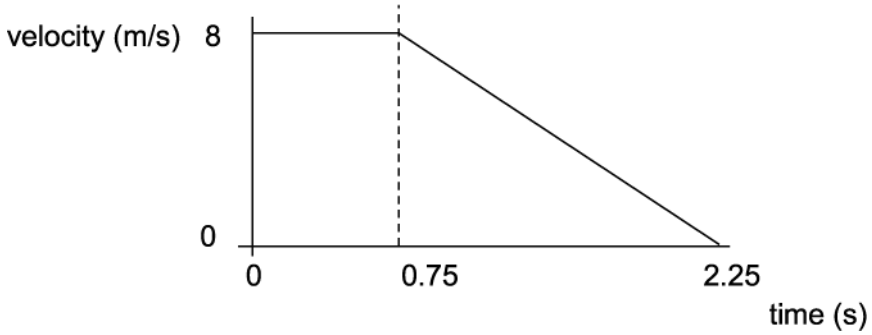
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4 A car takes 6 m to brake when moving at 8 m/s.

Look at the graph of a car travelling at 8 m/s, starting to brake and then stopping.



(i) Calculate the acceleration of the car during braking.

Show your working and state the unit.

---

answer: _____ unit _____ [4]

(ii) The car has a braking force of 5000 N.

Calculate the work done by the brakes on the car.

---

answer: _____ J [2]

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5 A car on a roller coaster is stationary at the top of a slope.

It has a weight of 6 500 N and a potential energy of 217 000 J.

Calculate how high above the ground it is.

---

answer: _____ m [2]

6 A car on a roller coaster is stationary at the top of a slope.

It has a weight of 6 500 N and a potential energy of 217 000 J.

Calculate how high above the ground it is.

---

answer: _____ m

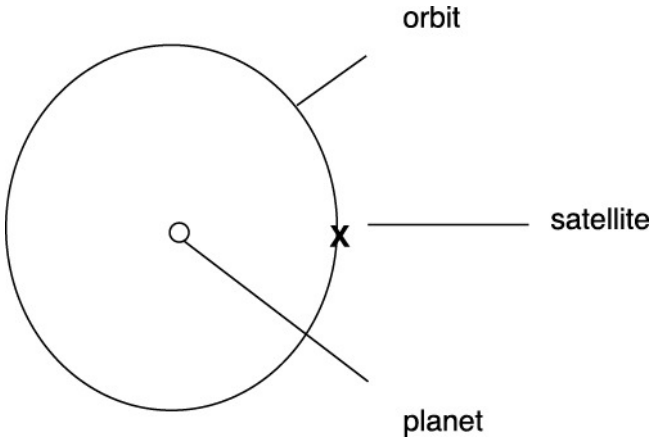
[2]

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7 An artificial satellite (X) is kept in a stable circular orbit around a planet by a centripetal force caused by gravity.



(i) Explain how the velocity of a satellite is constantly changing whilst its speed remains the same when it is in orbit.

---

[2]

(ii) The satellite is remotely controlled from Earth.

The scientists want the satellite to move slower.

What effect will this change in speed have on the height of its orbit?

Explain your answer.

---

[2]

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8 Cars and lorries have different brakes.

Brakes absorb the energy of the vehicle before it comes to rest.

The brakes on lorries have larger brake discs and brake pads than cars.

Brakes are designed for increased air flow.

Explain why this is more important for lorries than cars.

---

[4]

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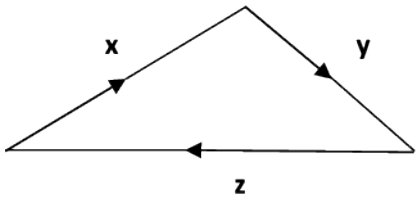
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9 A body has three forces, **x**, **y** and **z** acting on it.

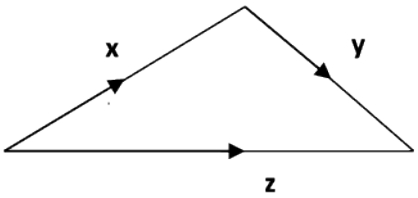
The body is in **equilibrium**.

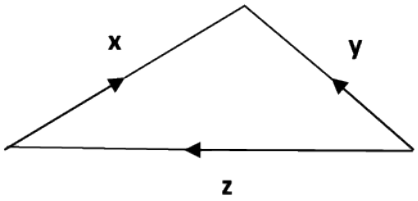
Which vector diagram represents this situation?

A

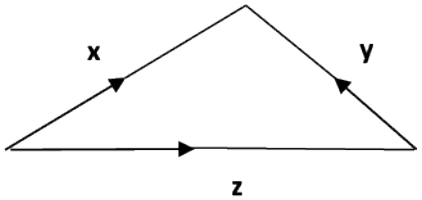


B





C



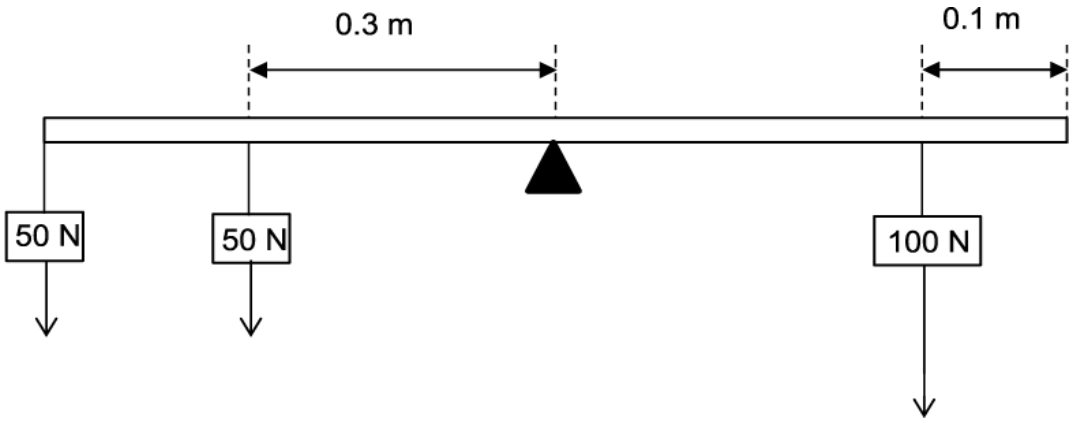
D

Your answer ☐

[1]

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10 A uniform 1.0 m rod is pivoted at its centre.



The rod is in equilibrium.

What is the value of the anti-clockwise moment about the pivot?

A 10 Nm
B 15 Nm
C 40 Nm
D 100 Nm

Your answer ☐

[1]

11 A car and driver with a total mass of 1000 kg is travelling at 20 m/s.

The driver applies the brake and the car comes to a stop in 4 seconds.

What is the mean force on the car?

