

Combined Science A (Gateway Science) (J250)

Physics Paper 1 - 100 MCQs Challenge

Mr Ahmad - Beal High School

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: 100 mins

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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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 **100**.
- The total number of marks may take into account some 'either/or' question choices.

- 1 0.18 J of energy is stored in a spring when it stretches by 12 cm.

What is the spring constant of the spring?

Use the Equation Sheet Jun24 J250-05-06-11-12

- A 0.0025 N / m
- B 3 N / m
- C 12.5 N / m
- D 25 N / m

Your answer

[1]

- 2 Which row describes the difference between a vector quantity and a scalar quantity?

	Has magnitude	Has direction
A	scalar only	vector only
B	vector and scalar	vector only
C	vector and scalar	scalar only
D	vector only	vector and scalar

Your answer

[1]

- 3 How do crumple zones make it safer for passengers in cars in a crash?

- A They increase the force needed to stop the car.
- B They increase the rate of change of momentum of the car.
- C They increase the time taken for the car to stop.
- D They increase the work done by the brakes.

Your answer

[1]

4 Different scientists have contributed to the model of the atom.

What is the order of each scientist's contribution from the oldest to the newest?

Oldest $\longrightarrow$ Newest

- A Bohr, Rutherford, Thomson
- B Rutherford, Bohr, Thomson
- C Thomson, Bohr, Rutherford
- D Thomson, Rutherford, Bohr

Your answer

[1]

5 An object is rubbed with a cloth and becomes **positively** charged.

Which sentence explains how the object becomes positively charged?

- A Electrons move from the cloth to the object.
- B Electrons move from the object to the cloth.
- C Protons move from the cloth to the object.
- D Protons move from the object to the cloth.

Your answer

[1]

- 6 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]

- 7 Which two units measure the same quantity?

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

Your answer

[1]

- 8 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]

- 9 A sealed rigid container of air is in a room at 20 °C. The container is then placed in a refrigerator at 4 °C.

Which row explains what happens to the speed of the air molecules and the pressure inside the container?

	Air molecules inside the container	Pressure on the inside of the container
A	move faster	decreases
B	move faster	increases
C	move slower	decreases
D	move slower	increases

Your answer

[1]

- 10 Four cars are travelling along a road.

Which car has the **highest** momentum?

Use the equation: momentum = mass × velocity

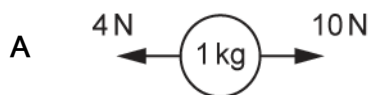
	Mass of car (kg)	Velocity of car (m / s)
A	1000	5
B	1000	10
C	2000	5
D	2000	10

Your answer

[1]

11 Four different objects are acted on by different forces.

Which object has the **highest** acceleration?



Your answer

[1]

12 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]

13 Which two instruments are used to measure the **density** of a rectangular glass block?

- A A measuring cylinder and a ruler
- B A protractor and a ruler
- C A protractor and an electronic balance
- D A ruler and an electronic balance

Your answer

[1]

14 A car changes velocity by 14 m / s in 3.5 s.

What is the acceleration of the car?

Use the equation: $\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$

- A 0.25 m / s²
- B 4.0 m / s²
- C 10.5 m / s²
- D 17.5 m / s²

Your answer

[1]

15 An object of mass 2.0 kg accelerates. The force acting on the object is 5.0 N.

Calculate the acceleration of the object.

Use the equation: $\text{force} = \text{mass} \times \text{acceleration}$

- A 0.4 m / s²
- B 2.5 m / s²
- C 3.0 m / s²
- D 10.0 m / s²

Your answer

[1]

16 A student stretches four different springs as shown in the table.

The student measures the length of each spring:

- before the stretching force is applied
- during the time that the stretching force is applied
- after the stretching force has been removed.

Which spring shows **plastic** deformation?

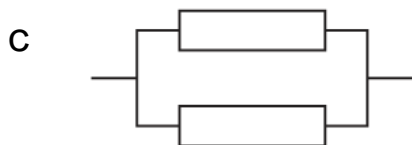
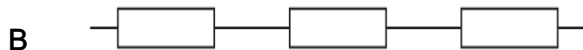
	Length before (cm)	Length during (cm)	Length after (cm)
A	2.4	2.9	2.4
B	2.5	5.0	2.5
C	2.5	2.9	2.9
D	2.6	2.6	2.6

Your answer

[1]

17 The resistors shown in **A**, **B**, **C** and **D** are identical.

Which arrangement has the **smallest** resistance?



Your answer

[1]

18 The diagram shows some forces acting on a moving object.



Which statement describes the motion of the object?

- A The object accelerates towards E.
- B The object accelerates towards W.
- C The object changes direction.
- D The object moves at constant velocity.

Your answer ☐

[1]

19 Which row describes the difference between a vector quantity and a scalar quantity?

	Has magnitude	Has direction
A	scalar only	vector only
B	vector and scalar	vector only
C	vector and scalar	scalar only
D	vector only	vector and scalar

Your answer ☐

[1]

20 Different scientists have contributed to the model of the atom.

What is the order of each scientist's contribution from the oldest to the newest?

Oldest $\longrightarrow$ Newest

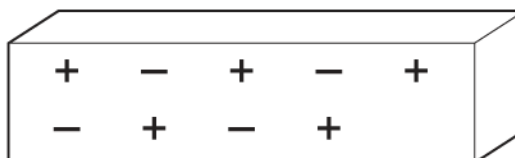
- A Bohr, Rutherford, Thomson
- B Rutherford, Bohr, Thomson
- C Thomson, Bohr, Rutherford
- D Thomson, Rutherford, Bohr

Your answer

[1]

21 Objects can be charged by rubbing them with a cloth.

The diagram shows a plastic rod which has become charged.



Which statement correctly describes the plastic rod?

- A The rod has an overall negative charge.
- B The rod has an overall positive charge.
- C The rod has gained neutrons.
- D The rod has gained protons.

Your answer

[1]

22 A spring has a spring constant of 20 N / m and its extension is 0.4 m.

What is the force exerted on the spring?

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

- A 0.8 N
- B 5.0 N
- C 8.0 N
- D 20.4 N

Your answer

[1]

23 A 6 V battery provides a current of 0.4 A in a circuit for 20 seconds.

How much energy is transferred by the battery?

Use the equations: charge flow = current $\times$ time

energy transferred = charge $\times$ potential difference

- A 0.12 J
- B 0.75 J
- C 15 J
- D 48 J

Your answer

[1]

24 Which new feature of the atomic model did Niels Bohr suggest?

- A Electrons are in stable shells.
- B Electrons orbit a nucleus.
- C The atom has a nucleus.
- D The nucleus is positive.

Your answer

[1]

25 Two rooms have the same fixed volume. They contain identical gases at the same pressure.

Room H is at a higher temperature than room L.

Which statement is correct?

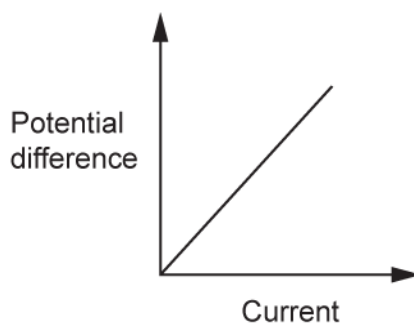
- A The particles are moving at the same speed in both rooms.
- B The particles are moving faster in room H.
- C The particles are moving faster in room L.
- D The particles are not moving in either room.

Your answer

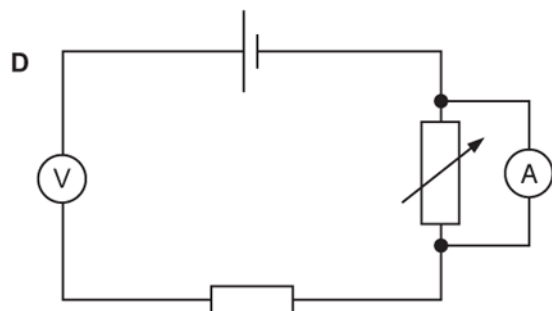
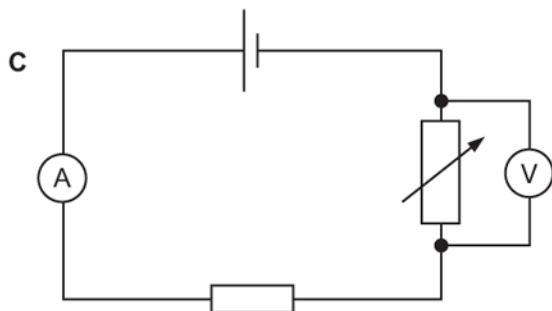
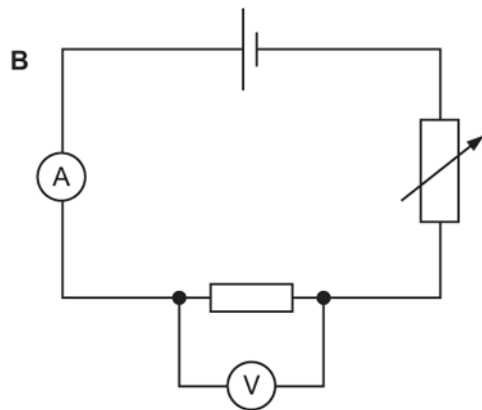
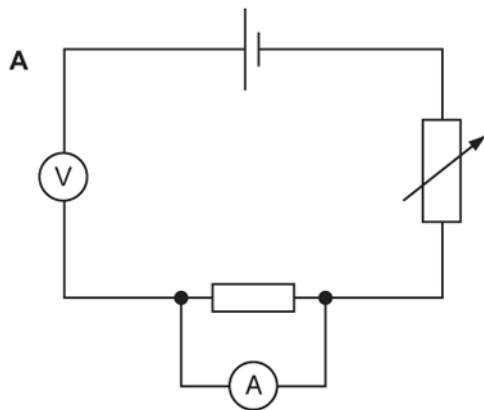
☐

[1]

26 The graph shows how potential difference varies with current for a fixed resistor.



Which circuit could be used to produce the graph?



Your answer

[1]

27 Which substance listed in the table has the **highest** density?

Substance	Mass (kg)	Volume (cm ³)
A	0.5	1.5
B	0.5	3.0
C	1.0	1.5
D	1.0	3.0

Your answer

[1]

28 Two magnets, X and Y, are placed next to each other.



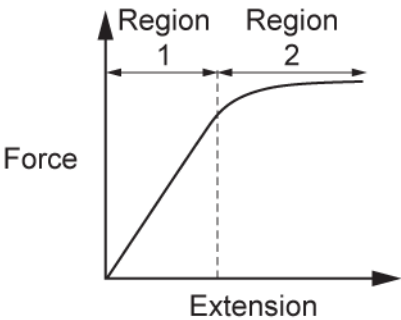
Which row is correct?

	Magnet X produces a force on Magnet Y	Magnet Y produces a force on Magnet X
A	no	no
B	yes	no
C	no	yes
D	yes	yes

Your answer ☐

[1]

29 The force-extension graph is shown for a copper wire.



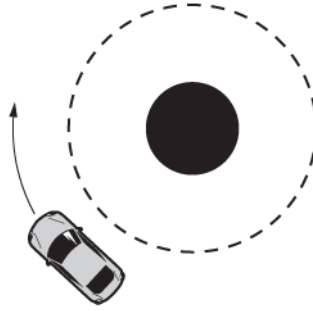
Which row describes the behaviour of copper in region 1 and region 2?

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

Your answer ☐

[1]

30 A car travels around a roundabout at 20 mph.



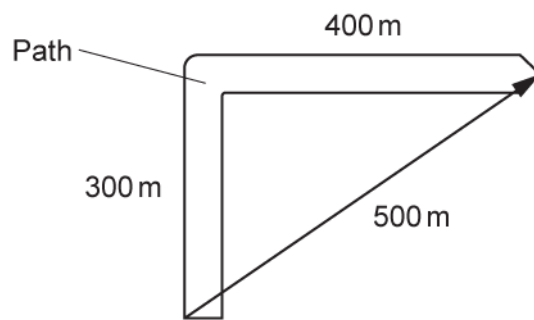
Why is the car accelerating?

- A The direction of the car is changing.
- B The forces on the car are balanced.
- C The mass of the car is decreasing.
- D The speed of the car is changing.

Your answer

[1]

31 A child walks 300 m north along a path. The path turns through a 90° angle. They then walk another 400 m east.



Which statement is correct?

