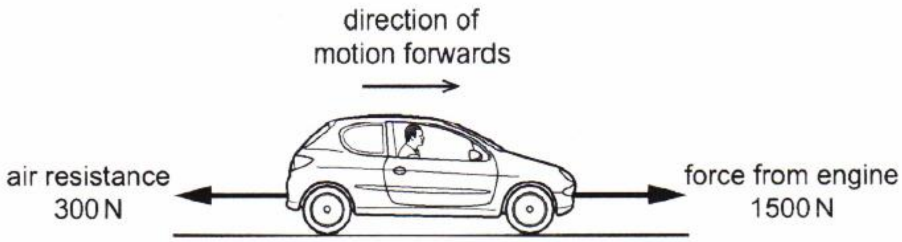
Forces – 2020 IGCSE 0625

1. March/2020/Paper_12,22/No.7

A car travels along a horizontal road at constant speed. Three horizontal forces act on the car. The diagram shows two of these forces.



What is the size and the direction of the third horizontal force acting on the car?

A 1200 N backwards ✓

B 1200 N forwards

C 1800 N backwards

D 1800 N forwards

– At constant speed,
forward force = backward force

$300 + x = 1500$
$x = 1500 - 300$
$= 1200$
backward direction

2. March/2020/Paper_22/No.2

A ball falls from rest through the air towards the ground. The diagram shows two forces acting on the ball.

As the ball falls, the air resistance increases.

Which statement is correct?

A The acceleration of the ball decreases. ✓

B The acceleration of the ball increases.

C The speed of the ball decreases.

D The gravitational force on the ball decreases.

– Increasing air resistance decreases the resultant force acting on the ball.

$R.F = ma$ ← constant (mass).

– So if R.F decreases, the acceleration decreases.

– When air resistance is equal to gravitational force, the ball falls at constant velocity called terminal velocity

– At terminal velocity, acceleration = 0.

3. March/2020/Paper_22/No.3

A compressed spring projects a ball horizontally in a vacuum chamber.

On the Earth, the ball reaches the chamber floor 4.0 m in front of the spring.

An identical experiment is done on the Moon. The gravitational field strength is lower on the Moon than on the Earth.

The experimental results on the Moon are compared with those on the Earth.

Which statement is correct?

A The horizontal speed is greater on the Moon and the ball hits the floor 4.0 m in front of the spring.

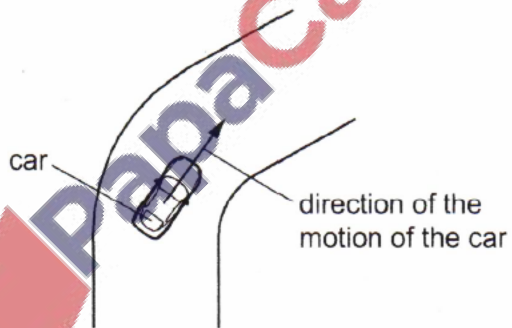
B The horizontal speed is greater on the Moon and the ball hits the floor more than 4.0 m in front of the spring.

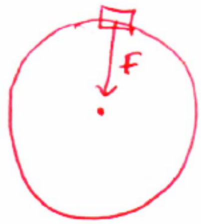
C The horizontal speed is the same on the Moon and the ball hits the floor 4.0 m in front of the spring.

D The horizontal speed is the same on the Moon and the ball hits the floor more than 4.0 m in front of the spring. – No air resistance in the moon, so ball travels longer horizontal distance.

4. March/2020/Paper_22/No.8

A car is driven round a bend in the road at a constant speed.





What is the direction of the resultant force on the car when it is going round the bend?

A parallel to the motion and in the same direction as the motion

B parallel to the motion and in the opposite direction to the motion

C perpendicular to the motion and towards the inside of the bend

D perpendicular to the motion and towards the outside of the bend

– In circular motion, the resultant force is directed towards the centre of circle.

5. March/2020/Paper_22/No.10

An air pistol fires a pellet forwards.

What is the motion of the air pistol?

According to 3rd Law of Newton, as pellet moves forward, the pistol moves back warks.

A The air pistol moves backwards with speed greater than the pellet.

B The air pistol moves backwards with speed less than the pellet.

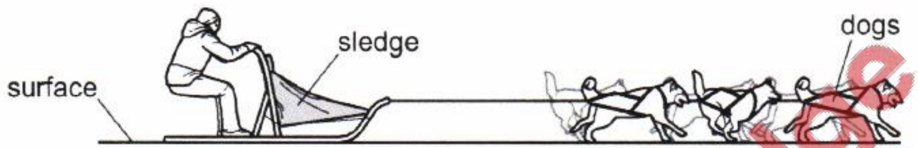
C The air pistol moves forward with speed greater than the pellet.

D The air pistol moves forward with speed less than the pellet.

- Consider momentum before is equal to momentum after, the motion of pistol is less than that of pellet.

6. June/2020/Paper_11/No.7

A sledge is pulled in a straight line by dogs, as shown.



The dogs produce a total horizontal driving force of 600 N.