A 80 000 N
B 5 000 N
C 200 N
D 12.5 N

Your answer ☐

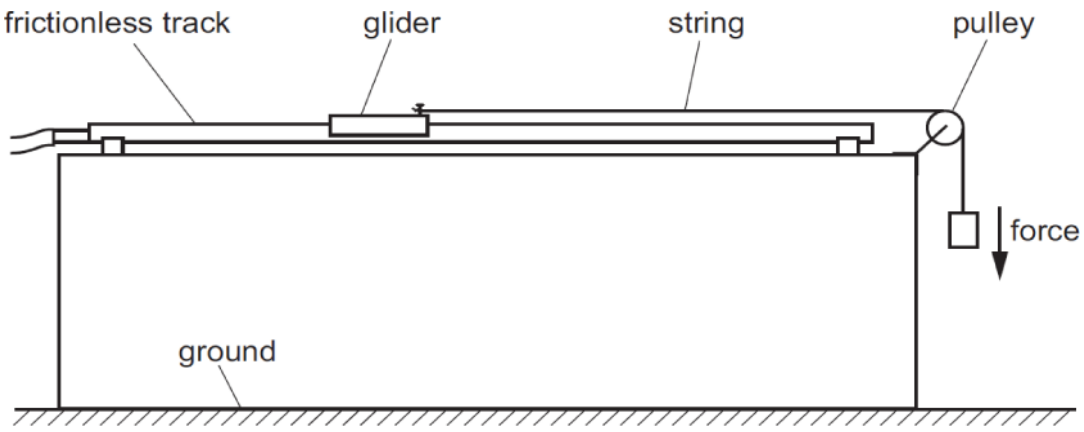
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12(a) A student investigates the motion of a glider on a frictionless air track using the apparatus shown in the picture.



(i) Explain how the student can use this apparatus to demonstrate Newton's Second Law.

Include details of any additional equipment required.

---

[3]

(ii) A 0.25 kg glider is pulled by a 1.0 N force.

Calculate the acceleration of the glider using the formula:

$$\text{force} = \text{mass} \times \text{acceleration}$$

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answer: _____ m/s^2

[1]

(iii) Suggest reasons why the recorded value was less than your calculated value.

---

[2]

(b) The student carries out the experiment for 5 forces

Force (N)	Acceleration (m/s^2)			
	Attempt 1	Attempt 2	Attempt 3	Mean
1.0	3.8	3.9	3.7	3.8
2.0	7.8	7.7	7.7	7.7
3.0	11.2	11.4	11.6	11.4
4.0	12.0	14.9	15.1	13.8
5.0	19.0	18.9	19.1	19.0

There is an anomaly in the results.

Identify the anomaly and explain how the student could have dealt with it.

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[2]

(c) Explain what is meant by a reproducible experiment.

---

[1]

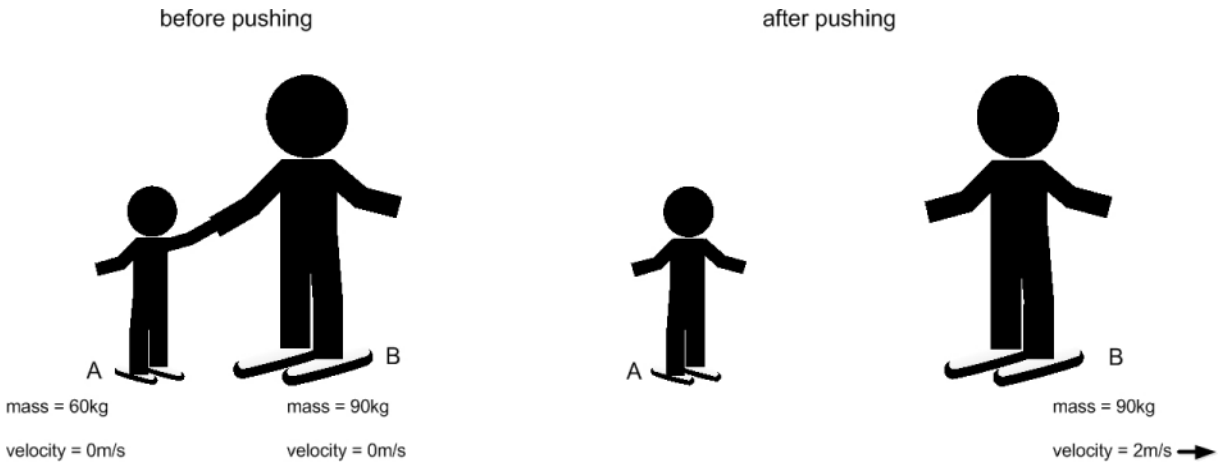
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13(a) Two ice skaters A and B, at rest, start together on the ice.

The ice skaters push apart and they move off in opposite directions.



State the law of conservation of momentum.

---

[1]

(b) Use the data and your knowledge of momentum to calculate the velocity of skater **A** after pushing.

---

[2]

14 A student researches potential and kinetic energy. She looks at some data from experiments with motion trolleys and energy.

The trolleys are stationary at the top of the ramp and have a gravitational potential energy of 8 J.

Each trolley has a mass of 1 kg.

Look at the research data on the trolleys.

Trolley	Velocity at the bottom of the ramp (m/s)
W	3
X	4
Y	5
Z	6

The student thinks the data is wrong.

Use the data and your understanding of energy transfer to justify why trolley W has the most likely velocity and why X, Y and Z do not.

[4]

15 A car runs out of fuel 80 m from a garage.

A passenger pushes the car to the garage with a constant force of 220 N.

Calculate the work done in pushing the car to the garage.

---

answer _____ J

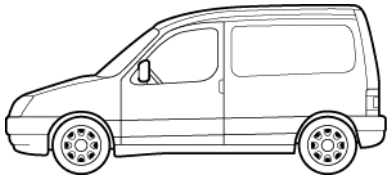
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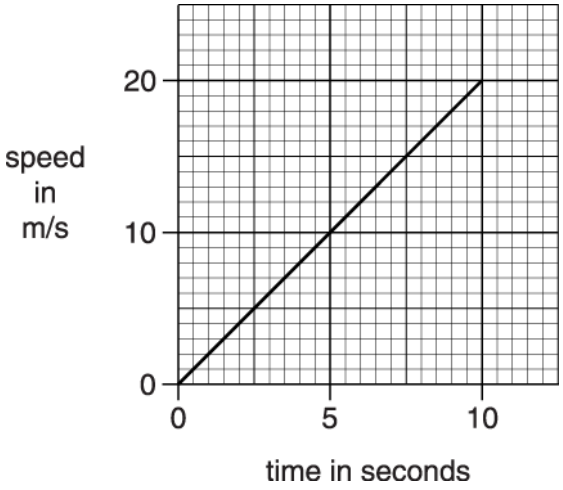
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16(a) Emily has a van.



The van has a mass of 1400 kg.

Look at the speed–time graph for the first 10 seconds of her journey in the van.



Calculate the acceleration of the van in the first 10 seconds.

Choose your answer from:

0.5 m/s^2 **2 m/s^2** **10 m/s^2** **100 m/s^2** **200 m/s^2**

answer _____ m/s^2

[1]

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(b) The accelerating force on the van is 2800 N.

