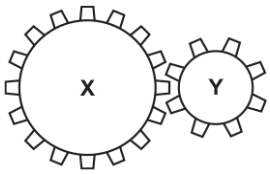
Forces in Action (F)

1. What is the gravitational field strength at the Earth's surface?

A 10 N/kg
B 16 N/kg
C 50 N/kg
D 230 N/kg

Your answer ☐ **[1]**

2. Cog **X** has 16 teeth and cog **Y** has 8 teeth.



Cog **X** is turned around **two** times.

How many times does cog **Y** turn around?

A 1
B 2
C 4
D 8

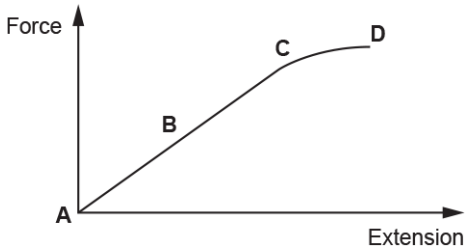
Your answer ☐ **[1]**

3. What is the **smallest** number of forces needed to bend an object?

A 1
B 2
C 3
D 4

Your answer ☐ **[1]**

4. The diagram shows the relationship between force and extension for a spring.



Which letter on the graph shows the **elastic limit** of the spring being stretched?

Your answer ☐ **[1]**

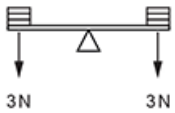
5. In which situation does the force cause a rotation?

A Bouncing on a trampoline
B Hitting a nail with a hammer
C Pushing a friend on a swing
D Sitting on a chair

Your answer ☐ **[1]**

6. A student puts different weights on four balances.

A



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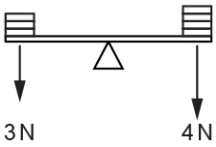

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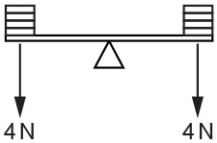
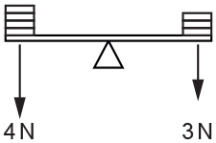


D



Which balance will give a **clockwise** moment?

Your answer ☐ **[1]**

7. On Mars the gravitational field strength is 4.0 N / kg.

How much would a 60 kg person weigh on Mars?

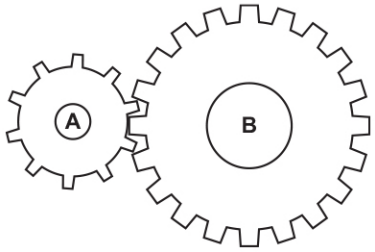
Use the equation: weight = mass × gravitational field strength

A 15 N
B 64 N
C 240 N
D 600 N

Your answer ☐ **[1]**

8. A student sets up two cogs.

Cog **A** has 10 teeth and cog **B** has 20 teeth.



Cog **A** is turned **2** times.

How many times does cog **B** turn?

A 0.5 times
B 1 time
C 2 times
D 20 times

Your answer ☐ **[1]**

9. Which one of the following uses of forces causes a rotation?

A Lowering a book vertically from a shelf
B Opening a door
C Lifting a book vertically onto a shelf
D Sitting in the centre of a see-saw

Your answer ☐ **[1]**

10. A boy of mass 65 kg climbs a ladder of height 3.0 m.

Calculate the gain in potential energy of the boy.

Use the equation: potential energy = mass × height × gravitational field strength

Gravitational field strength = 10 N / kg.

A 30 J
B 195 J
C 650 J
D 1950 J

Your answer ☐ **[1]**

11. A skydiver falls from a plane.

What is the name of the **downward** force in the diagram?

A Drag
B Electrostatic
C Mass
D Weight

Your answer ☐ **[1]**

12. On the Moon the gravitational field strength is 1.6 N / kg.

Calculate the gravity force for an 80 kg astronaut.

