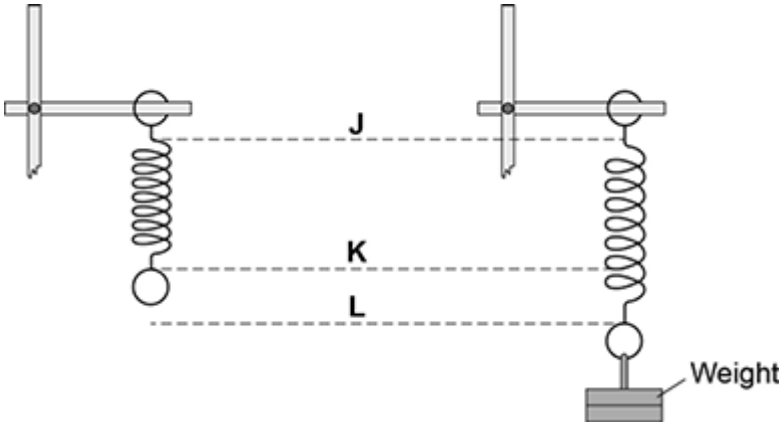
**Q1.** A student suspended a spring from a laboratory stand and then hung a weight from the spring.

**Figure 1** shows the spring before and after the weight is added.

**Figure 1**




(a) Which distance gives the extension of the spring?

Tick **one** box.

from **J** to **K** ☐

from **K** to **L** ☐

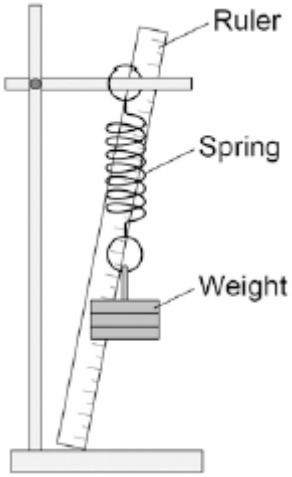
from **J** to **L** ☐

**(1)**

(b) The student used the spring, a set of weights and a ruler to investigate how the extension of the spring depended on the weight hanging from the spring.

**Figure 2** shows that the ruler is in a tilted position and not upright as it should be.

**Figure 2**




How would leaving the ruler tilted affect the weight and extension data to be recorded by the student?

Use answers from the box to complete each sentence.

Each answer may be used once, more than once or not at all.

| **greater than** | **the same as** | **smaller than** |
|---|---|---|

The weight recorded by the student would be ..... the actual weight.

The extension recorded by the student would be ..... the actual weight.

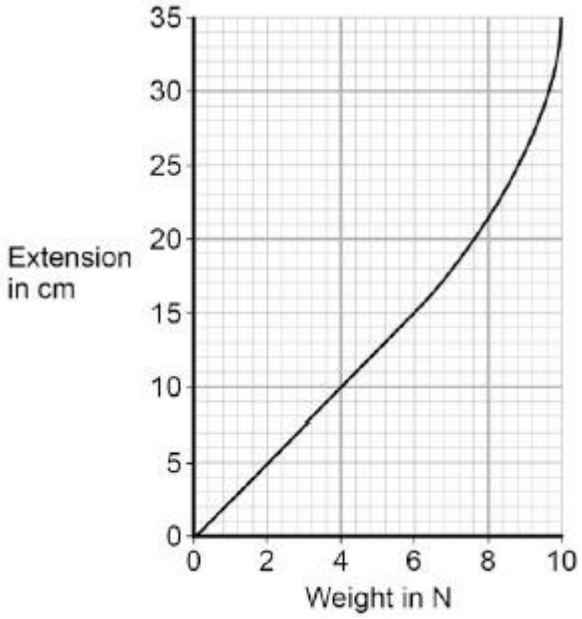
**(2)**

(c) The student moves the ruler so that it is upright and not tilted.

The student then completed the investigation and plotted the data taken in a graph.

The student's graph is shown in **Figure 3**.

**Figure 3**




Use **Figure 3** to determine the additional force needed to increase the extension of the spring from 5cm to 15cm.