Use this force and information from the graph to calculate the work done to accelerate the van in the first 10 seconds.

answer _____ J

[3]

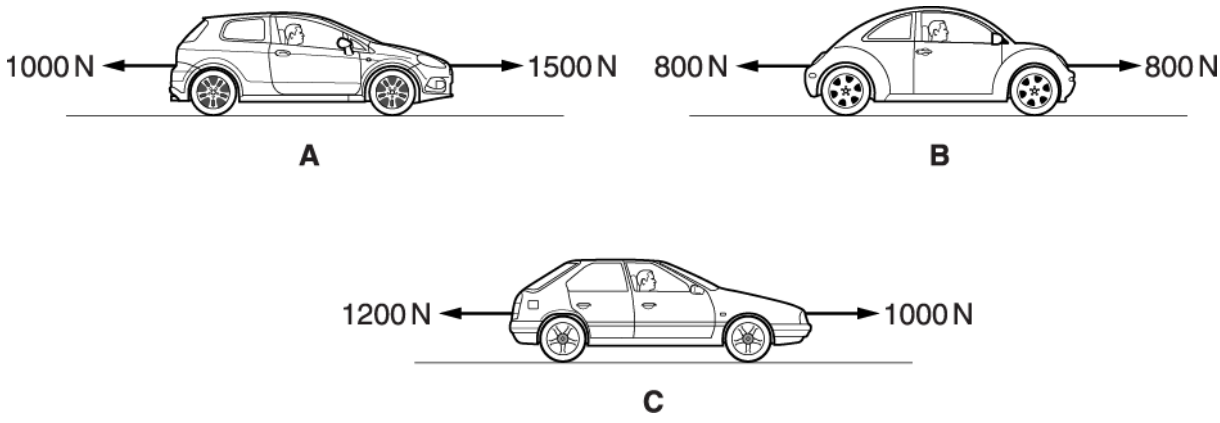
(c) The van now travels at a steady speed of 20 m/s.

Use the force given in **(b)** to calculate the power developed by the engine when travelling at this speed.

answer _____ W

[2]

17(a) Look at the drawings showing forces acting on cars **A, B** and **C** travelling from left to right.



Put a tick (✓) in the correct box in the table below to show if each car is moving at a steady speed, increasing speed or decreasing speed.

	steady speed	increasing speed	decreasing speed
A			
B			
C			

[2]

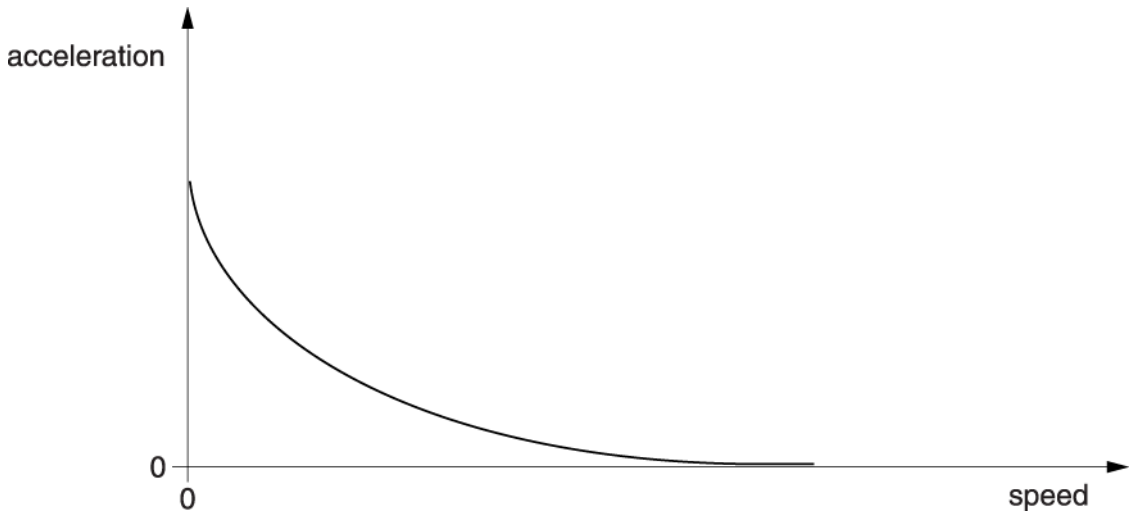
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(b) Amy accelerates her remote controlled car on a flat, straight test track with a constant driving force.

Look at the acceleration–speed graph for the car.



The acceleration changes as the speed changes.

(i) Describe how the acceleration changes as the speed increases.

---

[1]

(ii) Explain how the forces on the car cause the acceleration to change in this way.

---

[2]

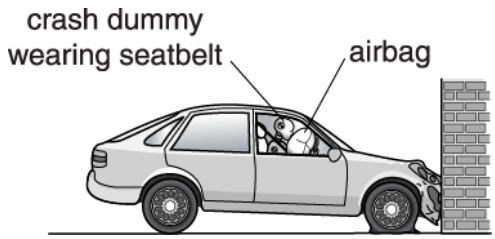
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18 Scientists check the safety of cars by doing crash tests with crash dummies.

They use sensors to make measurements.

They put the sensors in the car and on the crash dummy.

Look at the diagram of a car crashing into a wall.



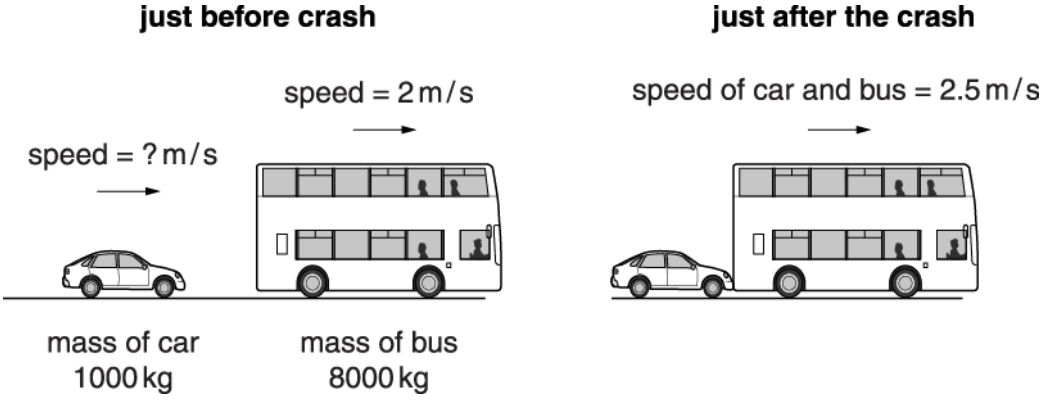
A minor accident happens outside school. The police investigate the accident.

Here are the facts:

- the speed limit outside school is 9 m / s (20 miles per hour)
- a car runs into the back of a bus
- lithe car and the bus move together at the same speed after the collision.

The police need to find out if the car was breaking the speed limit.

Look at the information in the diagrams.



Use a calculation to find the speed of the car just before the accident.

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Car's speed before crash = _____ m/s

Did the car break the speed limit? _____.

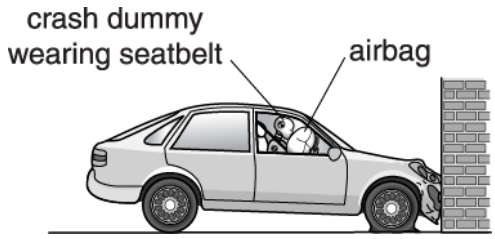
[3]

19(a) Scientists check the safety of cars by doing crash tests with crash dummies.

They use sensors to make measurements.

They put the sensors in the car and on the crash dummy.

Look at the diagram of a car crashing into a wall.



The crash dummy wears a seatbelt.

Just after the crash the dummy moves forward. A force then acts on the dummy.

What produces this force and what does the force do to the dummy's motion?