Use the equation: gravity force = mass × gravitational field strength

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

Your answer ☐ **[1]**

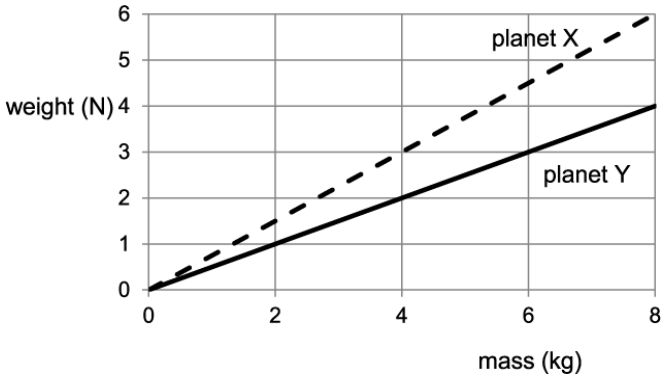
13. A student measures the weight of four boxes and the area in contact with the ground.

Box	Weight (N)	Area (cm^2)
A	50	100
B	75	250
C	90	400
D	100	500

Which box exerts the greatest pressure on the ground?

Your answer ☐ **[1]**

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



The weight of an object on planet **X** is 3 N.

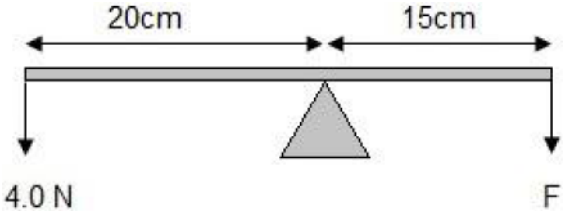
What is the weight of the same object on planet **Y**?

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

Your answer ☐

[1]

15. A see-saw is in equilibrium.



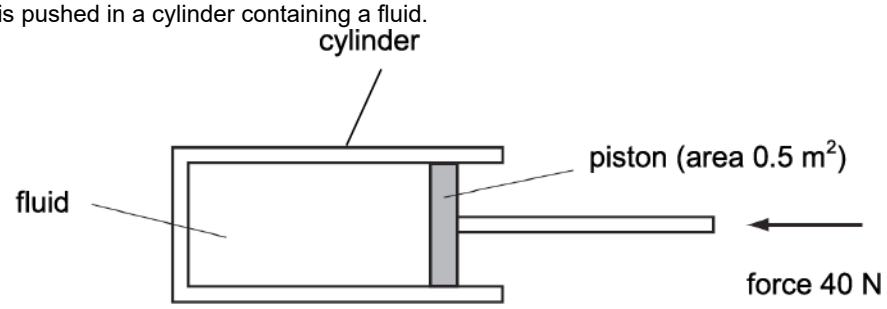
What force is needed for the see-saw to be in equilibrium?

A. 3.0 N
B. 3.5 N
C. 5.0 N
D. 5.3 N

Your answer ☐

[1]

16. A piston is pushed in a cylinder containing a fluid.



If **pressure = force ÷ area**, what is the pressure exerted on the fluid?

A. 20 Pa
B. 80 Pa
C. 160 Pa
D. 200 Pa

Your answer ☐

[1]

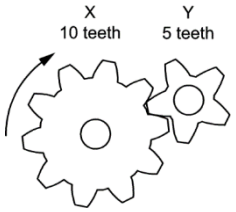
17. What is the **minimum** number of forces that are required to compress a spring?

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

Your answer ☐

[1]

18. The diagram shows 2 gears.



Gear **X** is rotated clockwise at 1.0 rotation per second.

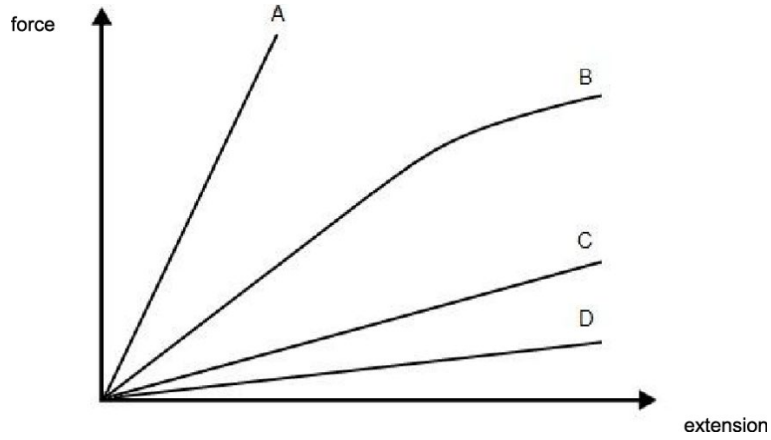
Which row is the correct description of the movement of gear **Y**?

	direction of rotation	**rotations per second**
A	anticlockwise	0.5
B	anticlockwise	2.0
C	clockwise	0.5
D	clockwise	2.0

Your answer ☐

[1]

19 (a). The extension of four different springs is shown in the graph.