Forward force = 600N
Backward force = 150 + 450 = 600N

The frictional force between the sledge and the surface is 150 N and the air resistance on the sledge is 450 N.

Since forward and backward force is equal, then Resultant force = 0.

What is the resultant force acting on the sledge?

R.F = forward force − backward force.

A 0 N **B** 300 N **C** 900 N **D** 1200 N

7. June/2020/Paper_11/No.10

Student P uses a force of 35 N to push a box 3.0 m across the floor.

Student Q uses a force of 22 N to push another box 1.8 m across the floor.

Which statement gives a full explanation why student P uses more energy than student Q?

A Student P pushes his box a greater distance than student Q.

B Student P pushes his box a greater distance and uses a bigger force than student Q.

C Student P uses a bigger force than student Q.

D Student P pushes a heavier box than student Q.

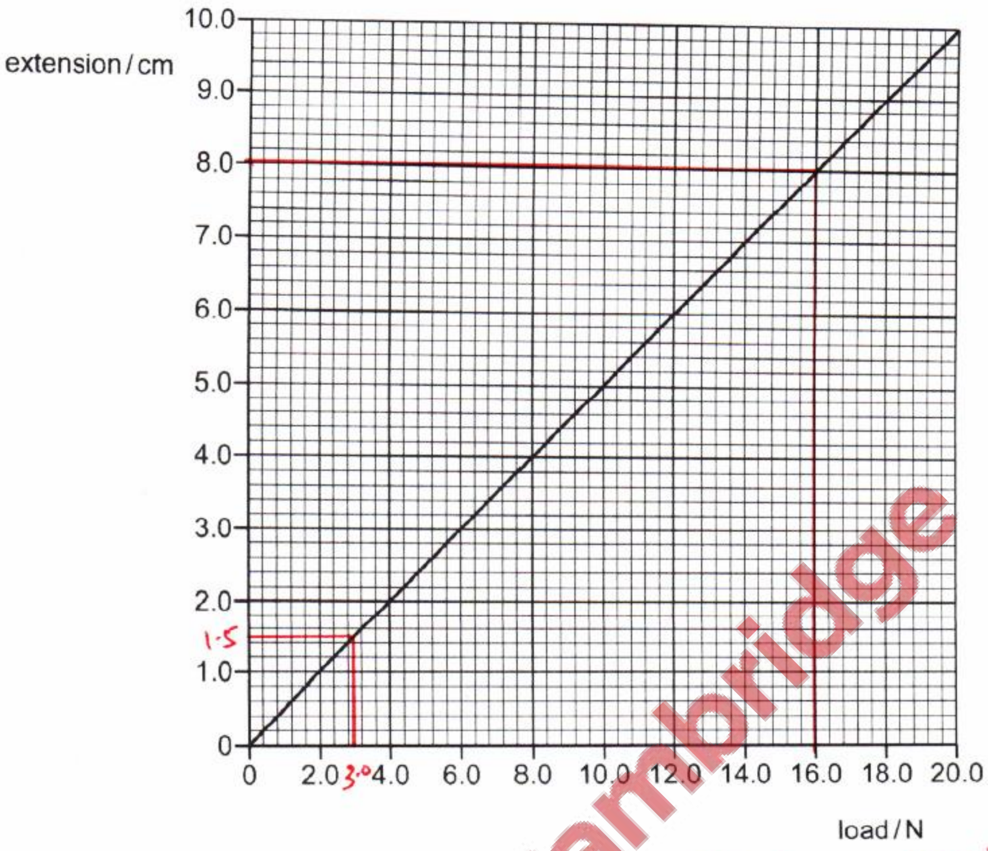
Energy = Work done.

Work done by P = 35N × 3.0m
= 105Nm

Work done by Q = 22N × 1.8m
= 39.6N

8. June/2020/Paper_12/No.7

The diagram shows an extension–load graph for a spring.



An empty can of weight 3.0 N is suspended from the spring.

Liquid is poured into the can until the extension is 8.0 cm.

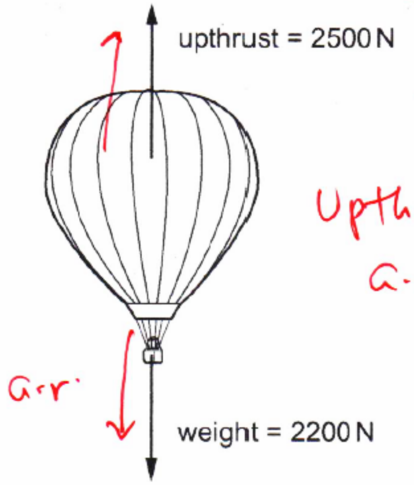
What is the weight of the liquid?

- At 8.0 cm load is 16 N.
- weight of empty can = 3 N
$16 - 3 = 13$ N

A 4.0 N **B** 10.0 N **C** 13.0 N **D** 16.0 N

9. June/2020/Paper_13/No.7

The diagram shows two of the three vertical forces acting on a hot-air balloon. The hot-air balloon is moving upwards at constant speed.