[1]

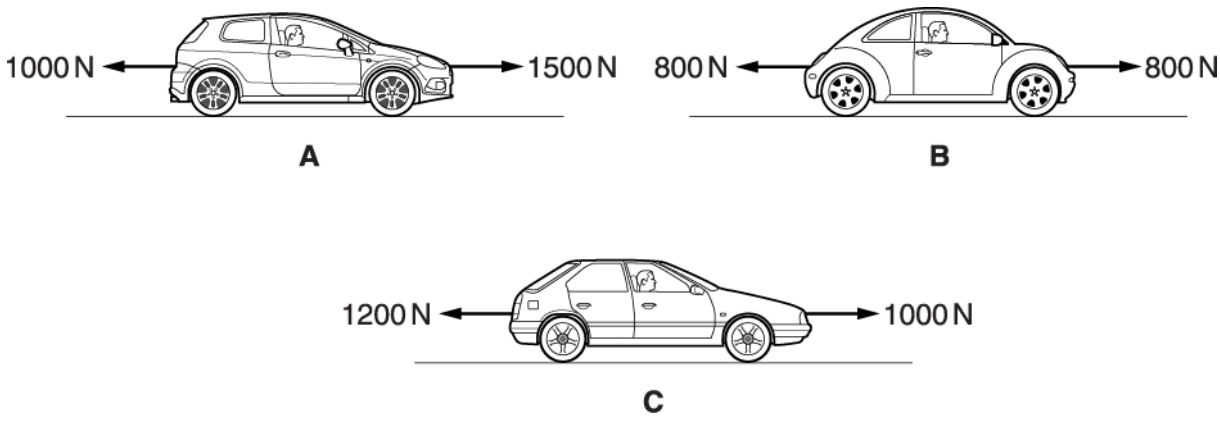
(b) On impact the airbag quickly inflates with gas.

Explain how the gas particles produce a pressure to inflate the airbag.

---

[2]

20 Look at the drawings showing forces acting on cars **A**, **B** and **C** travelling from left to right.



Put a tick (✓) in the correct box in the table below to show if each car is moving at a steady speed, increasing speed or decreasing speed.

	steady speed	increasing speed	decreasing speed
A			
B			
C			

[2]

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21 Air resistance reduces the speed of cars.

Suggest ways of reducing air resistance.

---

[2]

22(a) Adrian runs a 100 m race.

It takes him 12 seconds to run the race.

Calculate his average speed.

Give your answer to two significant figures.

---

answer _____ m/s

[2]

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(b) At the start of the race it takes him 4 seconds to increase his speed by 10 m/s.

(i) Calculate his average acceleration.

answer _____ units _____

[3]

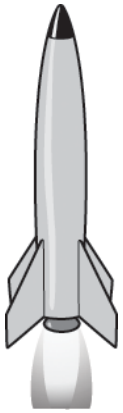
(ii) Adrian has a mass of 60 kg.

Calculate the average force needed at the start of the race to cause this acceleration.

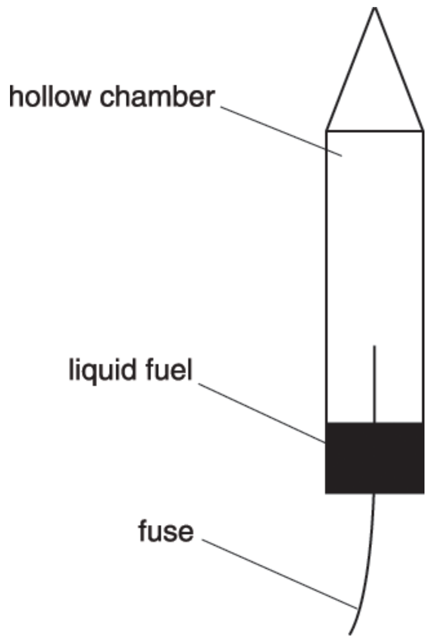
answer _____N

[2]

23(a) Rockets use hot gases to make them move.



Look at the diagram of a simple rocket.



Denise lights the fuse of the rocket. The fuel in the rocket ignites.

A very fast chemical reaction takes place which creates a large amount of hot gas.

Explain what happens to the hot gas and how this makes the rocket move.

____

____

____

____

____ [2]

(b) Denise re-uses the rocket. This time she puts in more fuel than before.

Suggest what happens to the acceleration of the rocket.

Explain your answer.

____

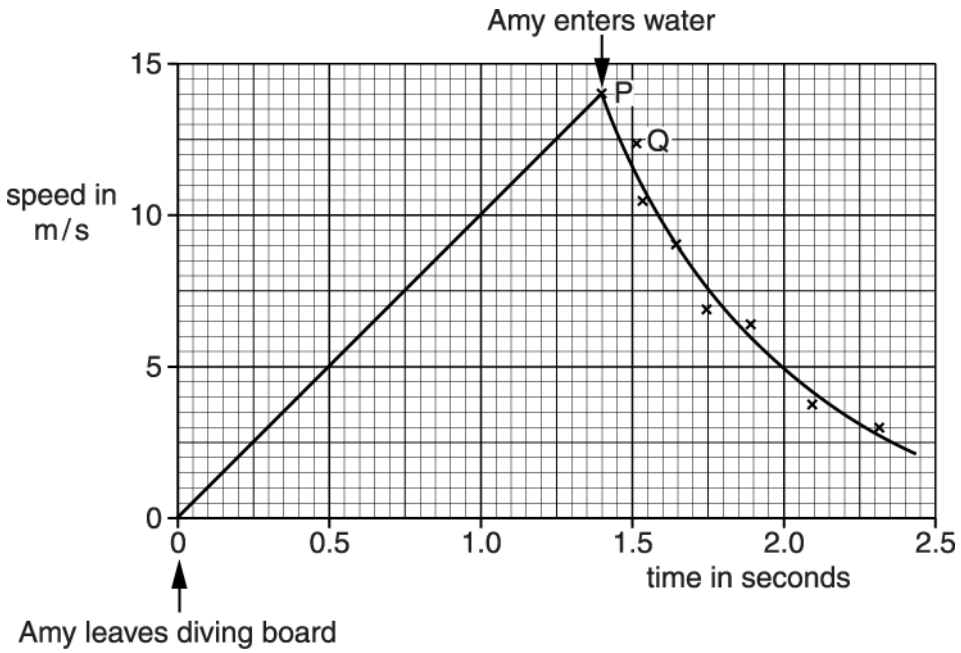
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____

____ [2]

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24 Amy dives from the high diving board at a swimming pool.
Look at the graph of her motion.



(i) John thinks that he can find Amy's deceleration just after she enters the water by using points **P** and **Q** on the graph.
Elaine thinks it is better to find Amy's deceleration just after she enters the water by using the gradient of the graph at point P.
Explain why Elaine's method is better than John's to find the deceleration.

---

[2]

(ii) Amy has a mass of 60 kg.
Amy's deceleration as she enters the water is 20 m/s^2.
Calculate the decelerating force on Amy just as she enters the water.

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answer _____ N

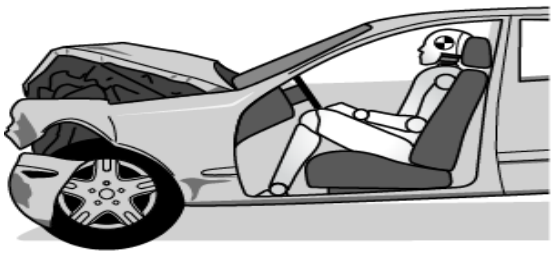
[1]

25 Scientists investigate the safety of seat belts.

They use two cars. Each car has an identical dummy in the driver's seat.

Both cars are crashed, at the same speed, into identical barriers.

In one car, the dummy is wearing a seat belt. In the other car, the dummy is not wearing a seat belt and hits the windscreen in the collision.