Explain which of the springs **A**, **B**, **C** or **D** has the highest spring constant?

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[2]

(b). Explain why the line for spring **B** has a different shape to the others.

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[2]

(c).

i. A spring has a spring constant of 27 N/m.

For an extension of 25 cm, calculate the energy transferred in stretching.

Use the formula: **energy transferred = 0.5 × spring constant × extension^2**.

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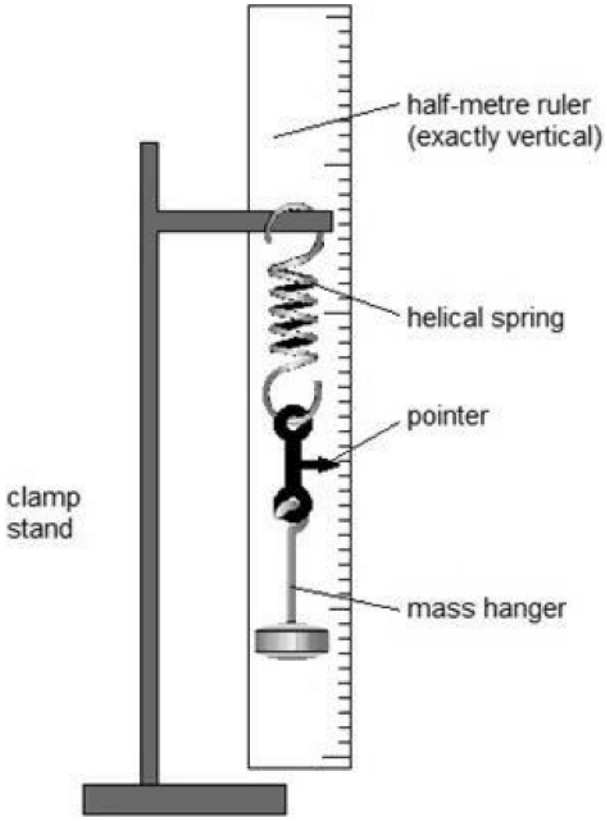
answer: ..... J **[2]**

ii. A student set up the apparatus shown in the diagram.



Describe how they could use this apparatus to collect data to draw a force / extension graph for this spring.

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[4]

iii. The above spring has a spring constant of 30 N/m, this is replaced by a spring with a spring constant of 10 N/m.
What changes will the student have to make to this method to investigate this spring?

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[2]

20. A boy kicks a football.

The football has a mass of 400 g.

What is the potential energy of the football when it is 0.8 m above the ground?

Use the constant: gravitational field strength (g) = 10 N/kg.

A. 0.032 J
B. 3.2 J
C. 320 J
D. 3 200 J

Your answer ☐

[1]

21 (a). A rocket carrying a vehicle called the Mars Rover was sent to Mars.

The Mars Rover has a mass of 185 kg.

The gravitational field strength (g) on Mars is 3.75 N/kg.

Calculate the weight of the Rover vehicle on Mars.

Show your working and give your answer to 3 significant figures.

State the unit for weight.

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answer: …… unit…… [5]

(b). Why did the Mars Rover weigh more on Earth than on Mars?

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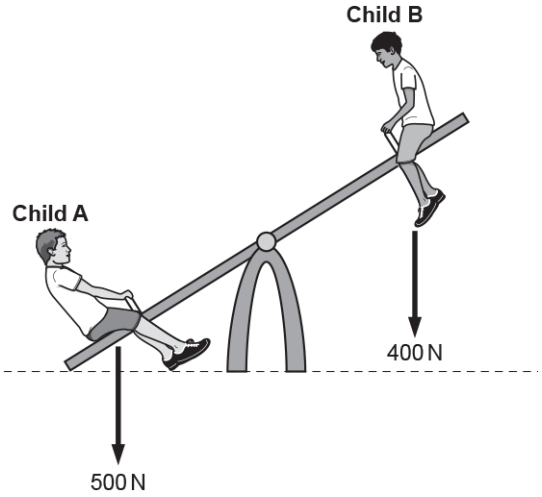
[1]

22(a). Two children play on a seesaw.