- A The total displacement is 500 m.
- B The total displacement is 700 m.
- C The total distance travelled is 500 m.
- D The total distance travelled is 1200 m.

Your answer

[1]

32 The diagram shows some forces acting on an object.



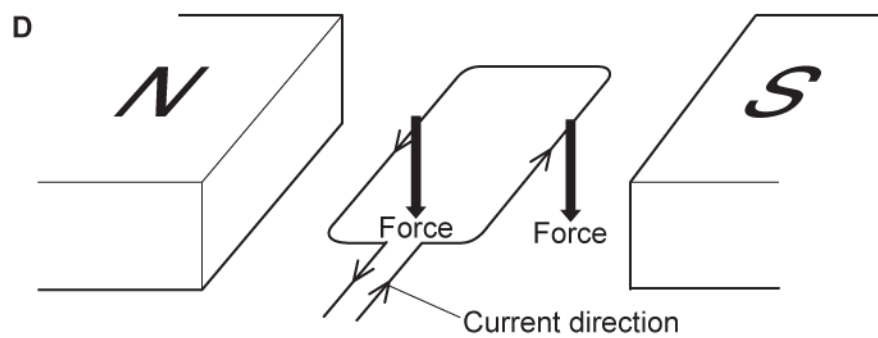
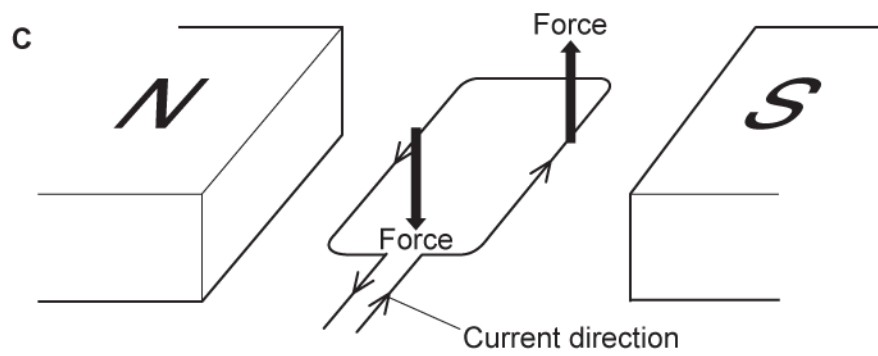
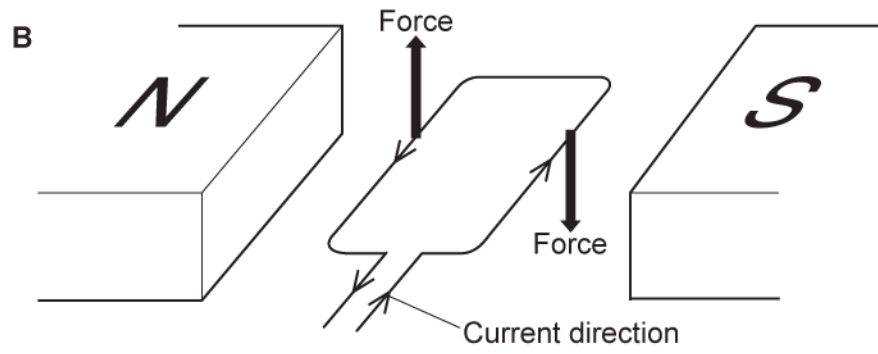
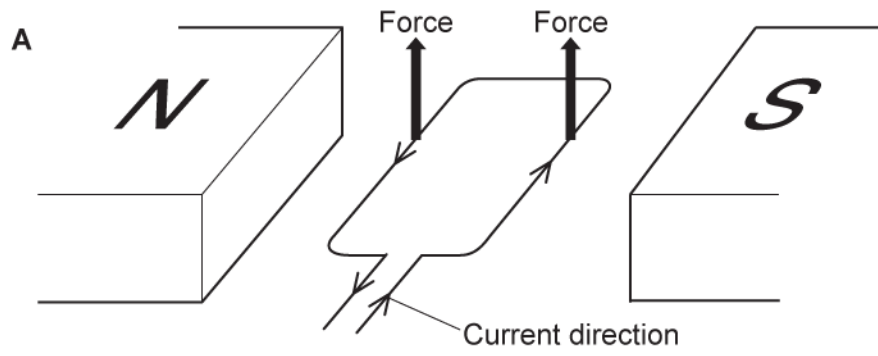
What is the resultant force on the object?

- A 5.4 N
- B 12 N
- C 13 N
- D 14.9 N

Your answer

[1]

33 Which diagram explains how a simple d.c. electric motor spins?



Your answer

[1]

34 A 200 g bar of chocolate is melted in a saucepan.

The specific latent heat of melting chocolate is 31.2 J / g .

How much energy is needed to melt the bar of chocolate?

Use the equation: thermal energy for a change in state = mass $\times$ specific latent heat

A 0.156 J

B 6.24 J

C 156 J

D 6240 J

Your answer

[1]

35 A transformer has an output potential difference of 24 V.

The output current is 5 A.

What is the power output of the transformer?

Use the Equation Sheet.

A 0.21 W

B 4.8 W

C 120 W

D 240 W

Your answer

[1]

36 A spaceship travels from planet P to planet Q.
The diagram shows the size of the forces acting on the spaceship.



Which sentence describes the motion of the spaceship?

- A It is accelerating.
- B It is decelerating.
- C It is staying at a constant speed.
- D Its speed is decreasing then increasing

Your answer ☐

[1]

37 Velocity is a vector.

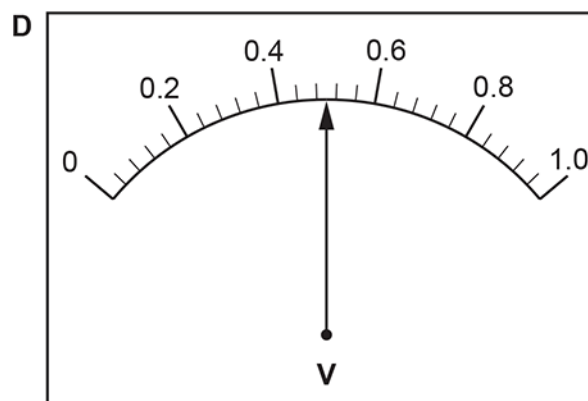
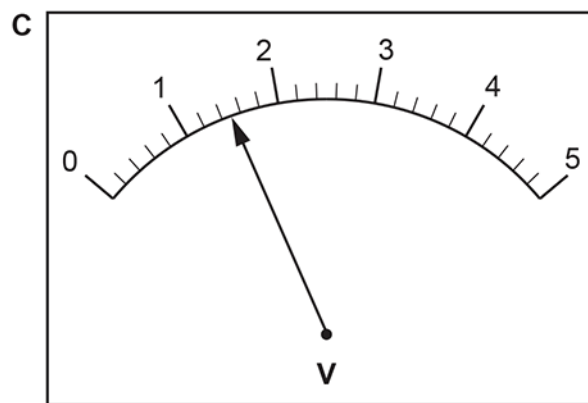
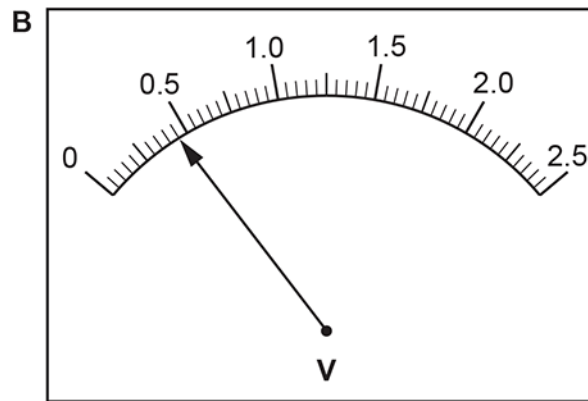
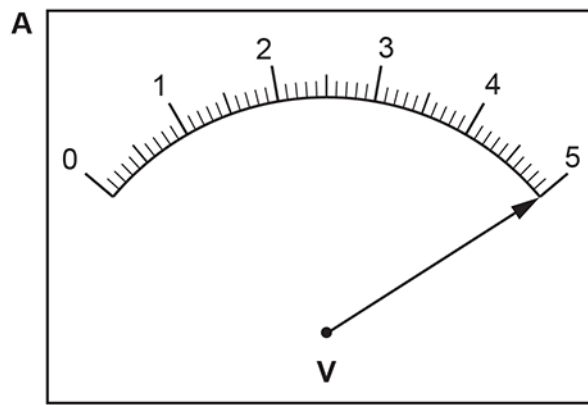
Which row is correct for velocity?

	Has size?	Has direction?
A	no	no
B	no	yes
C	yes	no
D	yes	yes

Your answer ☐

[1]

38 Which voltmeter shows a reading of 0.5 V?

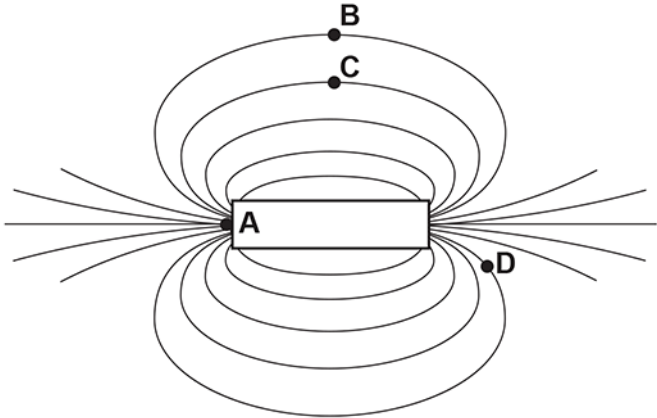


Your answer

[1]

39 The diagram shows the magnetic field around a bar magnet.

At which point is the magnetic field the **weakest**?



Your answer

[1]

40 Which substance listed in the table has the highest **density**?

Substance	Mass (kg)	Volume (cm ³)
A	1.0	1.5
B	1.0	3.0
C	1.0	4.5
D	1.0	6.0

Your answer

[1]

41 How much of the total mass of a hydrogen atom is made up by the nucleus?

- A None of the mass
- B Half of the mass
- C Almost all of the mass
- D All of the mass

Your answer

[1]

42 The mass of an astronaut is 80 kg.

Calculate the weight of the astronaut on the Moon.

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

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

- A 50 N
- B 128 N
- C 800 N
- D 1280 N

Your answer

[1]

43 The table shows the results from measuring the extension of a spring for different forces.

Force (N)	Extension of a spring (m)
0.0	0.00
0.9	0.05
1.8	0.10
2.7	0.15
3.6	0.20

Calculate the spring constant of the spring.

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

- A 0.045 N / m
- B 0.060 N / m
- C 0.72 N / m
- D 18 N / m

Your answer

[1]

44 Which new feature of the atomic model did Niels Bohr suggest?

- A Electrons are in stable shells.
- B Electrons orbit a nucleus.
- C The atom has a nucleus.
- D The nucleus is positive.

[1]

Your answer

☐

45 Two rooms have the same fixed volume. They contain identical gases at the same pressure.

Room H is at a higher temperature than room L.

Which statement is correct?

- A The particles are moving at the same speed in both rooms.
- B The particles are moving faster in room H.
- C The particles are moving faster in room L.
- D The particles are not moving in either room.

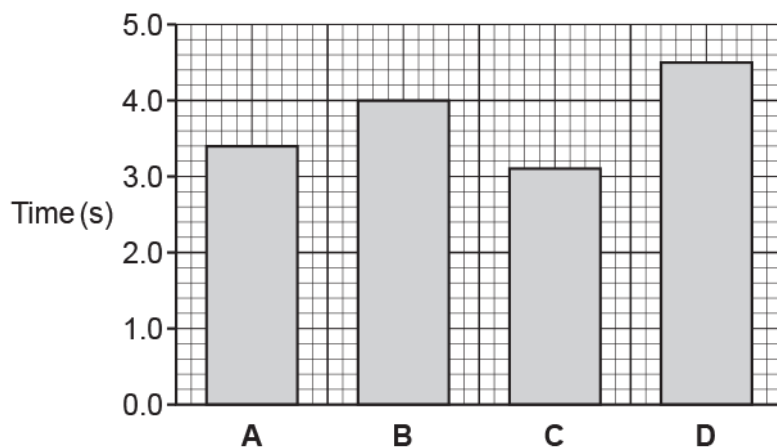
[1]

Your answer

☐

46 Four weightlifters A, B, C and D, each do 2000 J of work lifting a weight.

The time taken for each of them to do their lift is shown in the graph.