Look at the results.

	Crash with seat belt	Crash without seat belt
Mass of dummy	60 kg	60 kg
Distance travelled by dummy whilst stopping	60 cm after seat belt locked	20 cm after hitting windscreen
Time taken for dummy to stop moving	0.08 sec	0.03 sec
Deceleration	175 m / s^2	467 m / s^2
Stopping force	10500 N	

Calculate the missing data and use the information in the table to explain how seat belts reduce injury in a crash.

The quality of written communication will be assessed in your answer to this question.

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---[6]

26 Modern cars have many safety features.

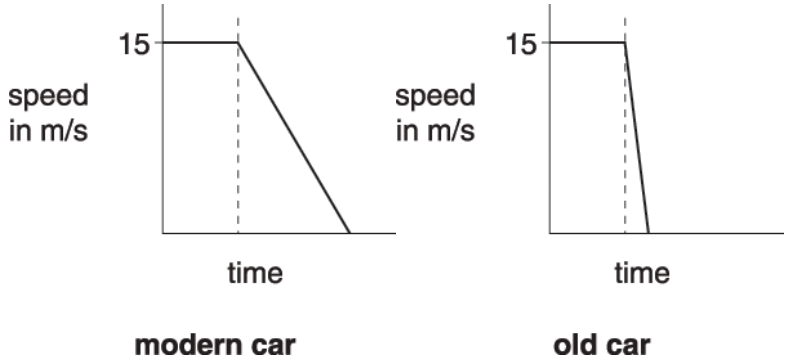
Some features protect people in a crash.

Scientists use crash dummies inside real cars to determine their safety ratings.

Look at the data from two crash tests at 15 m/s.

One is for a **modern** car.

The other is for an **old** car.



The forces on the crash dummies in the old car are much higher.

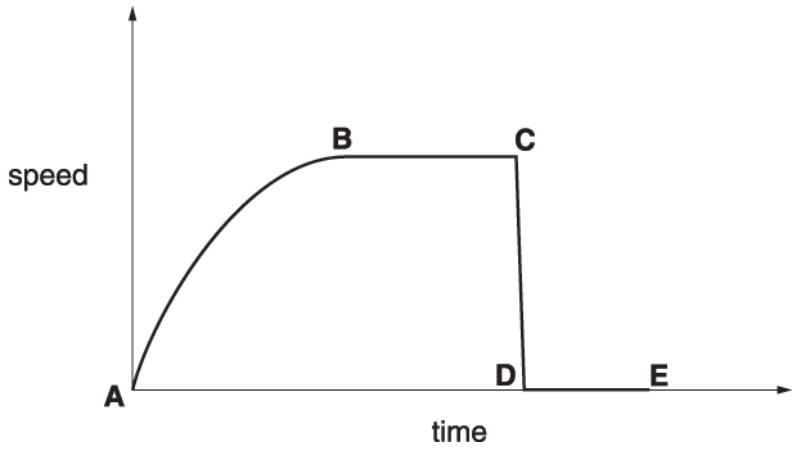
Old cars do not have crumple zones.

Use the information in the graphs to explain why crumple zones in modern cars reduce forces on crash dummies.

[3]

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27(a) Look at the graph. It shows the speed of a football dropped from a high cliff.



Write down the name of the force causing the football to accelerate in part **AB** of the graph.

---

[1]

(b) Write down the name of the force acting against the movement of the football in part **AB** of the graph.

---

[1]

(c)

(i) Which part of the graph shows the football **moving** at terminal speed?

Choose from

AB **BC** **CD** **DE**

answer _____

[1]

(ii) Why does the football reach a terminal speed?

---

[1]

(i) When a lift is moving upwards work is done by the lift motors.

There are 8 people in the lift. The **average** weight of each person is 600 N.

They travel a distance of 30 m upwards from the first floor.

Calculate the work done in lifting the 8 people.

_____ J

[2]

(ii) The lift now travels upwards a further 40 m with the 8 people inside.

Put a tick (✓) in the box which correctly completes the sentence about this second journey.

Compared with the first journey …

… more work is done in the second journey. ☐

… the same amount of work is done in the second journey. ☐

… less work is done in the second journey. ☐

[1]

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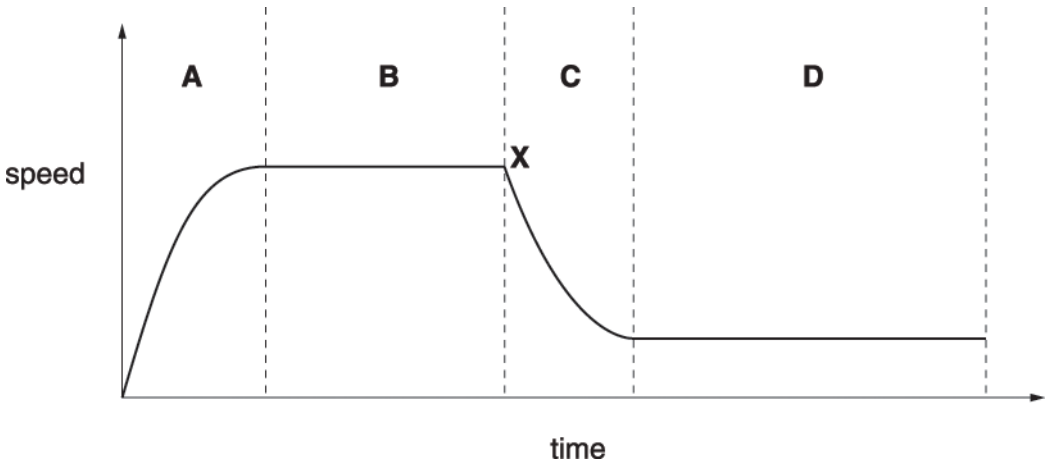
29(a) Susie is a skydiver.

Look at the graph.

It shows her speed after she has jumped from an aeroplane.

There are four sections of the graph, labelled **A**, **B**, **C** and **D**.

Susie opened her parachute at point **X** shown on the graph.

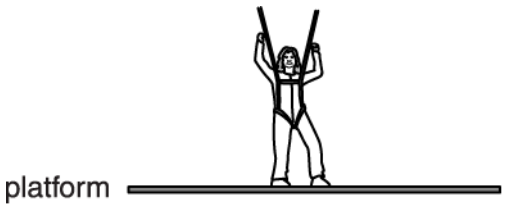


Write about the forces acting on Susie during her descent to explain the different speeds she travels at.

[4]

(b) Susie practises her landings by jumping from a low platform.

She is attached to straps which act like a parachute.



A Susie **standing still** on platform.

B Susie is **exactly half way** down.



C Susie is **on** the ground.

Look at the statements about Susie's energy as she does her practice fall.

Put a tick (✓) in the box beside any correct statement and a cross (✗) beside any incorrect statement.

The first one has been done for you.

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At **A** all of Susie's energy is GPE.	✓
Between **A** and **B** Susie gains **both** GPE and KE.	
Between **A** and **B** Susie gains **only** KE.	
At **B** her KE is **exactly** half her GPE at **A**.	
Just before touching the ground at **C** Susie has her maximum KE.	
On the ground at **C** Susie has zero KE.	
On the ground at **C** Susie has her maximum GPE.	

[3]

30 Scientists investigate the safety of seat belts.

They use two cars. Each car has an identical dummy in the driver's seat.

Both cars are crashed, at the same speed, into identical barriers.