Both children sit **2 m** from the pivot.

i. Calculate the clockwise and anti-clockwise moments around the pivot when the seesaw is horizontal.

Clockwise moment = ... Nm

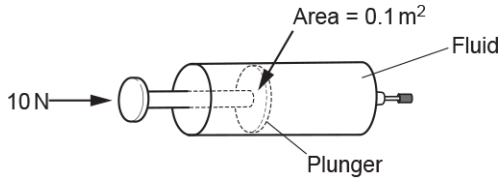
Anti-clockwise moment = ... Nm

[3]

ii. Calculate where **Child A** should sit to balance the seesaw.

Answer = ... **[3]**

(b). A student tries to compress the fluid in a sealed syringe with a force of 10 N.



The area of the end of the syringe is 0.1 m^2.

i. Calculate the pressure in the fluid.

Answer = ... Pa **[3]**

ii. Write down the direction of the force produced by the fluid on the plunger.

_____ **[1]**

23(a).

A car has a total weight of 12 000 N. It has four tyres which each have an area of 25 cm^2 in contact with the road.

Calculate the pressure of the car on the road.

Answer = _____ N/cm^2 **[3]**

(b). Seatbelts in cars are made of a wide material that stretches in a crash.

i. Explain why it is important that the material is **wide.**

_____

_____ **[1]**

ii. Explain why it is important that the material is **stretchy.**

_____

_____ **[1]**

(c). Children in cars use special seats with their own seatbelts.

The seatbelts for children are narrower than adult seatbelts.

Why is it safe for children's seatbelts to be **narrower** than adult seatbelts?

_____

_____

_____ **[2]**

24 (a). The 2.0 N weight has a surface area of 0.005 m^2.

Calculate the **pressure** when it is placed on a surface.

Use the equation: pressure = force normal to a surface ÷ area of that surface

Pressure = ... Pa **[2]**

(b). A student has a spring, a ruler and a 2.0 N weight.

Describe how the student can use this equipment to determine the **spring constant** of the spring.

_____

_____

_____

_____

_____ **[3]**

(c). Describe how to change the shape of an object.

Use the idea of forces in your answer.

_____

_____

_____

_____ **[2]**

(d). Describe the differences between elastic and plastic deformation.

_____

_____

_____

_____ **[2]**

25 (a). A student investigates how a spring stretches.

She measures the original length of the spring, adds a 2.0 N weight, and then measures the extended length of the spring.

Look at her data in the table.

Force used	2.0 N
Original length	3.0 cm
Extended length	7.0 cm
Extension	4.0 cm

i. Calculate the spring constant for the spring.

Use the equation: force = spring constant × extension

Spring constant = ... N / cm **[3]**

ii. Suggest **two** ways that the student could improve and develop their method to find the spring constant.

_____

_____

_____ **[2]**

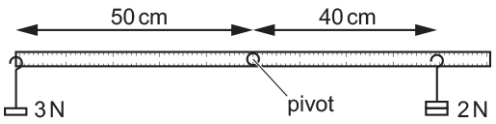
(b). The spring constant of a different spring is 40 N / m.

Calculate the energy stored in the spring when it is stretched 0.20 m.

Use an equation from the data sheet to help you.

Energy stored = ... J **[4]**

(c). The diagram shows an experiment a student set up to study moments.



The student:
- holds the metre rule so that it is horizontal
- adds weights to the metre rule at different distances from the pivot.

i. Calculate the moments of the 2 N weight and the 3 N weight about the pivot.

Use the equation: moment = force × distance from pivot

Moment of 2 N weight = ... N cm

Moment of 3 N weight = ... N cm **[2]**

ii. Which way will the metre rule rotate when it is released by the student?

_____ **[1]**

END OF QUESTION PAPER