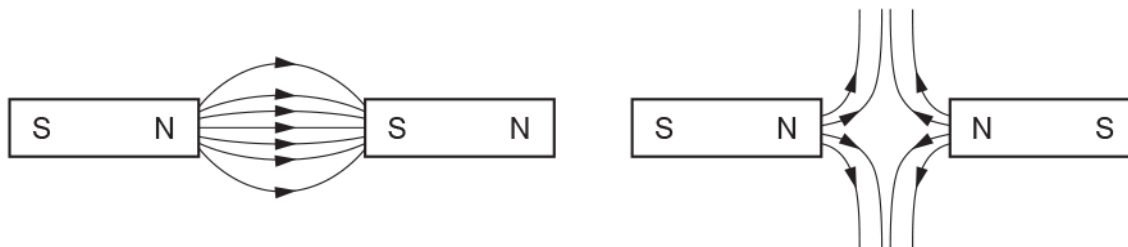
Which weightlifter has the **highest** power?

Use the Data Sheet, J250 05/06/11/12, June 2022.

Your answer

[1]

47 The diagrams show the magnetic field lines around the bar magnets.



Which answer is **correct**?

- A N poles repel S poles.
- B The direction of the magnetic field lines is N to S.
- C The magnetic field is stronger further from the bar magnet.
- D The poles are at the centre of the bar magnet.

Your answer

[1]

48 A student records the time it takes to run three distances. The table shows their results.

Distance (m)	25.2	25.0	25.1
Time taken (s)	40.0	41.6	42.4

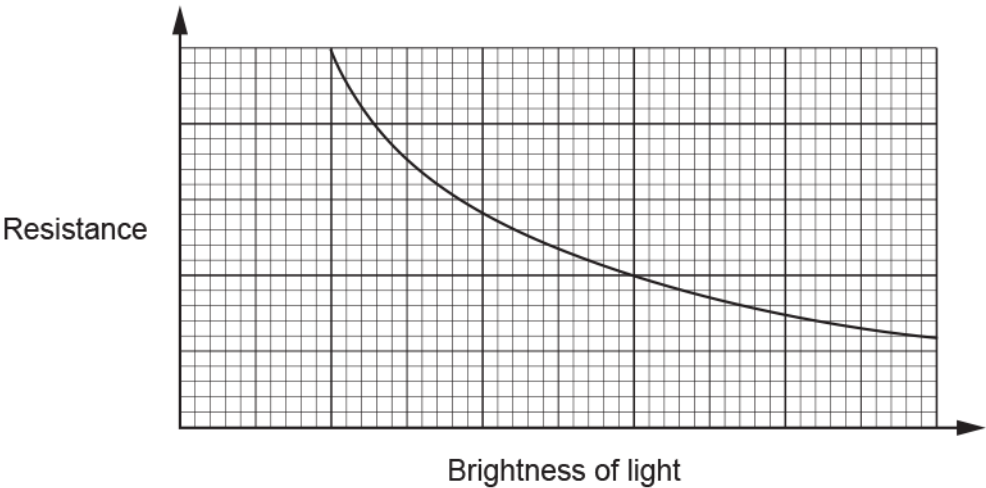
How many significant figures is the student using?

- A 1
- B 2
- C 3
- D 4

Your answer

[1]

49 The graph shows how the resistance of a circuit component changes with the brightness of light.



What is the name of the circuit component?

- A Diode
- B Filament lamp
- C LDR
- D Thermistor

Your answer

[1]

50 A cell transfers energy.

- The potential difference is 6 V.
- The charge flowing is 40 C.

What is the amount of energy transferred by the cell?

Use the equation: energy transferred = charge $\times$ potential difference

- A 0.15 J
- B 0.9 J
- C 6.7 J
- D 240 J

Your answer

[1]

51 Which force is a **contact** force?

- A Electrostatic
- B Friction
- C Gravity
- D Magnetic

Your answer

[1]

52 A child is riding a bicycle. They accelerate from 0 m/s to 4 m/s in 20 seconds.

Calculate the acceleration of the child.

Use the equation: $\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$

- A 0.2 m/s²
- B 4 m/s²
- C 5 m/s²
- D 8 m/s²

Your answer

[1]

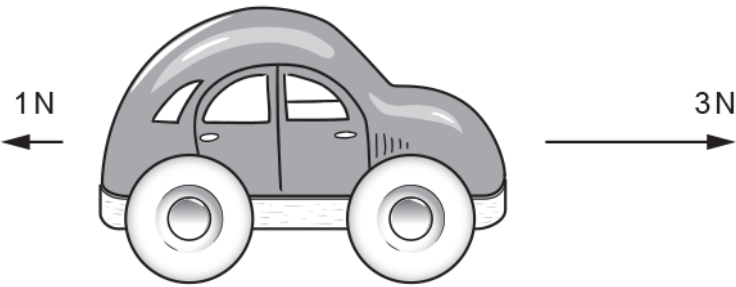
53 Which pair of forces are a Newton's third law pair?

- A Weight of magnet and magnetic force
- B Weight of person and friction on person
- C Weight of person and pull of person on the Earth
- D Weight of skydiver and air resistance on skydiver

Your answer

[1]

54 The diagram shows some forces acting on a toy car.



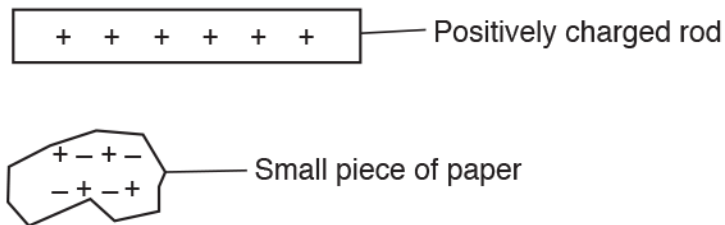
Which row in the table describes the motion of the toy car?

	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]

55 The diagram shows a positively charged rod near a small piece of paper.



The paper is attracted to the rod.

Which diagram shows the **correct** distribution of positive and negative charges in the piece of paper as the rod is brought closer?

A

Diagram A shows a positively charged rod above a piece of paper. The paper has '+' signs concentrated on its top side and '-' signs on its bottom side.

B

Diagram B shows a positively charged rod above a piece of paper. The paper has '-' signs concentrated on its top side and '+' signs on its bottom side.

C

Diagram C shows a positively charged rod above a piece of paper. The paper has '+' signs concentrated on its top side and '-' signs on its bottom side.

D

Diagram D shows a positively charged rod above a piece of paper. The paper has '+' signs concentrated on its bottom side and '-' signs on its top side.

Your answer ☐

[1]

56 A student stands near a wall and claps their hands.

The sound echo takes 0.2 s to return to the student. The speed of sound is 330 m / s.

What is the **distance** between the student and the wall?

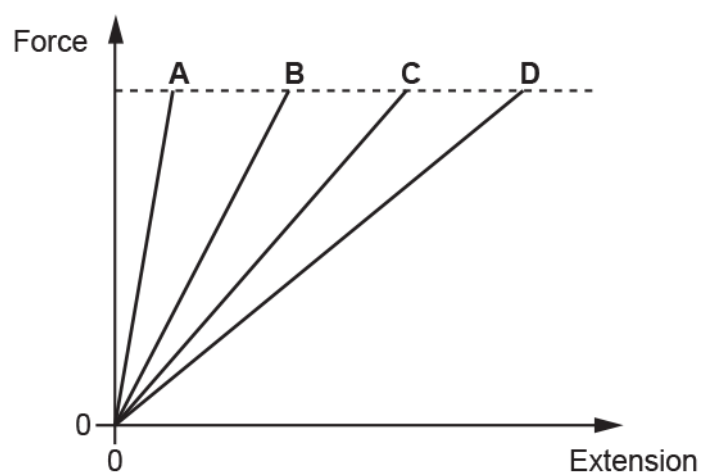
Use the equation: distance travelled = speed $\times$ time

- A 33 m
- B 66 m
- C 1650 m
- D 3300 m

Your answer

[1]

57 The graph shows the extension of four different springs, A, B, C and D.

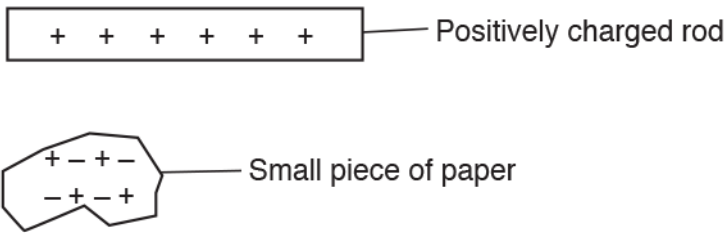


Which spring stores the most energy?

Your answer

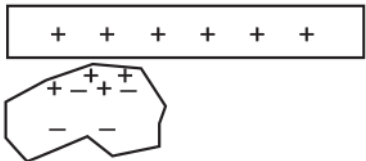
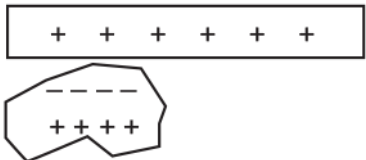
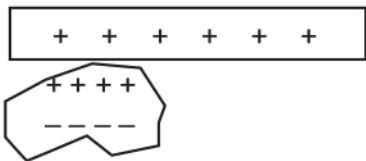
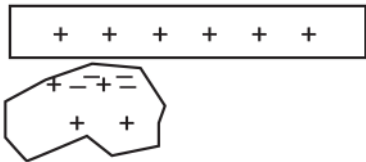
[1]

58 The diagram shows a positively charged rod near a small piece of paper.



The paper is attracted to the rod.

Which diagram shows the **correct** distribution of positive and negative charges in the piece of paper as the rod is brought closer?

- A 
- B 
- C 
- D 

Your answer ☐

[1]

- 59 A compass needle is made of a magnet containing a north pole and a south pole.
The N pole of the compass needle points north on Earth.

Which row in the table describes the magnetic field of the Earth?

	Type of magnetic pole near to the Earth's geographic north pole	Direction of magnetic field
A	N	N to S
B	N	S to N
C	S	N to S
D	S	S to N

Your answer

[1]

- 60 A ball is inflated with air.

In which environment will the air inside the ball have the **highest** pressure?

- A In a refrigerator (3 °)
- B In a house (18 °)
- C Outside on a cold day (5 °)
- D Outside on a warm day (21 °)

Your answer

[1]

- 61 A 1.5 V cell transfers 18 mC of charge in a circuit.

What is the amount of energy transferred by the cell?

Use the download Data Sheet (Physics) J250-/05/06/11/12, June 2022.

- A 0.027 mJ
- B 0.27 J
- C 27 mJ
- D 27 J

Your answer

[1]

62 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.

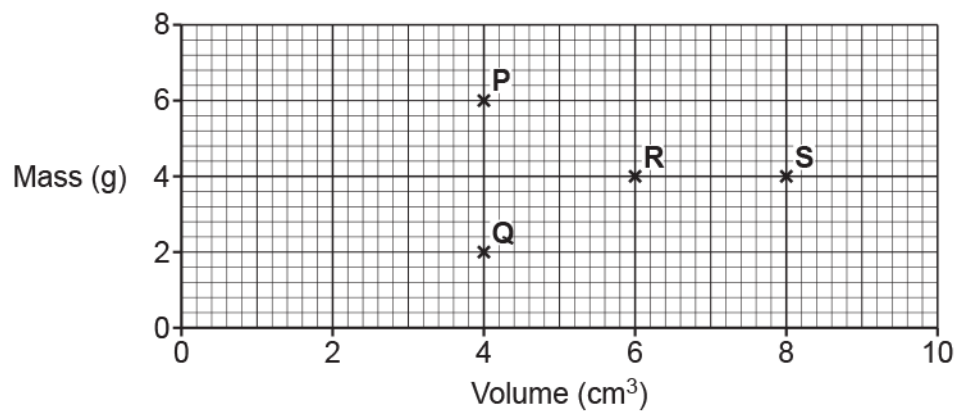
Use the equation: power = $\frac{\text{work done}}{\text{time}}$

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

Your answer

[1]

- 63 A student measures the mass and volume of four blocks.
The graph shows their results.