Additional force = ..... N

**(1)**

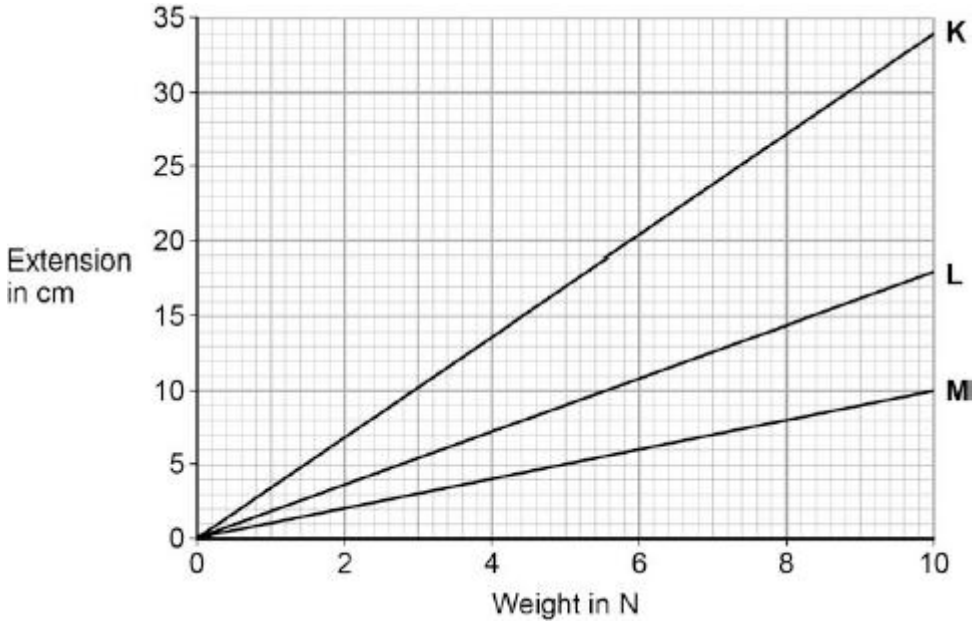
(d) What can you conclude from **Figure 3** about the limit of proportionality of the spring?

**(1)**

(e) The student repeated the investigation with three more springs, **K**, **L** and **M**.

The results for these springs are given in **Figure 4**.

**Figure 4**




All three springs show the same relationship between the weight and extension.

What is that relationship?

Tick **one** box.

The extension increases non-linearly with the increasing weight. ☐

The extension is inversely proportional to the weight. ☐

The extension is directly proportional to the weight. ☐

**(1)**

(f) Which statement, **A**, **B** or **C**, should be used to complete the sentence?

Write the correct letter, **A**, **B** or **C**, in the box below.

**A** a lower spring constant than

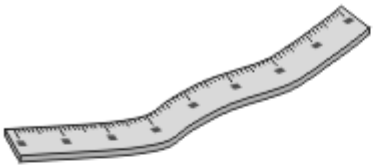
**B** the same spring constant as

**C** a greater spring constant than

From **Figure 4** it can be concluded that spring **M** has ☐ the other two springs.

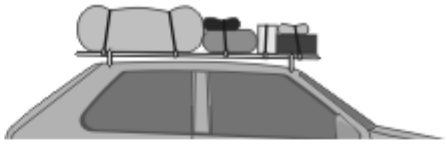
**(1)**
**(Total 7 marks)**

**Q2.** (a) The pictures show four objects. Each object has had its shape changed.



Bent metal ruler

**A**



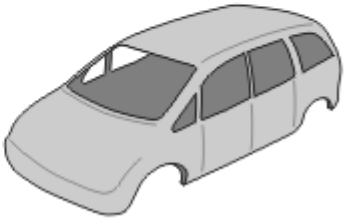
Stretched bungee cords

**B**



Springs on a playground ride

**C**



Moulded plastic model car body

**D**

Which of the objects are storing elastic potential energy?

.....

Explain the reason for your choice or choices.

.....

.....

.....