In one car, the dummy is wearing a seat belt. In the other car, the dummy is notwearing a seat belt and hits the windscreen in the collision.



Look at the results.

	Crash with seat belt	Crash without seat belt

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Mass of dummy	60 kg	60 kg
Distance travelled by dummy whilst stopping	60 cm after seat belt locked	20 cm after hitting windscreen
Time taken for dummy to stop moving	0.08 sec	0.03 sec
Deceleration	175 m / s^2	467 m / s^2
Stopping force	10500 N	

Calculate the missing data and use the information in the table to explain how seat belts reduce injury in a crash.



The quality of written communication will be assessed in your answer to this question.

[6]

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31 Alice drops a pebble from the top of a high cliff.

(i) The mass of the pebble is 0.30 kg.

Calculate the momentum of the pebble when it is falling at a speed of 4.0 m / s.

---

answer _____ kg m / s

[2]

(ii) It reaches a terminal speed before it hits the ground.

Explain why it travels at a terminal speed.

---

[2]

(iii) An astronaut does the same experiment as Alice, on the Moon.

In this experiment, the pebble falls, but does not reach a terminal speed.

Suggest why.

---

[1]

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32(a) Haroon completes a project about work done.

Look at his project.

Work Done

Work is done when you lift weights, climb stairs, pull a sledge or lean against a wall.

Work done depends on the distance moved and the time it takes to move the object.

The unit for work done is the joule.

Energy is never transferred when work is done.

There are three mistakes in Haroon's homework.

Write down the **three** mistakes.

--- [3]

(b) Choose **one** of the mistakes and write down the correct information.

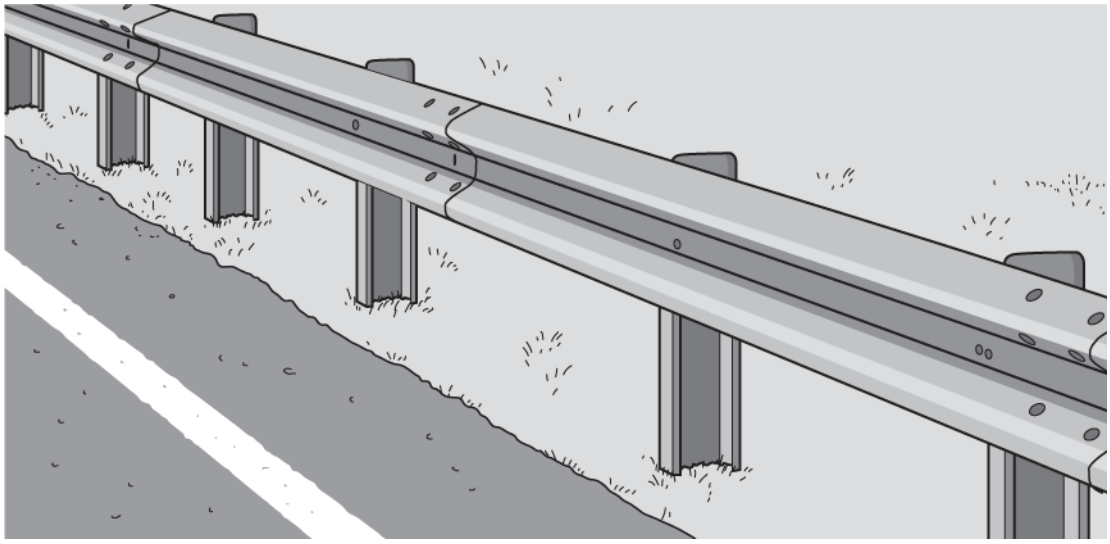
--- [1]

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33 Crash barriers are used at the side of motorways.



Explain how a crash barrier can reduce the force on the passengers in a car when the car crashes.

---

[3]

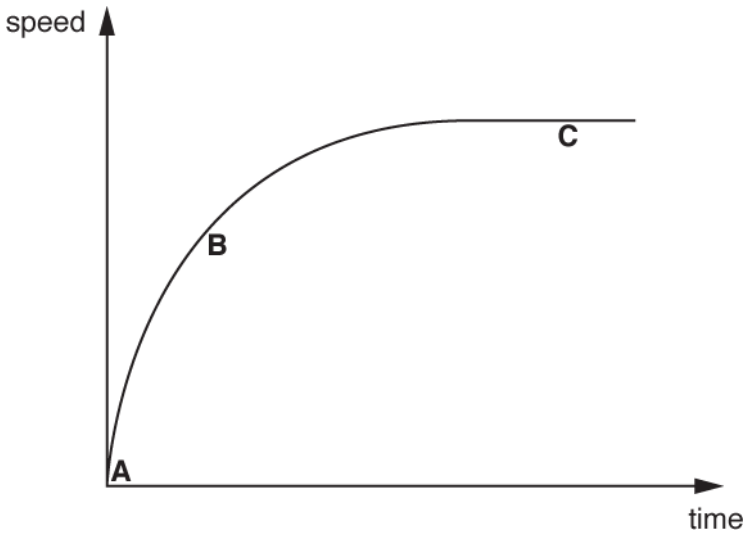
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34 Mia investigates terminal velocity.

She drops an object and looks at its motion as it falls through the air.

Mia plots a graph of the speed of the object against time as it falls through the air.

Look at the graph.



Describe the motion of the object from being dropped until it reaches terminal velocity.

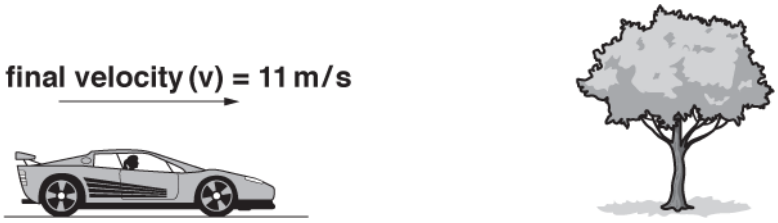
Include ideas about forces and acceleration in your answer.

The quality of written communication will be assessed in your answer to this question.

---

[6]

35 The car stops accelerating when it reaches the final velocity of 11 m / s.



The car crashes into a tree.

(i) Describe what happens to the motion of the car **and** the tree during the collision.

---

[1]

(ii) What type of forces act on the car and the tree during the collision?

Choose from

forces are equal and in the same direction
forces are equal and in opposite directions
forces are unequal and in the same direction
forces are unequal and in opposite directions

answer ---------- [1]

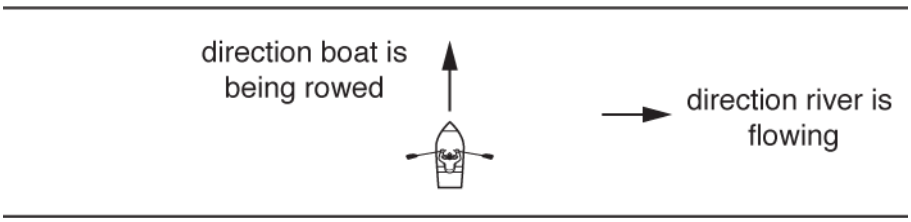
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36 A boat is rowed across a river at 4 m/s.

The river flows at 3 m/s.



The velocities are at right angles to each other.

Use a scale diagram to find the **size and direction** of the resultant velocity.

[3]

37 The maker of a car wants to increase the acceleration of the car.

Suggest **one** factor they could change to **increase** the acceleration of the car.

---

[1]

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38 An object moved 20 cm with a force of 20 N.