Which two blocks have the **same** density?

Use the equation: density = $\frac{\text{mass}}{\text{volume}}$

- A P and Q
- B P and R
- C Q and S
- D R and S

Your answer

[1]

64 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 $1 \times 10^{25} \text{ kg}$.
- Planet Z has a mass of $4 \times 10^{25} \text{ kg}$.

What is the gravitational field strength on planet Z?

Use the download Data Sheet (Physics) J250-/05/06/11/12, June 2022.

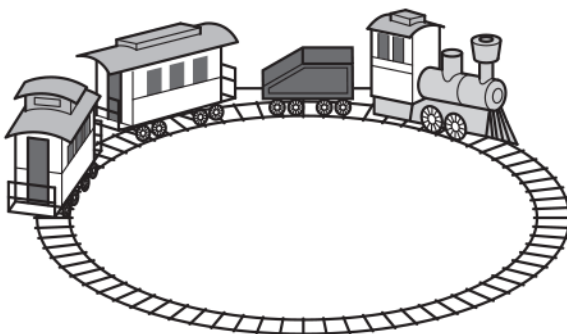
- A 0.75 N/kg
- B 3 N / kg
- C 12 N / kg
- D 48 N / kg

Your answer

[1]

65 A toy train moves around a circle of track.

The speed of the toy train is 2 cm / s .



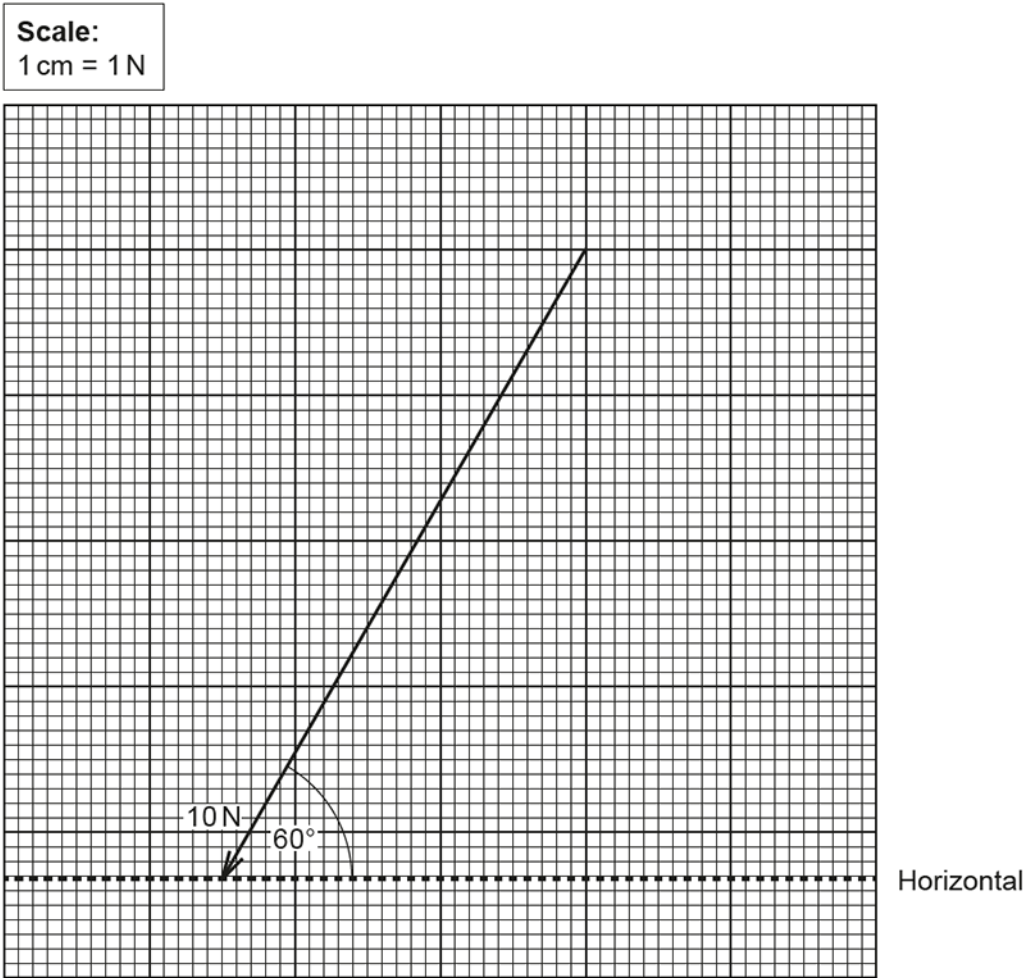
Why is the velocity of the toy train changing?

- A Air resistance is acting on the toy train.
- B Force of track on toy train = force of toy train on track.
- C Friction is acting between the track and the toy train.
- D The toy train is changing direction.

Your answer

[1]

66 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:



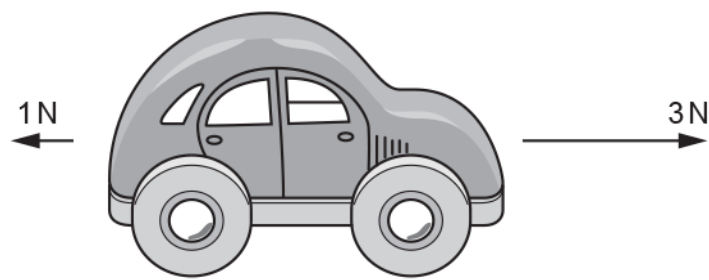
What is the **horizontal** component of the force pushing the toy car?
Use the scale diagram.

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

Your answer

[1]

67 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]

68 A filament lamp has a resistance of 1000 Ω and a current of 0.25A.

What is the power of the filament lamp?

Use the equation: $\text{power} = (\text{current})^2 \times \text{resistance}$

- A 62.5 W
- B 250 W
- C 4000 W
- D 250 000 W

Your answer

[1]

69 A 6 V battery transfers 1860 J of energy.

Calculate the charge transferred by the battery.

Use the equation: energy transferred = charge $\times$ potential difference

- A 0.31 C
- B 11.16 C
- C 310 C
- D 11 160 C

Your answer

[1]

70 A 2.5 kW electric radiator is used for 2 hours.

Calculate the energy transferred.

Use the equation: energy transferred = power $\times$ time

- A 1.25 kWh
- B 5 kWh
- C 1250 kWh
- D 5000 kWh

Your answer

[1]

71 The braking distance for a car is 25 m. The braking force is 4000 N.

Calculate the work done by the brakes.

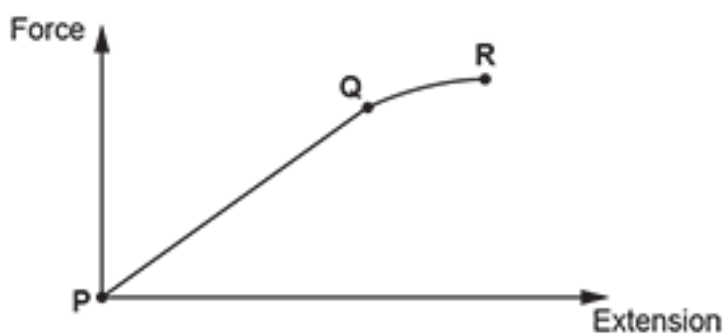
Use the equation: work done = force $\times$ distance

- A 1.6 J
- B 100 J
- C 160 J
- D 100 000 J

Your answer

[1]

72 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]

73 Electrical circuits can be used to transfer energy.

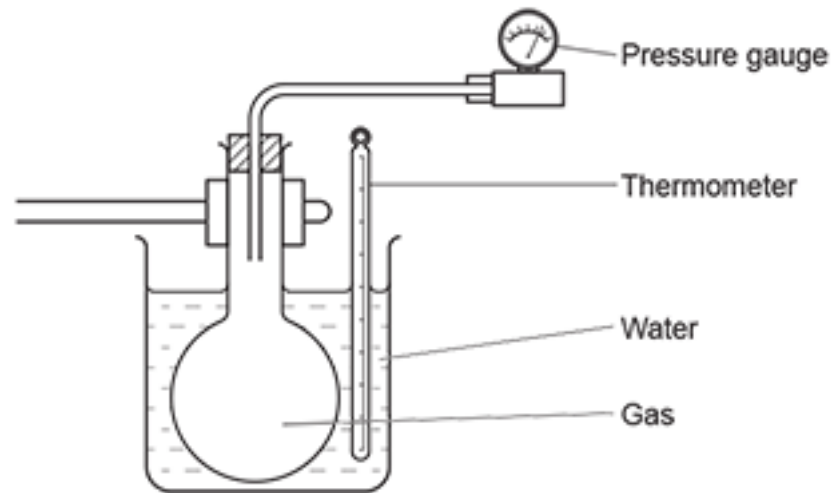
Which row of the table correctly shows the information needed to calculate the amount of energy transferred?

	Current	Potential difference	Time the circuit is used for
A	✓	✓	×
B	✓	×	×
C	✓	✓	✓
D	×	✓	✓

Your answer

[1]

74 This apparatus is used to measure the pressure of a fixed volume of gas.



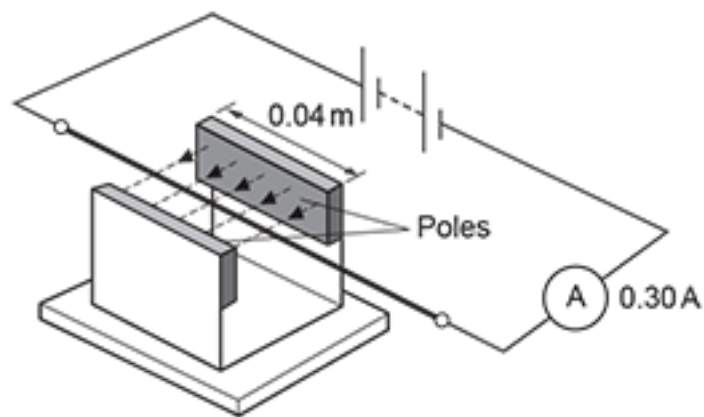
When the temperature of water increases what happens to the pressure and the speed of the gas particles?

	Pressure	Speed of gas particles
A	Decreases	Decreases
B	Decreases	Increases
C	Increases	Decreases
D	Increases	Increases

Your answer

[1]

75 A current-carrying wire is placed in a magnetic field.



The magnetic flux density between the poles is 0.08 T.

Calculate the force acting on the wire.

Use values from the diagram and an equation from the Data Sheet to help you.

- A $9.6 \times 10^{-5} \text{ N}$
- B $9.6 \times 10^{-4} \text{ N}$
- C $9.6 \times 10^{-3} \text{ N}$
- D $9.6 \times 10^{-2} \text{ N}$

Your answer

[1]

76 This is a diagram of a collision between two cars.

The cars stick together in the collision.



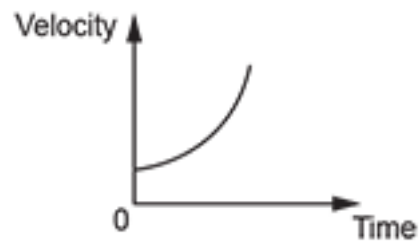
Which statement is correct?

- A The total momentum after the collision = 8 m/s.
- B The total momentum after the collision = 64 000 J.
- C The total momentum before the collision = 8 000 kg m/s.
- D The total momentum before the collision = 16 000 kg m/s.

Your answer

[1]

77 This is a velocity-time graph for an object.



Which statement describes the motion of the object?