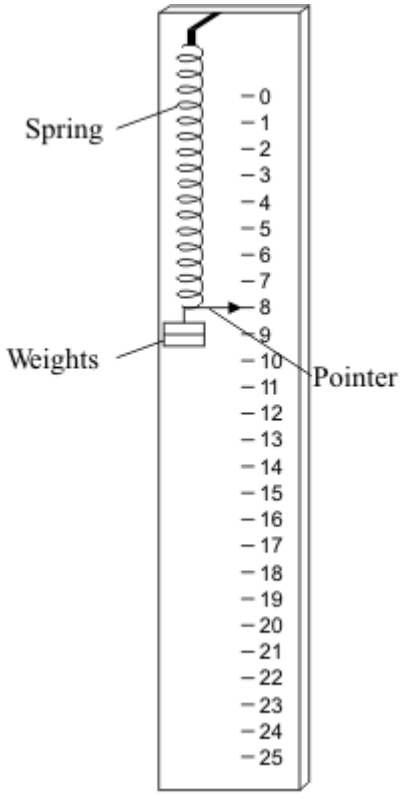
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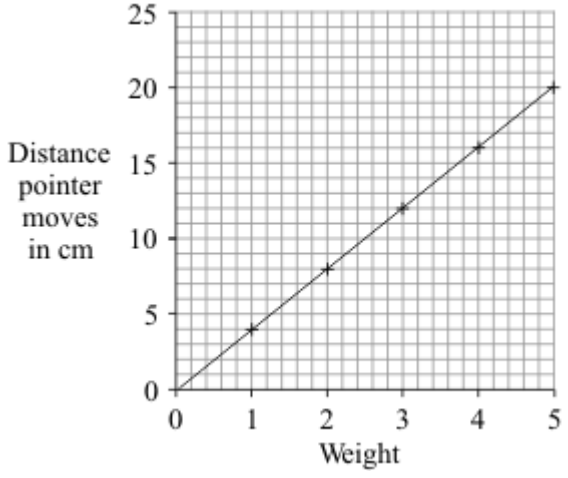
.....

**(3)**

(b) A student makes a simple spring balance. To make a scale, the student uses a range of weights. Each weight is put onto the spring and the position of the pointer marked




The graph below shows how increasing the weight made the pointer move further.




(i) Which **one** of the following is the unit of weight?.

Draw a ring around your answer.

**joule** **kilogram** **newton** **watt**

**(1)**

(ii) What range of weights did the student use?

.....

**(1)**

(iii) How far does the pointer move when 4 units of weight are on the spring?

.....

**(1)**

(iv) The student ties a stone to the spring. The spring stretches 10 cm.

What is the weight of the stone?

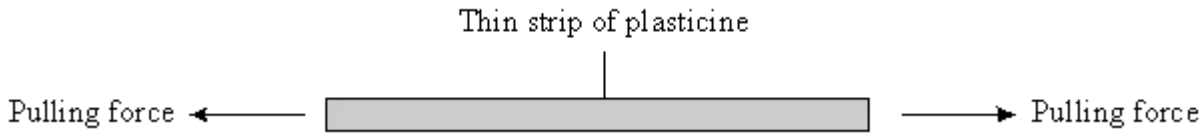
.....

**(1)**

**(Total 7 marks)**

**Q3.** (a) The diagrams below show pairs of forces acting on different objects. In each case describe what happens when the forces are increased. Then describe what happens when the forces are removed.

(i)




When the forces are increased

.....

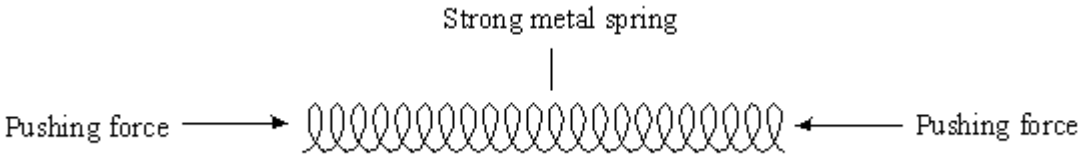
.....

When the forces are removed

.....

.....

(ii)




When the forces are increased

.....

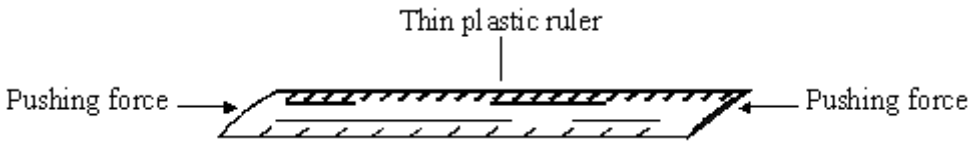
.....

When the forces are removed

.....

.....

(iii)




When the forces are increased

.....

.....