Use the equation: work done = force × distance

Which is the correct calculation of work done?

A 0.4 J

B 4.0 J

C 40 J

D 400 J

Your answer ☐ [1]

39(a)

Objects can interact in many ways. Pairs of forces arise when objects interact.

Write down **one** type of force involved when objects interact.

---

[1]

(b) A book rests on a table.

Draw a free body force diagram to show the forces acting on the book.

Use arrows to represent the forces.

[4]

(c) A teacher uses an air-track for motion experiments. Using the air-track means that there is no friction between the glider and the air-track.

The teacher places the glider on the horizontal air-track and gives it a small push to start it moving.

Explain the motion of the glider.

---

[2]

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(d) A presenter on a car TV programme says:

"The car maker has reduced the mass of this car and it now has better acceleration."

(i) Explain why the presenter is correct.

--- [2]

(ii) A car accelerates from 5 m/s to 25 m/s in 4 seconds.

Calculate the acceleration of the car.

Use the equation: Acceleration = Change in speed ÷ Time taken

Answer = ... m/s^2 **[3]**

40 Which statement is equivalent to the mass of an object?

A The ratio of acceleration over force

B The ratio of force over acceleration

C The ratio of velocity over acceleration

D The ratio of displacement over acceleration

Your answer ☐ [1]

41(a) A student investigates collisions of trolleys on a horizontal airtrack.

Write down the **two** quantities involved with motion which are conserved during an elastic collision.

---

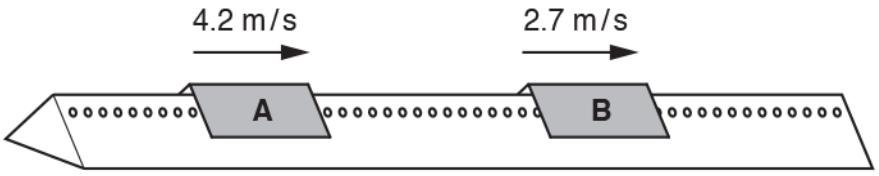
[2]

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(b) Trolley **A** has a mass of 2 kg. Trolley **B** has a mass of 2.5 kg.



(i) Calculate the **momentum** of each trolley.

Trolley **A** = ... kg m/s
Trolley **B** = ... kg m/s
[3]

(ii) The two trolleys collide and stick together after the collision. Use your answers to **(i)** to calculate the **speed** of the combined trolleys after the collision.

Record your answer to **2** significant figures.

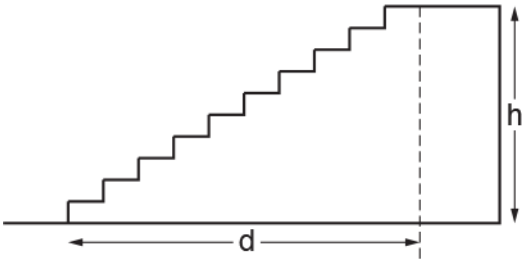
Answer = ... m/s **[3]**

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42 A student of weight W runs up a flight of stairs.



She moves a distance d metres horizontally and h metres vertically.

What is the work done against gravity running up the stairs?

A $W \times d$

B $W \times h$

C $(W \times d) + (W \times h)$

D $W \times \frac{h}{d}$

Your answer [1]

43 A student wants to find out the depth of a well.

She thinks that she can calculate this by dropping a stone into the well and timing how long it takes to hear the stone splash at the bottom.

Describe the motion of the stone as it falls.

Assume it does not reach terminal velocity.

Use a free body diagram to help you.

---

[4]

44 Look at the information about different electric motors.

Electric motor	Energy input per hour (J)	Useful energy output per hour (J)	Energy 'wasted' per hour (J)
A	72 000	60 000	
B	54 000	36 000	
C	18 000		3 000
D		48 000	12 000
E	54 000	48 000	

(i) Calculate the energy input per hour in J for electric motor D.

Answer = _____ J [2]

(ii) Which electric motor has the **lowest** 'wasted' energy in one hour?

_____ [1]

(iii) Which electric motor has the **highest** 'wasted' energy in one hour?

_____ [1]

(iv) Describe how energy is 'wasted' in an electric motor.

_____

_____ [1]

(v) Suggest how this 'wasted' energy can be reduced in an electric motor.

_____

_____ [1]

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45 This question is about force, mass and acceleration.

A roller coaster car moves down a slope with an acceleration of 5 m/s^2.

The force on the roller coaster car is 4000 N.

Calculate the **mass** of the roller coaster car.

Answer = _____ kg **[2]**

46 A 2.0 kg object moves at a velocity of 40 m / s.

What is the momentum of the object?

Use the equation: momentum = mass × velocity

A 20 kg m / s

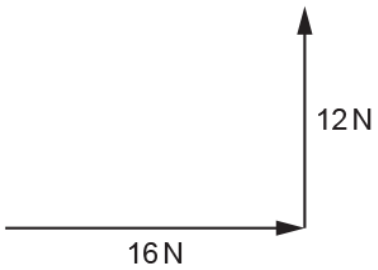
B 38 kg m / s

C 42 kg m / s

D 80 kg m / s

Your answer ☐ **[1]**

47 Two forces act at right angles to each other.



What is the magnitude of the resultant force?

A 18 N

B 20 N

C 22 N

D 24 N

Your answer [1]

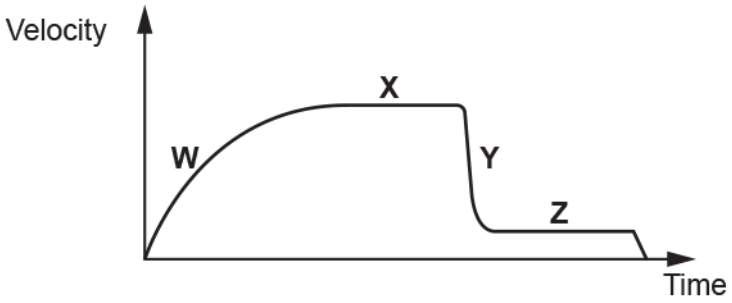
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48 A skydiver falls from a plane. His parachute opens and he lands safely.

Look at the velocity-time graph of his journey.



Which parts of the graph show balanced forces on the skydiver?

A X only

B Y and Z

C X and Z

D Y only

Your answer [1]

49 A student puts a small load on a spring. It is in equilibrium.

Draw and label a free body force diagram for the load at the end of the spring.

[3]

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50 Which of the following is Newton's Third Law?

A For every action there is an equal and opposite reaction.

B What goes up must come down.

C The acceleration that a resultant force produces depends on the size of the force and mass of the object.

D An object will continue to stay at rest or move with uniform speed unless a force acts on it.