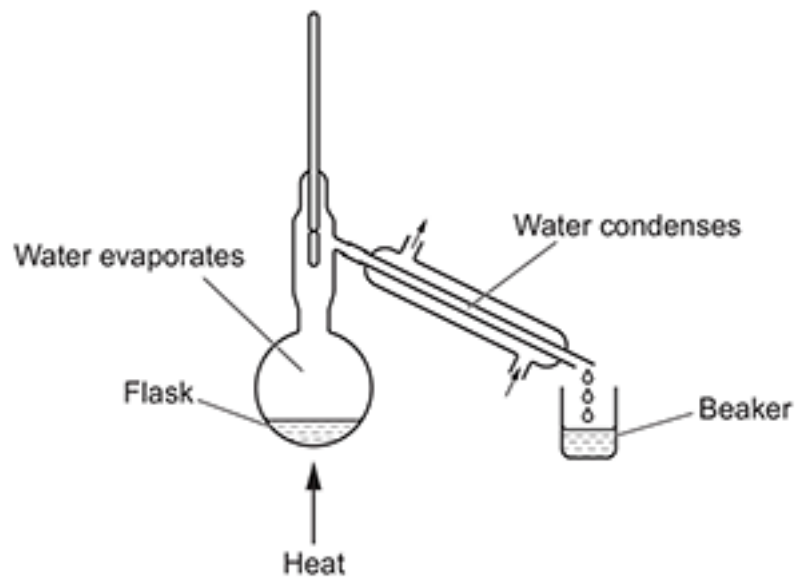
- A The object has a constant acceleration.
- B The object is accelerating at a decreasing rate.
- C The object is accelerating at an increasing rate.
- D The object is decelerating.

Your answer

[1]

78 A teacher is distilling water using the equipment shown in the diagram.

Distillation involves evaporating and condensing the water.



When the teacher starts, there is 100 g of water in the flask, and the beaker is empty.

They stop when less than half of the water in the flask has been distilled.

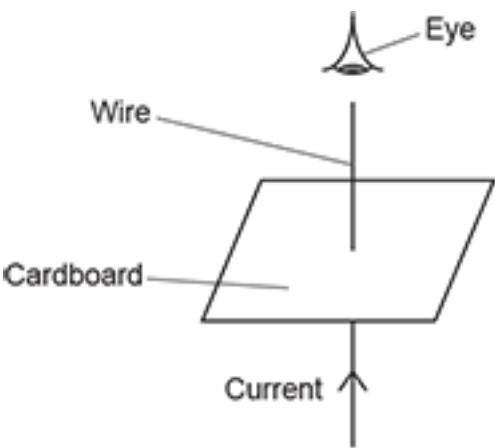
Which statement is correct?

- A Mass of water in flask + Mass of water in beaker = 100 g
- B Mass of water in flask – Mass of water in beaker = 100 g
- C Mass of water in flask = Mass of water in beaker
- D There is twice as much water in the beaker than in the flask

Your answer

[1]

79 A magnetic field is produced around a current-carrying wire.



A student views the magnetic field from above, as shown by the eye in the diagram.

Which diagram shows the magnetic field around the wire?

- A

Diagram A shows four concentric circles with a central dot. Arrows on the circles indicate a counter-clockwise direction of the magnetic field when viewed from above.
- B

Diagram B shows four concentric circles with a central dot. Arrows on the circles indicate a clockwise direction of the magnetic field when viewed from above.
- C

Diagram C shows four concentric circles with a central dot. Arrows on the circles indicate a clockwise direction of the magnetic field when viewed from above.
- D

Diagram D shows four concentric circles with a central dot. Arrows on the circles indicate a counter-clockwise direction of the magnetic field when viewed from above.

Your answer

[1]

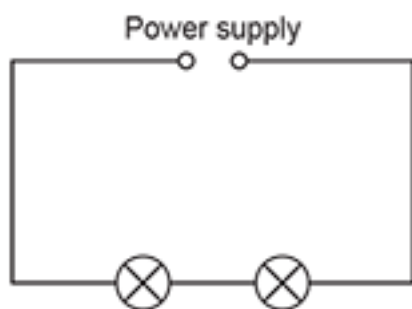
80 Which row of the table describes charge and current?

	Charge	Current
A	A property of all matter	The energy supplied per coulomb
B	A property of all matter	The rate of flow of charge
C	Resistance to current flow	The energy supplied per coulomb
D	Resistance to current flow	The rate of flow of charge

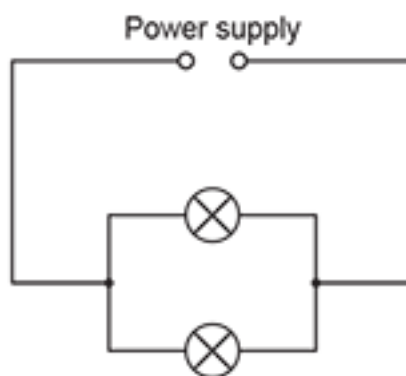
Your answer

[1]

81 Circuits X and Y contain identical lamps.



Circuit X



Circuit Y

Which statement explains why circuit X has a higher resistance than circuit Y?

- A In circuit X each lamp has the full potential difference across it.
- B In circuit X the current is the same at all points.
- C In circuit Y the current is the same at all points.
- D In circuit Y there are two pathways for current.

Your answer

[1]

82 Each planet, A–D, has the same diameter (width).

Which planet has the largest gravitational field strength?

- A  Mass = 1×10^{24} kg
- B  Mass = 2×10^{24} kg
- C  Mass = 1×10^{26} kg
- D  Mass = 2×10^{26} kg

Your answer

[1]

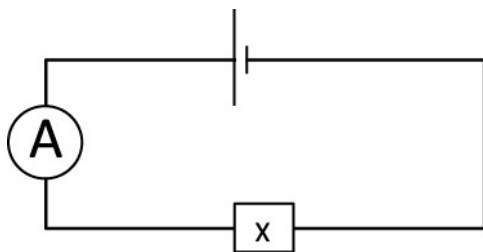
83 Which statement describes power?

- A The rate of flow of charge.
- B The rate of flow of current.
- C The rate of stretching of a spring.
- D The rate of transfer of energy.

Your answer

[1]

84 A circuit contains an unknown component X and the ammeter has a reading of 1 A.



The connections to the component are reversed and the ammeter reading changes to 0 A.

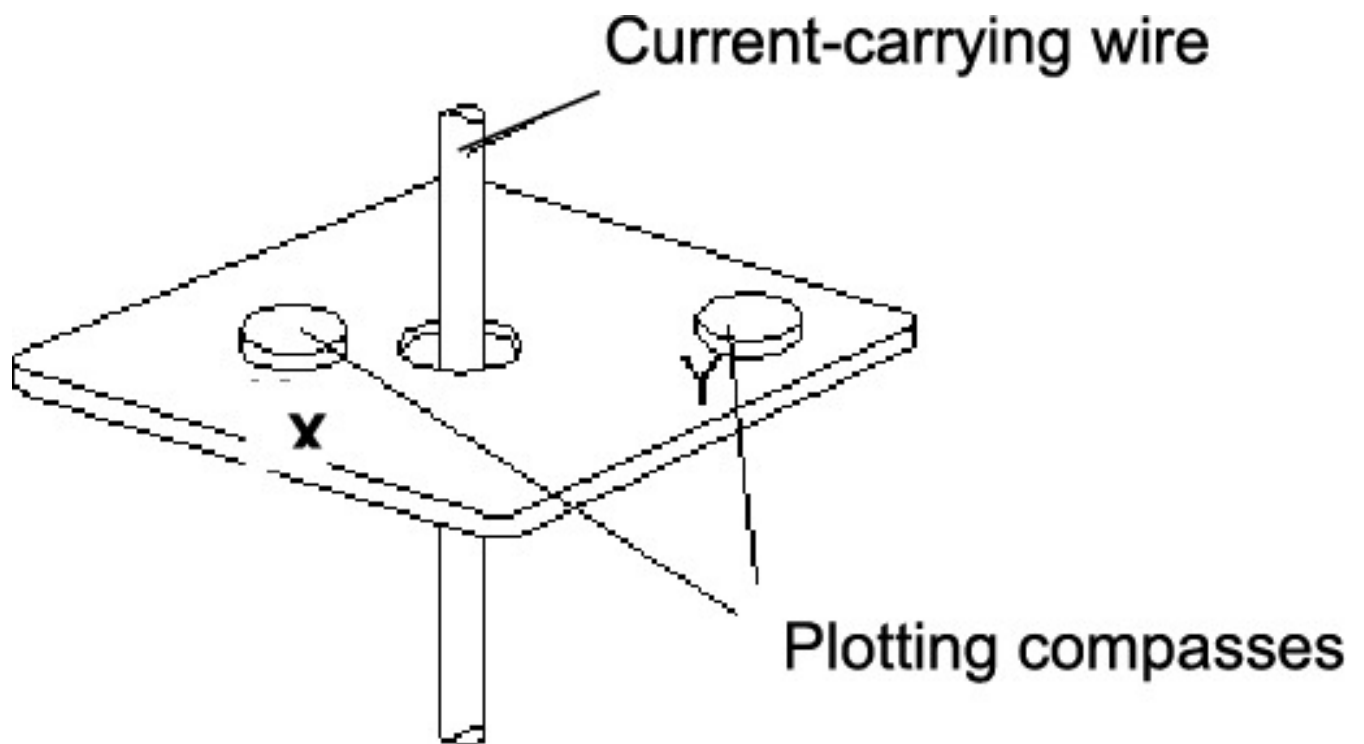
What type of component is X?

- A diode
- B light dependent resistor
- C thermistor
- D variable resistor

Your answer ☐

[1]

85 Plotting compasses are positioned at X and Y near to a current-carrying wire.



Compared to Y, the strength and direction shown on the compass, of the magnetic field at X is:

- A the same strength and direction
- B the same strength and the opposite direction
- C weaker and the opposite direction
- D weaker and the same direction

Your answer

[1]

86 The current in a $12\ \Omega$ resistor is $9.0\ \text{A}$.

How much charge flows in 2 minutes?

- A $108\ \text{C}$
- B $720\ \text{C}$
- C $1\ 080\ \text{C}$
- D $12\ 960\ \text{C}$

Your answer

[1]

87 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

88 A ball has a kinetic energy of 100 J. If the speed of the ball is doubled what will its kinetic energy be? [1]

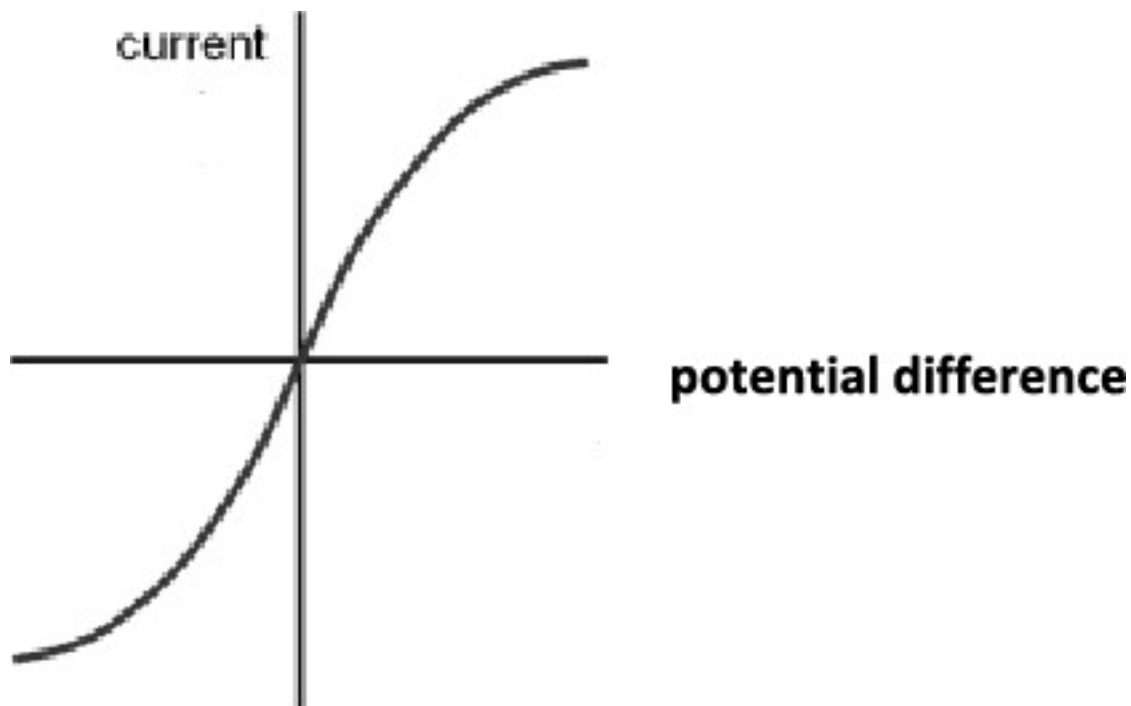
- A 25 J
- B 50 J
- C 200 J
- D 400 J

Your answer

[1]

89 The filament in a lamp heats up when electric current passes through it.

The graph shows how the current changes with potential difference for this type of lamp.