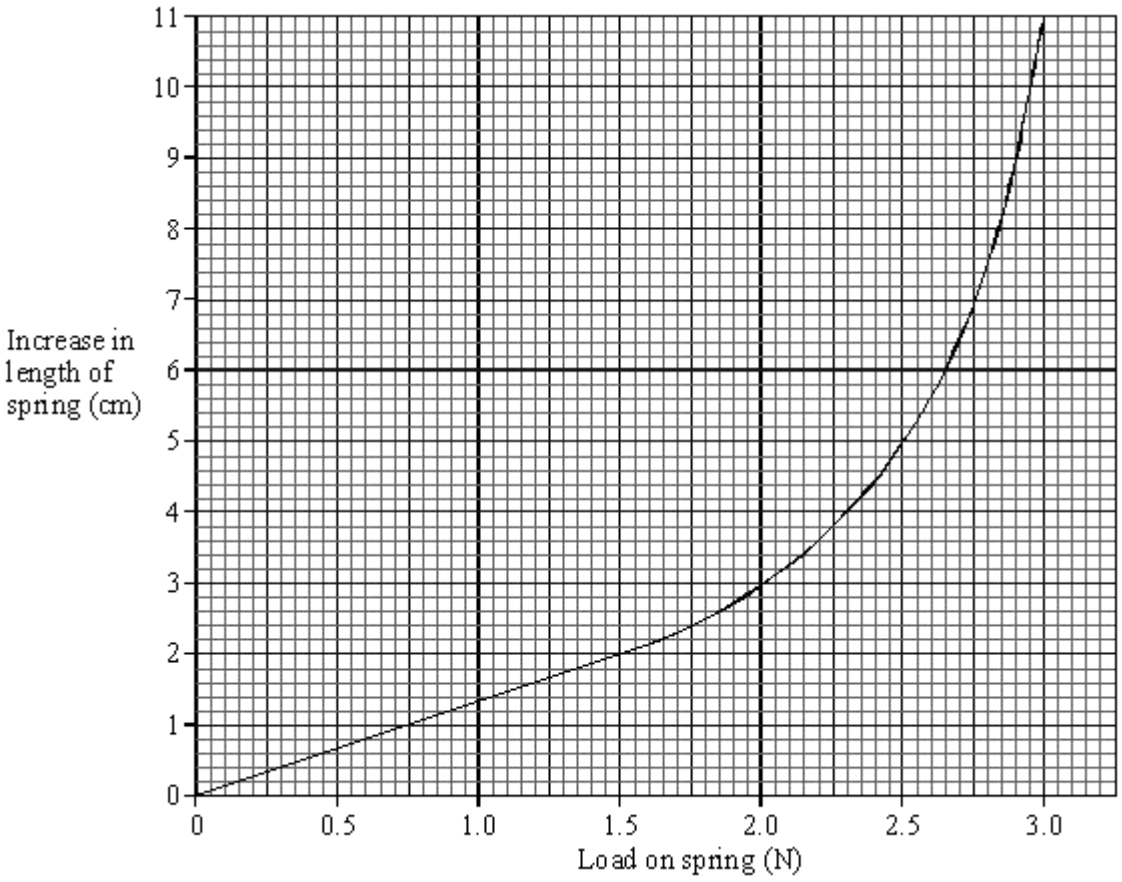
When the forces are removed

.....

.....

**(6)**

(b) The graph shows the increase in length of a spring against **load** (force).




The length of the spring with no load was 15 cm.

Use the graph to find:

(i) The load needed to produce an increase in length of 2 cm.

.....

(ii) The increase in length produced by a load of 2.3 N.

.....

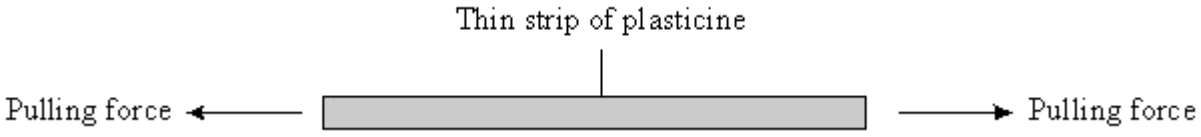
(iii) The **length** of the spring when the load was 2.3 N.

.....

**(3)**
**(Total 9 marks)**

**Q4.** The diagrams show pairs of forces acting on different objects. In each case describe what happens when the forces are increased. Then describe what happens when the forces are removed.

(a)




When the forces are increased .....

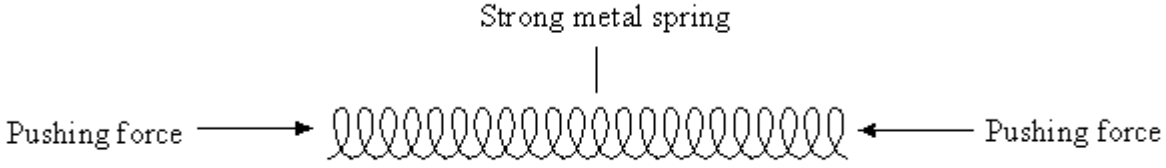
.....

When the forces are removed .....

.....

**(2)**

(b)




When the forces are increased .....

.....

When the forces are removed .....

.....

**(2)**
**(Total 4 marks)**