Newton's Law (F)

1. 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]**

2. 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]**

3. 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]**

4. 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]**

5. Four cars of the same mass are shown here.

A

B

C

D

Which car will accelerate?

Your answer ☐ **[1]**

6. 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]

7. 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]

8(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.

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[2]

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

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[1]

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

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[2]

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

How much power do they use?

Show your working.

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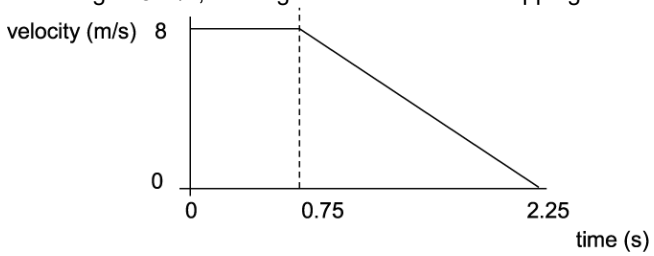
answer: ..... W **[4]**

9. 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.

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answer: ……unit…… **[4]**

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

Calculate the work done by the brakes on the car.

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answer: …… J **[2]**

10. 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]**

11(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]**

(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]**

12. 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]**

13. 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.

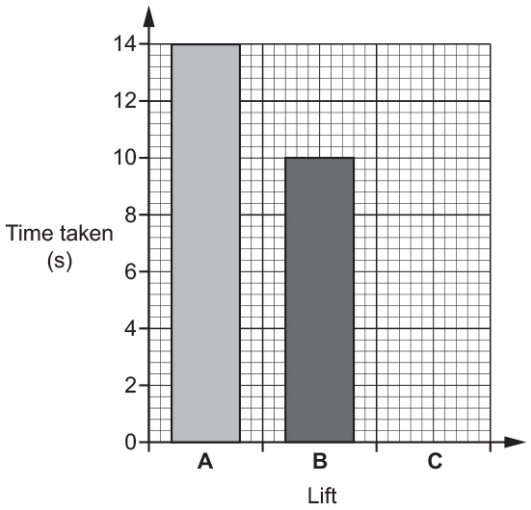
Answer = _____ kg **[2]**

14(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]

(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]**

15(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