Which row has the correct statements about this type of lamp?

	resistance	current
A	decreases as temperature increases	directly proportional to potential difference
B	decreases as temperature increases	not directly proportional to potential difference
C	increases as temperature increases	directly proportional to potential difference
D	increases as temperature increases	not directly proportional to potential difference

Your answer ☐

[1]

90 Complete the sentence:

A constant resultant force acting on an object, **cannot** change the object's ...

- A acceleration
- B kinetic energy
- C momentum
- D velocity

Your answer ☐

[1]

91 Two forces act on an object in equilibrium.

Which **one** of these statements describe the forces correctly?

- A They are different in size, but have the same direction.
- B They are different in size, but have opposite directions.
- C They are equal in size, but have the same direction.
- D They are equal in size, but have opposite directions.

Your answer ☐

[1]

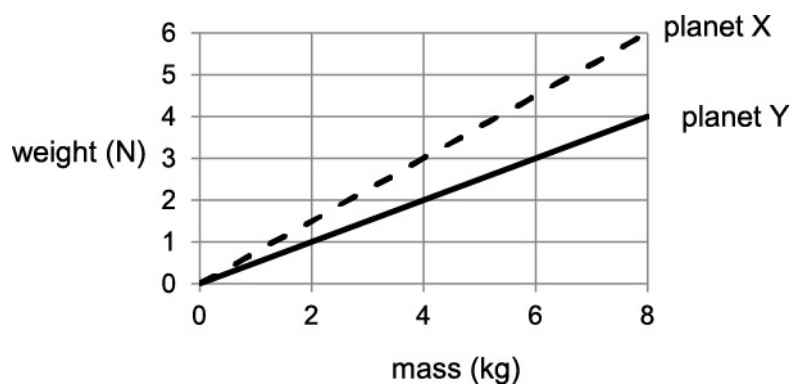
92 What is the **minimum** number of forces that are acting on a compressed spring?

- A 3
- B 2
- C 1
- D 0

Your answer ☐

[1]

93 The graph shows the relationship between mass and weight on two different planets.



The weight of an object on planet X is 3.0 N.

What is the weight of the same object on planet Y?

- A 1.5 N
- B 2.0 N
- C 4.0 N
- D 6.0 N

Your answer

[1]

94 A student lifts a box with a force of 12 N a distance of 7 m.

How much work do they do?

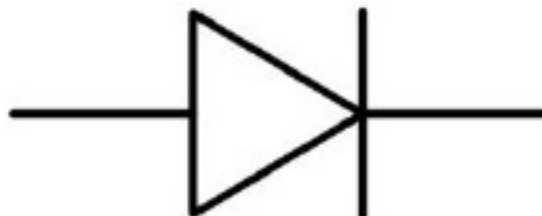
- A 1.7 J
- B 5.0 J
- C 19 J
- D 84 J

Your answer

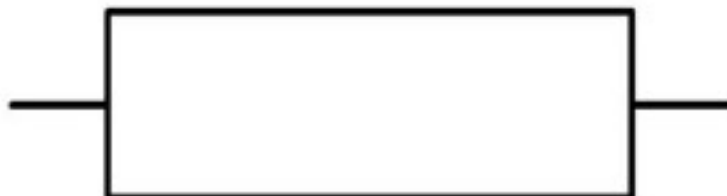
[1]

95 Which of these symbols is used to show an LDR?

A



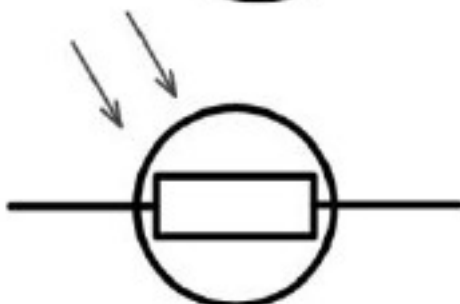
B



C



D



Your answer

☐

[1]

96 A bus takes 1.8 hours to travel 24 km.

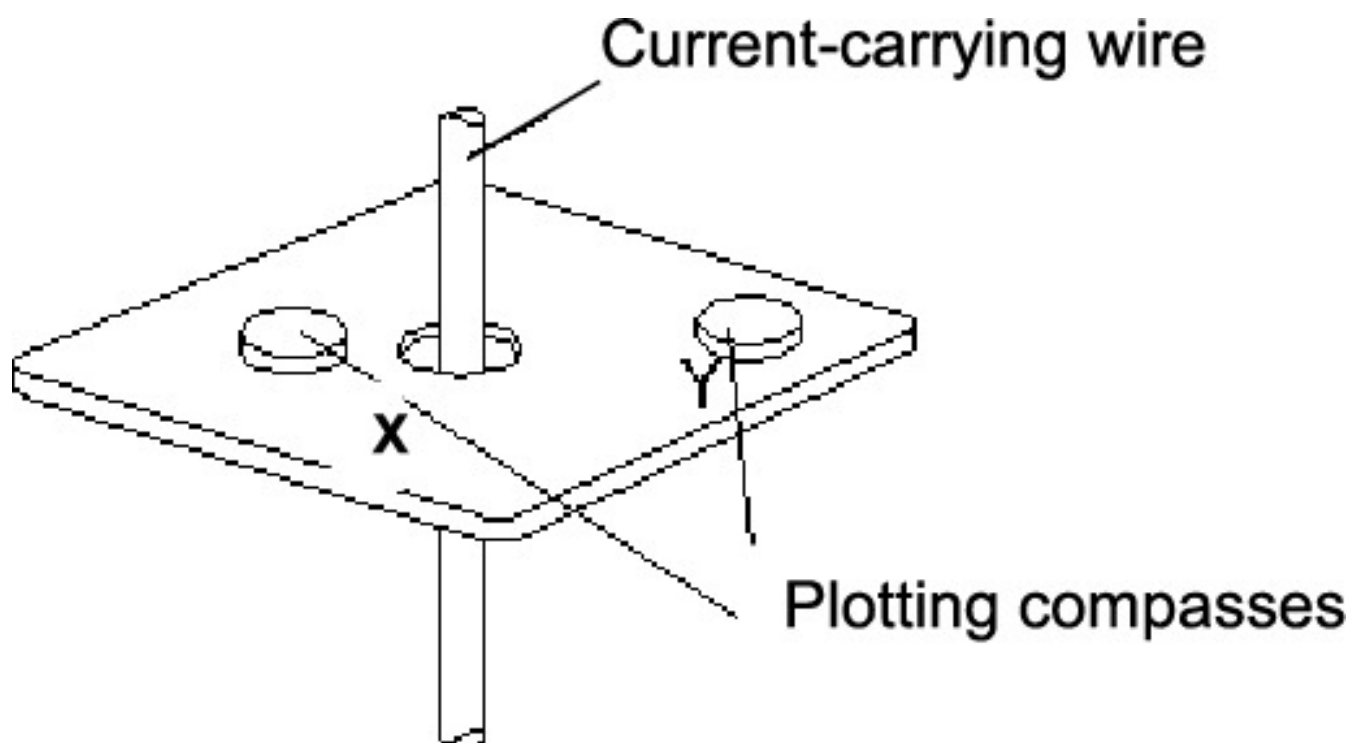
What is the average speed of the bus?

- A 43.2 km/hr
- B 25.8 km/hr
- C 22.2 km/hr
- D 13.3 km/hr

Your answer

[1]

97 Plotting compasses are positioned at X and Y near to a current-carrying wire.



Compared to Y, the strength and direction shown on the compass, of the magnetic field at X is:

- A the same strength and direction
- B the same strength and the opposite direction
- C stronger and the opposite direction
- D stronger and the same direction

Your answer ☐

[1]

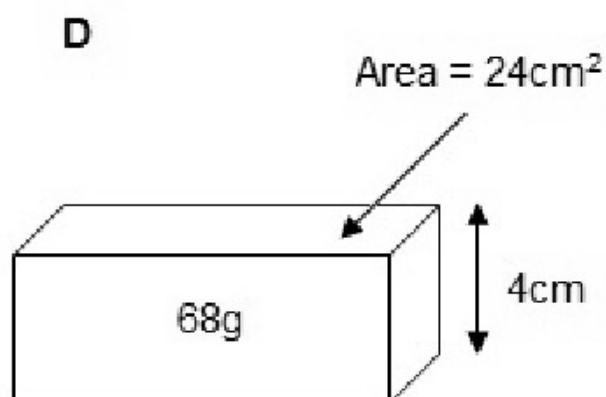
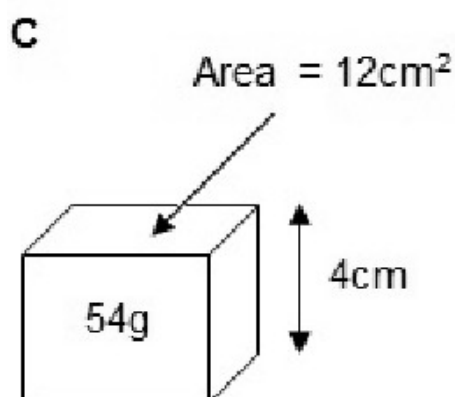
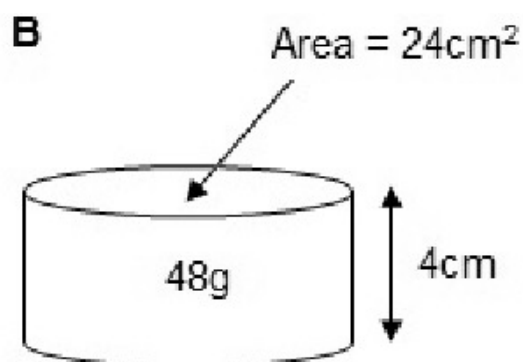
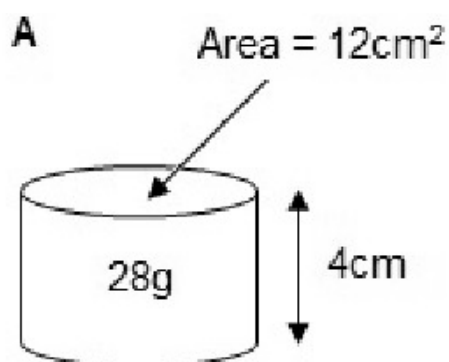
98 Which sentence about static electricity is **not** correct?

- A A charged object exerts a force of attraction or repulsion on another charged object.
- B If charges are the same on two objects they attract each other.
- C Static electricity due to friction involves the movement of electrons.
- D When a neutral object gains electrons it always becomes negatively charged.

Your answer ☐

[1]

99 Which of these solid blocks of material has the **smallest** density?



Your answer ☐

[1]

100 A sealed bottle contains gas. The bottle is heated and the pressure of the gas increases.

How do the gas particles cause this increase in pressure?

- A Their average distance apart increases.
- B They expand.
- C They hit each other more frequently.
- D They hit the can more frequently.