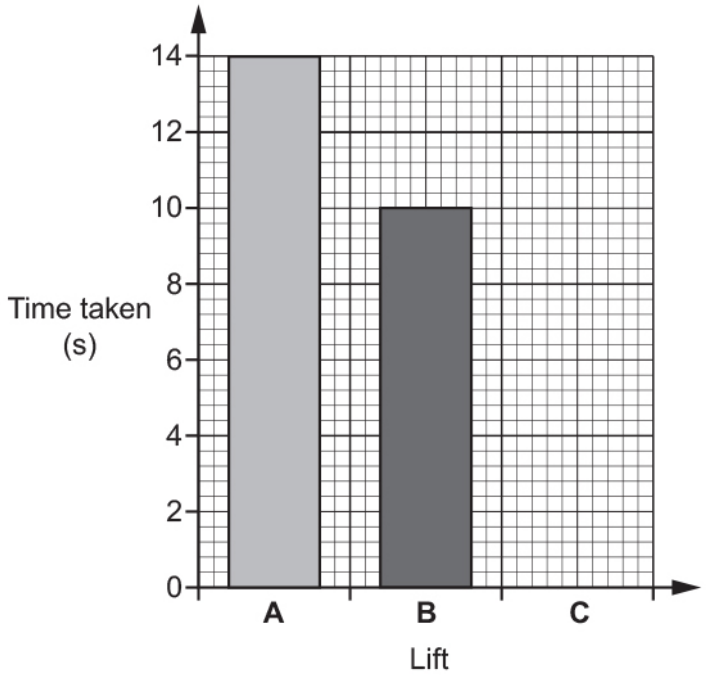
Your answer ☐ **[1]**

51(a) A tall building needs a lift to move people from one floor to another.

The builder has a choice of three different lifts.

Each lift takes a different amount of time to move between the two floors.

Look at a bar chart of the time taken for each lift.



(i) Lift **C** takes 12 s to move between the two floors.

Draw a bar for lift **C** on the bar chart. **[1]**

(ii) Calculate the **mean** time of the three lift journeys.

Mean = ... s **[2]**

(iii) Explain which lift uses the most power.

---

[2]

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(b)

(i) One lift uses 50 000 J for a 12 s journey.

Calculate the power of the lift.

Give your answer to 1 decimal place.

Power = ... W **[4]**

(ii) When the lift is broken the stairs are used.

Calculate the work done when a 750 N person climbs a distance of 4 m.

Work done = ... J **[3]**

52 The acceleration of a car is 2 m / s^2. The mass of the car is 1000 kg.

Calculate the resultant force on the car.

A 20 N

B 200 N

C 2000 N

D 20 000 N

Your answer ☐ **[1]**

53 A runner has a mass of 80 kg and moves at a speed of 5 m / s.

Calculate the kinetic energy of the runner.

Use the equation: kinetic energy = 0.5 × mass × $(\text{speed})^2$

A 200 J

B 1000 J

C 2000 J

D 40 000 J

Your answer ☐ **[1]**

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54 A student uses 2250 J of energy climbing up steps. It takes the student 15 seconds to climb the steps.

Calculate the power of the student.

Use the equation: power = work done ÷ time taken

A 15 W
B 150 W
C 9000 W
D 33750 W

Your answer [1]

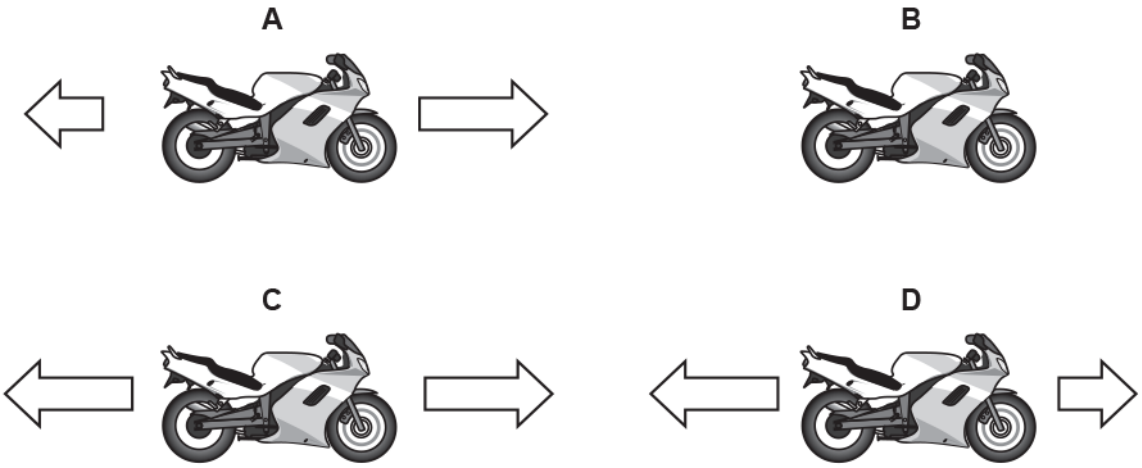
55 Which of the pairs are contact forces?

A Air resistance and gravity
B Friction and gravity
C Magnetism and normal contact force
D Normal contact force and air resistance

Your answer [1]

56 A motorbike travels along a straight flat road.

The arrows represent the horizontal forces acting on the motorbike.



Which motorbike is travelling at a uniform velocity?

Your answer [1]

57 Which statement is an example of Newton's third law?

A Doubling the engine force on a car doubles its acceleration.
B Doubling the engine force on a car halves its acceleration.
C When a ball is rolling on a table it continues rolling at a steady speed.
D When you clap your hands each hand experiences a force from the other hand.

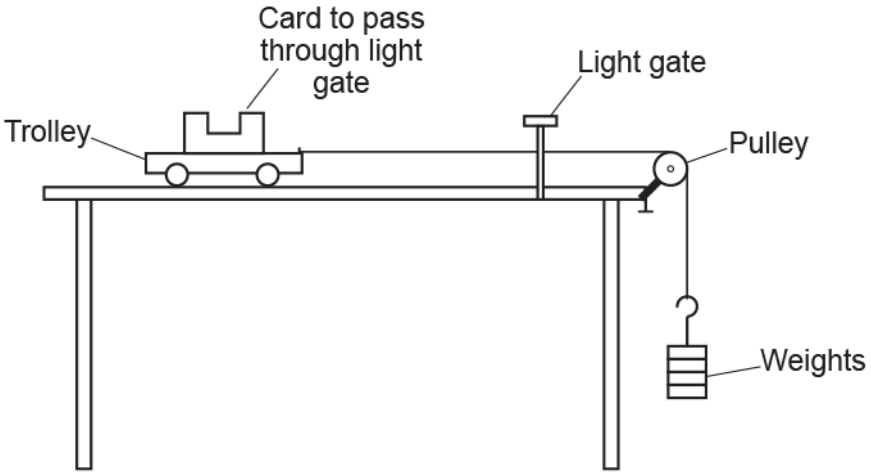
Your answer [1]

58 A student investigates the acceleration of a trolley.

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The trolley is released from a fixed position and accelerates.

(i) Describe the energy transfer as the trolley accelerates on the desk.

---

[1]

(ii) The trolley moves a distance of 86 cm along the desk.

Calculate the work done when a force of 3.0 N is applied.

Use the equation: work done = force × distance

Give your answer to **2** significant figures.

Work done = ... J **[4]**

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59 Four cars of the same mass are shown here.

A



B



C



D



Which car will accelerate?

Your answer ☐ [1]

60(a) The mass of a toy car is 5 kg and it has an acceleration of 4 m / s^2.

(i) Calculate the force needed to accelerate the toy car.

Use the equation: force = mass × acceleration

Force = ... N [2]

(ii) Suggest why the actual force needed would be more than in part **(i)**.

[1]

(b)

(i) A toy car requires a constant force of 30 N to move it along a surface.

Calculate the work done on the car when it moves a distance of 50 m.

Use the equation: work done = force × distance

Work done = ... J **[2]**

(ii) Calculate the power output of this toy car if the work is done over 75 seconds.

Use your answer from **(i)**.

Power = ... W **[3]**

END OF QUESTION PAPER