Your answer ☐

[1]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			D	1 (AO 2.1)	<u>Examiner's Comments</u> Few candidates selected the correct answer, option D, 25 N / m. Most candidates selected option A. These candidates showed their calculation as $0.18 = \frac{1}{2} \times SC \times (12)^2$ rather than $0.18 = \frac{1}{2} \times SC \times (0.12)^2$, so had not converted the 12 cm to 0.12m.
			Total	1	
2			B	1 (AO 1.1)	<u>Examiner's Comments</u> Most candidates recognise that vectors and scalars have magnitude but only vectors have direction, option B. A few candidates selected option D, confusing the terms magnitude and direction.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
3			C	1 (AO 1.1)	<u>Examiner's Comments</u> Few candidates selected option C, that crumple zones increase the time taken for a car to stop. The most common incorrect answer was option B, that crumple zones increase the rate of change of momentum of the car.  Misconception A significant number of candidates selected their answer as option B, that crumple zones increase the rate of change of momentum of the car. Crumple zones are areas of a car that are designed to crush in a controlled manner during a collision. Crumple zones increase the time taken to change the speed of the passengers in a crash, which reduces the force acting on the passengers.
			Total	1	
4			D	1 (AO 1.1)	<u>Examiner's Comments</u> Most candidates know the order of each scientist's contribution to the model of the atom with D being the most common answer. The most common incorrect answer was C, with the order of the contributions from Bohr and Rutherford being in the incorrect order.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
5			B	1 (AO 1.1)	<u>Examiner's Comments</u> Most candidates know that electrons are negative and move and that protons are positive and do not move, giving option B as their answer. A few candidates selected option A, knowing that electrons move but confusing the direction of movement of the electrons to make the object positively charged.
			Total	1	
6			C	1 (AO 1.1)	<u>Examiner's Comments</u> Most candidates selected option C, knowing that mass stays the same and weight changes on the Moon compared to the Earth. The most common incorrect answer was D, where candidates thought that mass and weight remain constant on the Moon compared to the Earth.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
7			B	1 (AO 1.2)	<u>Examiner's Comments</u> Few candidates selected the correct answer, B, N m and J. These candidates usually named the quantities being measured next to the units: option A, W and J being power and energy, option C, kg and N being mass and weight and option D, V and A being voltage and current, leaving option B, Nm and J as units with the same quantity.  Misconception The most common answer to this question was option A, units W and J, with many candidates labelling units W and J both as units of energy rather than W as power and J as energy.
			Total	1	
8			A	1 (AO 1.1)	<u>Examiner's Comments</u> Most candidates knew that at terminal velocity the forces are balanced and so the air resistance equals the weight of the skydiver. The most common incorrect answer was option D, where candidates thought that the air resistance is less than the weight of the skydiver at terminal velocity.
			Total	1	

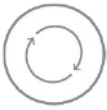
Mark Scheme

Question			Answer/Indicative content	Marks	Guidance															
9			C	1 (AO 2.1)	<u>Examiner's Comments</u> Most candidates selected the correct answer, C, understanding that air molecules move slower and the pressure decreases inside the rigid container when the temperature decreases. The most common incorrect answer was D, with these candidates appreciating that the speed of the air molecules decreases but thinking that the pressure inside the container would increase.															
			Total	1																
10			D	1 (AO 2.1)	<u>Examiner's Comments</u> Most candidates selected the correct answer, option D. Exemplar 1 Use the equation: momentum = mass × velocity <table><tr><th></th><th>Mass of car (kg)</th><th>Velocity of car (m/s)</th></tr><tr><td>A</td><td>1000</td><td>5</td></tr><tr><td>B</td><td>1000</td><td>10</td></tr><tr><td>C</td><td>2000</td><td>5</td></tr><tr><td>D</td><td>2000</td><td>10</td></tr></table> Your answer: <u>D</u> A $1000 \times 5 = 5000$ B $1000 \times 10 = 10000$ C $2000 \times 5 = 10000$ D $2000 \times 10 = 20000$ This candidate has underlined the important words in the question; 'highest momentum'. The candidate has then used the equation given in the question; momentum = mass × velocity, to calculate the momentum for options A, B, C and D. This candidate has carefully set out the complete calculations for each option. This minimises the possibility of errors and also allows the candidate to quickly recheck the calculations at the end if there is sufficient time.		Mass of car (kg)	Velocity of car (m/s)	A	1000	5	B	1000	10	C	2000	5	D	2000	10
	Mass of car (kg)	Velocity of car (m/s)																		
A	1000	5																		
B	1000	10																		
C	2000	5																		
D	2000	10																		
			Total	1																

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
11			A	1 (AO 2.1)	<u>Examiner's Comments</u> Most candidates selected option A as their answer. Many candidates calculated the difference in the size of the opposite forces and crossed out options C and D as the resultant force was 3 N compared to 6 N for options A and B. These candidates then used $F = m \times a$ to identify that A was the correct answer.
			Total	1	
12			A	1 (AO 2.1)	ALLOW 0.3 (m) <u>Examiner's Comments</u> Most candidates used the equation given in the question, to calculate the extension of the spring as 0.3m. The most common incorrect answer was B, where candidates had calculated the value as 0.3 but then thought the measurement was in mm rather than m, although the value for the spring constant was given as 20 N/ m.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
13			D	1 (AO 2.2)	<u>Examiner's Comments</u> More than half of candidates correctly identified the two instruments used to measure the density of a rectangular glass block. However, many candidates did not recognise that an instrument was needed to measure the mass as well as the volume of the object, and therefore incorrectly chose option A.  Assessment for learning Candidates could benefit from short activities, such as a card sort, where they match measuring instruments to the different quantities that they measure.
			Total	1	
14			B	1 (AO 2.1)	ALLOW 4.0 (m/s²)
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
15			B	1 (AO 2.1)	ALLOW 2.5 (m/s²) <u>Examiner's Comments</u> This question required candidates to rearrange the equation provided in order to calculate the acceleration of the object. The 'equation triangle' proved to be a very useful tool as candidates who wrote this down next to the question tended to gain credit. However, approximately half of candidates appeared to struggle with rearranging the equation and chose option A (dividing mass by force) or option D (multiplying mass by force). Exemplar 1 A 0.4m/s² B 2.5m/s² C 3.0m/s² D 10.0m/s² $\frac{F}{m \times a}$ Your answer  B The use of the 'equation triangle' has proved a useful tool in enabling the candidate to rearrange the equation correctly and choose the correct option.
			Total	1	
16			C	1 (AO 2.2)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
17			C	1 (AO 1.2)	<u>Examiner's Comments</u> The majority of candidates found this question about net resistance very challenging. Most candidates appeared to know that the net resistance of resistors in series increases as the number of resistors increases but did not recall that the net resistance of resistors in parallel decreases The most common incorrect response was the single resistor-option D.  Misconception A very common misconception was that the net resistance of resistors in parallel also increases with the number of resistors.
			Total	1	
18			D	1 (AO 1.1)	
			Total	1	
19			B	1 (AO 1.1)	<u>Examiner's Comments</u> The majority of candidates appeared to struggle to apply their knowledge of scalar quantities and vector quantities to how the information was presented in the table. Candidates who wrote down the definition of each quantity next to the question were more likely to choose the correct option.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
20			D	1 (AO 1.1)	Examiner's Comments This question about the model of the atom proved to be challenging to the majority of candidates. Some candidates were able to recall the order of the scientist's contributions by learning a mnemonic for their names, or they found it helpful to learn just the first letters of the scientist's names in order, e.g. TRB.
			Total	1	
21			B	1 (AO 1.1)	Examiner's Comments Many candidates observed that the plastic rod had more positive charges than negative charges. However, a common incorrect response of D suggests that candidates lack understanding about which particles can move.  Misconception A common misconception was that protons can be gained when an object becomes charged.
			Total	1	
22			C	1 (AO 2.1)	ALLOW 8.0 (N)
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
23			D	1 (AO 2.1)	Examiner's Comments The majority of candidates were able to correctly calculate the energy transferred by the battery as D, 48 J. These candidates tended to show all the steps for their calculation in the space beside the question. The most common incorrect response was C, 15 J. Exemplar 1 How much energy is transferred by the battery? $V = 6V$ $I = 0.4A$ $t = 20s$ Use the equations: charge flow = current $\times$ time $Q = It$ $Q = 8$ energy transferred = charge $\times$ potential difference A 0.12 J $E = QV$ 8×6 B 0.75 J C 15 J D 48 J Your answer D In this response, it was evident that the candidate had substituted the given values into the first equation and then substituted this value into the second equation. Candidates who used this method and showed steps in the two calculations like this performed well. Candidates who tried to perform the two calculations without writing anything tended to give an incorrect response.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
24			A	1 (AO 1.1)	<u>Examiner's Comments</u> The majority of candidates gave the correct response A, electrons are in stable shells. The most common incorrect response was response B, electrons orbit a nucleus.
			Total	1	
25			B	1 (AO 1.1)	<u>Examiner's Comments</u> This question was well answered with the majority of candidates recognising that B, the particles are moving faster in room H, was the correct response. The most common incorrect response was A, the particles are moving at the same speed in both rooms.
			Total	1	
26			B	1 (AO 1.2)	<u>Examiner's Comments</u> The majority of candidates gave the correct response B, the circuit with an ammeter in series and a voltmeter connected across the fixed resistor. The most common incorrect response was response C, the circuit with an ammeter correctly in series but with the voltmeter connected across the variable resistor.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance															
27			C	1 (AO 2.1)	<u>Examiner's Comments</u> The majority of candidates correctly selected option C, mass of 1.0 kg and volume of 1.5 cm³. Candidates often calculated each density to determine the substance with the highest density. Exemplar 1 <table><tr><th>Substance</th><th>Mass (kg)</th><th>Volume (cm³)</th></tr><tr><td>A</td><td>0.5</td><td>1.5</td></tr><tr><td>B</td><td>0.5</td><td>3.0</td></tr><tr><td>C</td><td>1.0</td><td>1.5</td></tr><tr><td>D</td><td>1.0</td><td>3.0</td></tr></table> Your answer C This response shows a candidate who has calculated the density for each of the substances, A, B, C and D. The candidate has written the answers at the end of each row so that it is easy to determine the substance with the highest density. Other candidates calculated each value in the space next to the question but because they did not then label each calculation carefully, they sometimes chose the incorrect substance.	Substance	Mass (kg)	Volume (cm ³)	A	0.5	1.5	B	0.5	3.0	C	1.0	1.5	D	1.0	3.0
Substance	Mass (kg)	Volume (cm ³)																		
A	0.5	1.5																		
B	0.5	3.0																		
C	1.0	1.5																		
D	1.0	3.0																		
			Total	1																
28			D	1 (AO 1.1)	<u>Examiner's Comments</u> This question was well answered with the majority of candidates recognising that D, both magnets produce a force on the other magnet, was the correct response. The most common incorrect response was A, the magnets did not produce a forces on each other.															
			Total	1																

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
29			B	1 (AO 1.1)	<u>Examiner's Comments</u> The majority of candidates selected option B. Region 1 is linear extension and elastic deformation below the limit of proportionality. Region 2 shows significant extension beyond the limit of proportionality, associated with plastic deformation..
			Total	1	
30			A	1 (AO 1.1)	<u>Examiner's Comments</u> A large majority of candidates selected option A, the direction of the car is changing, as the reason why the car is accelerating. The most common incorrect response was B, the forces on the car are balanced.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
31			A	1 (AO 2.1)	<u>Examiner's Comments</u> More successful candidates were able to work out that the total displacement is 500 m, option A. These candidates tended to draw on the diagram or draw a separate diagram with a line and arrow for 300 m, a line and arrow for 400 m and then the displacement line and arrow from the start to the end of the journey. Many of these diagrams were drawn to scale as a double check. The most common incorrect response was B, the total displacement is 700 m followed by C, the total distance travelled is 500 m.  Misconception Some candidates find it difficult to distinguish between distance travelled (a scalar quantity) and displacement (a vector quantity). In this question, the candidates are asked which statement is correct, with the statements containing two options about displacement and two options about distance. Many candidates gave the answer as the total displacement being 700 m, when this is actually the total distance travelled.
			Total	1	

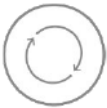
Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
32			C	1 (AO 1.1)	<u>Examiner's Comments</u> Most candidates gave the incorrect response to this question, option B and 12 N, rather than the correct answer of option C and 13 N.  Assessment for learning Candidates need to read the question carefully and look at all the information on the diagram. This question asks candidates to give the resultant force on the object. The majority of candidates only looked at the 2 N force to the left and the 14 N force to the right on the diagram to deduce the resultant force. These candidates did not consider the 5 N vertical force. All the forces must be considered on a force diagram.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
33			B	1 (AO 1.2)	<u>Examiner's Comments</u> The majority of candidates gave the correct response, B, to explain how a simple d.c. motor works. The most common incorrect response was response C, where the forces were reversed.  Misconception Many candidates found it difficult to use Fleming's left-hand rule. They appear to have either used their right hand, confused the direction of the magnetic field, or they confused the directions that the fingers and thumb represent. The forefinger is lined up with the magnetic field lines pointing from north to south, the second finger is lined up with the arrow shown from the current direction in the diagram, and the thumb then shows the direction of the motor effect force on the wire carrying the current.
			Total	1	
34			D	1 (AO 2.1)	ALLOW 6240 J <u>Examiner's Comments</u> Most candidates correctly answered this question.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
35			C	1 (AO 2.1)	ALLOW 120 W Examiner's Comments Most candidates correctly answered this question.
			Total	1	
36			A	1 (AO 1.1)	Examiner's Comments The majority of candidates were able to identify the correct motion of the spaceship, with most incorrect responses choosing option C.  Assessment for learning Candidates could benefit from practising describing the motion of objects with different balanced or unbalanced forces acting on them.
			Total	1	
37			D	1 (AO 1.1)	Examiner's Comments The majority of candidates found this question challenging and were not given the mark  Misconception The most common misconception in responses to this question was that vectors have direction but not size.
			Total	1	

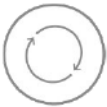
Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
38			D	1 (AO 1.2)	<u>Examiner's Comments</u> Almost all candidates identified that the voltmeter in option D shows a reading of 0.5V.
			Total	1	
39			B	1 (AO 1.1)	<u>Examiner's Comments</u> The majority of candidates successfully applied their knowledge of magnetic fields to identify that the field is weakest at point B.
			Total	1	

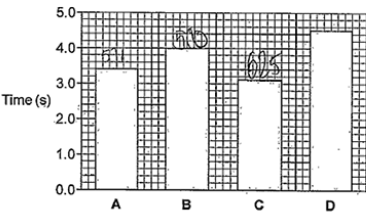
Mark Scheme

Question			Answer/Indicative content	Marks	Guidance																				
40			A	1 (AO 2.1)	Examiner's Comments This question required candidates to either use an equation from the Equation Sheet to calculate the density of each substance, or to recognise that the substance with the smallest volume will have the highest density, as the mass of each substance is the same. Almost half of the candidates answered this correctly, usually by calculating and comparing the density of each substance. A common error was to choose option D, as some candidates thought that 0.16 is greater than 0.6. Exemplar 1 <table><tr><th>Substance</th><th>Mass (kg)</th><th>Volume (cm³)</th><th>Density</th></tr><tr><td>A</td><td>1.0</td><td>1.5</td><td>$\frac{1.0}{1.5} = 0.6$</td></tr><tr><td>B</td><td>1.0</td><td>3.0</td><td>$\frac{1.0}{3.0} = 0.3$</td></tr><tr><td>C</td><td>1.0</td><td>4.5</td><td>$\frac{1.0}{4.5} = 0.2$</td></tr><tr><td>D</td><td>1.0</td><td>6.0</td><td>$\frac{1.0}{6.0} = 0.16$</td></tr></table> Your answer A [1] The candidate in Exemplar 1 has used the equation to calculate and write down the density of each substance in order to determine which substance has the highest density.	Substance	Mass (kg)	Volume (cm ³)	Density	A	1.0	1.5	$\frac{1.0}{1.5} = 0.6$	B	1.0	3.0	$\frac{1.0}{3.0} = 0.3$	C	1.0	4.5	$\frac{1.0}{4.5} = 0.2$	D	1.0	6.0	$\frac{1.0}{6.0} = 0.16$
Substance	Mass (kg)	Volume (cm ³)	Density																						
A	1.0	1.5	$\frac{1.0}{1.5} = 0.6$																						
B	1.0	3.0	$\frac{1.0}{3.0} = 0.3$																						
C	1.0	4.5	$\frac{1.0}{4.5} = 0.2$																						
D	1.0	6.0	$\frac{1.0}{6.0} = 0.16$																						
			Total	1																					
41			C	1 (AO 1.1)	Examiner's Comments The majority of candidates were unable to identify that almost all of the mass of an atom is made up by the nucleus.																				
			Total	1																					

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
42			B	1 (AO 2.1)	<u>Examiner's Comments</u> Almost all candidates were able to substitute the values into the equation provided to work out that the weight of the astronaut is 128N.
			Total	1	
43			D	1 (AO 2.1)	<u>Examiner's Comments</u> This question required candidates to rearrange the equation provided to calculate the spring constant. Approximately half of candidates were able to do this correctly, with the majority of candidates who used the 'equation triangle' to rearrange the equation correctly gaining the mark.  Assessment for learning Candidates could benefit from a short starter or plenary activity where they have to change the subject of both familiar and unfamiliar equations.
			Total	1	
44			A	1 (AO 1.1)	<u>Examiner's Comments</u> The majority of candidates found this question challenging and were not given the mark. The most common error in the responses to this question was that Niels Bohr was the scientist who suggested that electrons orbit a nucleus (option B).
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
45			B	1 (AO 1.1)	Examiner's Comments The majority of responses correctly identified that particles are moving faster in room H.
			Total	1	
46			C ✓	1 (AO 2.2)	Examiner's Comments Most candidates were able to interpret the bar chart and link the highest power to the weightlifter who took the least amount of time. Many successful candidates wrote down their workings and/or an equation to calculate the power of each weightlifter. Exemplar 1  Which weightlifter has the highest power? Use the Data Sheet. Your answer C Exemplar 1 shows how the candidate used the equation triangle to calculate the power of each weightlifter.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
47			B ✓	1 (AO 1.1)	<u>Examiner's Comments</u> The majority of candidates successfully applied their knowledge of magnetic fields to identify that only option B was the only correct statement.
			Total	1	
48			C ✓	1 (AO 1.2)	<u>Examiner's Comments</u> This question assessed candidates' knowledge of significant figures. Nearly one half of candidates did not know that three significant figures were being used and the most common incorrect answer was option A.  Assessment for learning Candidates could benefit from short starter or plenary activities where they practise identifying the number of significant figures in a number or write numbers to a given number of significant figures.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
49			C ✓	1 (AO 1.1)	<u>Examiner's Comments</u> Some candidates were unable to correctly identify that the graph was for an LDR.(P3.2h)  Assessment for learning Candidates could benefit from a short activity such as a card sort where they match components with their I-V characteristic graphs.
			Total	1	
50			D ✓	1 (AO 2.1)	<u>Examiner's Comments</u> Almost all candidates were able to substitute the values into the equation provided to work out that the energy transferred was 240 J.
			Total	1	
51			B ✓	1 (AO 1.1)	<u>Examiner's Comments</u> Most candidates were able to identify that friction is a contact force.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
52			A ✓	1 (AO 2.1)	<u>Examiner's Comments</u> This question required candidates to work out the change in the velocity of the bicycle and then substitute that number and the time given into the equation provided to calculate the acceleration. Most candidates were able to do this correctly, but the most common error observed involved using the equation upside down and dividing the time by the change in velocity.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
53			C ✓	1 (AO 1.1)	<u>Examiner's Comments</u> The question required candidates to apply their knowledge of Newton's third law to identify the correct pair of forces as option C. Just over half of candidates were able identify the correct pair but the most common error observed involved candidates confusing forces acting in interaction pairs with forces on a free-body diagram and therefore choosing option D.  Misconception Candidates are confusing Newton's third law forces with free-body diagram forces. Newton's third law involves pairs of forces interacting and each force acts on a different object. Free-body diagrams involve forces acting on a single object.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
54			A ✓	1 (AO 2.1)	<u>Examiner's Comments</u> Around two thirds of candidates were unable to correctly identify the resultant force and motion for the toy car. Many candidates recognised that the car was accelerating but thought that the resultant force was 3 N and therefore chose option C.  Assessment for learning Candidates could benefit from practising describing the motion of objects with different balanced or unbalanced forces acting on them.
			Total	1	
55			D ✓	1 (AO 1.1)	<u>Examiner's Comments</u> The majority of candidates found this question challenging and did not gain credit. The most common incorrect answer was option B as candidates thought that there would be no positive charges remaining at the top of the paper.  Misconception The most common misconception was that positive charges in the piece of paper which are repelled by the rod must therefore move further away from the rod.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
56			A ✓	1 (AO2.1)	<u>Examiner's Comments</u> Very few candidates scored this mark. Answer B was generally seen where the candidate simply substituted into the given equation without taking the echo into account and halving the time.
			Total	1	
57			D ✓	1 (AO2.1)	<u>Examiner's Comments</u> This question was well answered with A the most common incorrect answer.
			Total	1	
58			D ✓	1 (AO 1.1)	<u>Examiner's Comments</u> The majority of candidates selected response B or A, rather than the correct response D.
			Total	1	
59			C ✓	1 (AO 1.1)	<u>Examiner's Comments</u> Most candidates were able to identify the direction of the magnetic field as being N to S, however, a few were unable to identify the type of magnetic pole near the Earth's geographic north pole as S. Therefore, the most common error was to select response A rather than the correct response C.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
60			D ✓	1 (AO 1.1)	<u>Examiner's Comments</u> This question was well answered with the majority of candidates recognising that D, outside on a warm day, was the correct response. The most common incorrect response was A, in a refrigerator.
			Total	1	
61			C ✓	1 (AO 2.1)	<u>Examiner's Comments</u> Half the candidates gave the correct response C, 27 mJ. The most common incorrect response was response A, 0.027 mJ.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
62			B ✓	1 (AO 2.1)	<u>Examiner's Comments</u> The majority of candidates selected option B, 125 W, having carefully read in the question that 3000 J was the total work done by the student. Exemplar 1 Calculate the power of the student. Use the equation: $\text{power} = \frac{\text{work done}}{\text{time}}$ A 6.25W B 125W C 2500W D 3600W Your answer B [1] This response shows a candidate who highlighted the important information in a question by underlining it, and, where appropriate, clearly showed the individual steps in a calculation performed well. The candidate has used the equation given, power = $\frac{\text{work done}}{\text{time}}$
			Total	1	
63			C ✓	1 (AO 2.1)	<u>Examiner's Comments</u> The majority of candidates selected option C, points Q and S on the graph. These candidates often gave all the calculations, $P = 6/4$, $Q = 2/4$, $R = 4/6$ and $S = 4/8$ before coming to the response that the density for Q and S are both 0.5 g/cm^3.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
64			D ✓	1 (AO 2.2)	Erratum Notice Turn to page 6 of the question paper and look at question 8. In line 6 cross out 'Use the Data Sheet'. <u>Examiner's Comments</u> The majority of candidates selected the response D, 48 N/kg, with many of these candidates showing their workings in the space beside the question. The most common incorrect response was B, 3 N/kg.
			Total	1	
65			D ✓	1 (AO 1.1)	<u>Examiner's Comments</u> Half the candidates gave the correct response D, the toy train is changing direction. The most common incorrect response was response C, friction is acting between the track and the toy train.  Misconception Many candidates find it difficult to distinguish between speed and velocity. In this question the candidates are told that the speed of the toy train is 2 cm/s and are asked why the velocity is changing as it moves around the circular track in the diagram. Many candidates think that velocity can only change if the toy train slows down due the friction acting between the track and the toy train.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
66			B ✓	1 (AO 1.1)	<u>Examiner's Comments</u> The majority of candidates selected the response B, 5 N, with many of these candidates drawing both the vertical and horizontal components on the grid.
			Total	1	
67			A ✓	1 (AO 2.1)	<u>Examiner's Comments</u> Most candidates were able to identify the resultant force as being 2N but found it harder to identify the motion being acceleration rather than constant speed. Therefore, the most common error was to select response B rather than the correct response A.
			Total	1	
68			A ✓	1 (AO 2.1)	<u>Examiner's Comments</u> The majority of candidates selected option A, 62.5 W, having carefully read the question and used the values of current as 0.25A and resistance of 1000Ω in the equation given to obtain the correct response.
			Total	1	
69			C	1(AO2.1)	
			Total	1	
70			B	1(AO2.1)	
			Total	1	
71			D	1(AO2.1)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
72			A✓	1(AO1.2)	
			Total	1	
73			C✓	1(AO1.1)	
			Total	1	
74			D✓	1(AO2.2)	
			Total	1	
75			B✓	1(AO2.1)	
			Total	1	
76			D✓	1(AO2.1)	
			Total	1	
77			C✓	1(AO1.2)	
			Total	1	
78			A✓	1(AO1.1)	
			Total	1	
79			B✓	1(AO1.2)	
			Total	1	
80			B✓	1(AO1.1)	
			Total	1	
81			D✓	1(AO2.2)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
82			D ✓	1 (AO1.1)	
			Total	1	
83			D ✓	1 (AO1.1)	
			Total	1	
84			A	1	
			Total	1	
85			C	1	
			Total	1	
86			C	1	
			Total	1	
87			B	1	
			Total	1	
88			D	1	
			Total	1	
89			D	1	
			Total	1	
90			A	1	
			Total	1	
91			D	1	
			Total	1	
92			B	1	
			Total	1	
93			B	1	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
94			D	1	
			Total	1	
95			D	1	
			Total	1	
96			D	1	
			Total	1	
97			C	1	
			Total	1	
98			B	1	
			Total	1	
99			B	1	
			Total	1	
100			D	1	
			Total	1	