– Since balloon up moving upwards the air resistance is acting downwards

Upthrust = A.r + weight

A.r = upthrust – weight

= 2500N – 2200N

= 300N downwards

What is the air resistance acting on the hot-air balloon?

A 300 N downwards

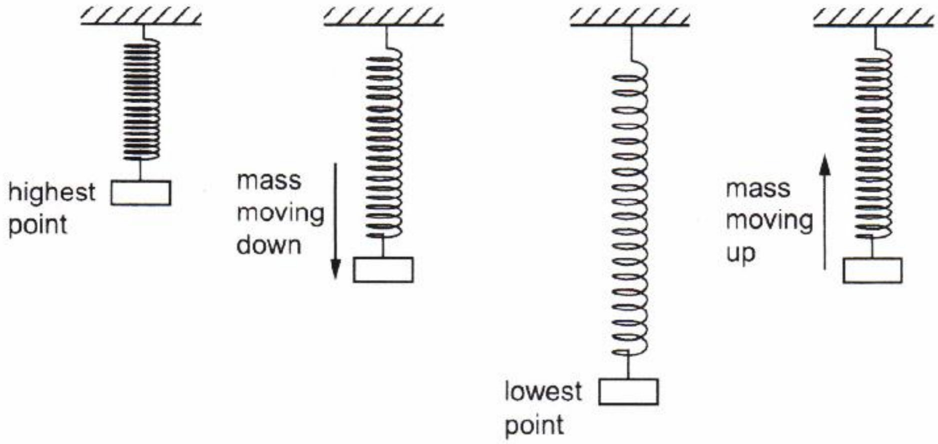
B 300 N upwards

C 4700 N downwards

D 4700 N upwards

10. June/2020/Paper_13/No.9

A mass bounces up and down on a steel spring. The diagram shows the mass and the spring at different points during the motion.



At which point does the mass have the least gravitational potential energy and at which point is the most elastic energy stored in the spring?

	least amount of gravitational potential energy	most elastic energy stored in spring
A	mass moving down	mass moving up
B	mass moving down	lowest point
C	lowest point	mass moving up
D	lowest point	lowest point

- Least g.p.e at the lowest point
- Most elastic energy stored when spring is extended the most.

11. June/2020/Paper_21/No.9

An object of mass 1.2 kg is moving with a velocity of 2.0 m/s when it is acted on by a force of 4.0 N. The velocity of the object increases to 5.0 m/s.

For what period of time does the force act on the object?

A 0.90 s **B** 1.1 s **C** 1.5 s **D** 3.6 s

$F = \frac{mv - mu}{t}$

$t = \frac{mv - mu}{F} = \frac{1.2(5-2)}{4} = 0.9\,s$

m = 1.2 kg, v = 5.0 m/s, u = 2.0 m/s, F = 4 N.

12. June/2020/Paper_22/No.7

A satellite orbits the Earth at constant speed in a circular orbit.

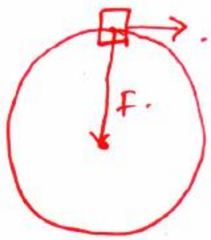
Which statement is correct?

A The resultant force on the satellite is zero.

B The resultant force on the satellite is towards the Earth.

C The resultant force on the satellite is away from the Earth.

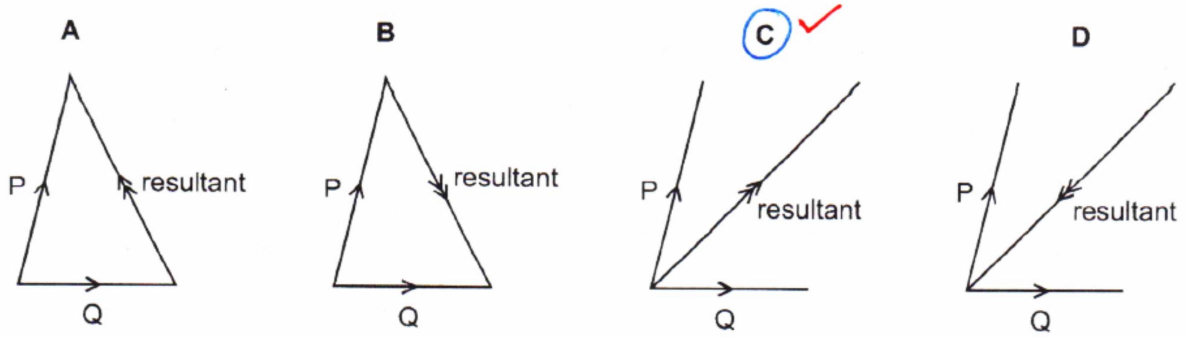
D The resultant force on the satellite is in the direction of motion.



13. June/2020/Paper_22/No.8

Two forces P and Q act on an object.

Which diagram shows the resultant of these two forces?



14. June/2020/Paper_23/No.7

Which moving object has a resultant force acting on it?

A a diver rising vertically through water at constant speed

B an aircraft circling an airport at constant speed

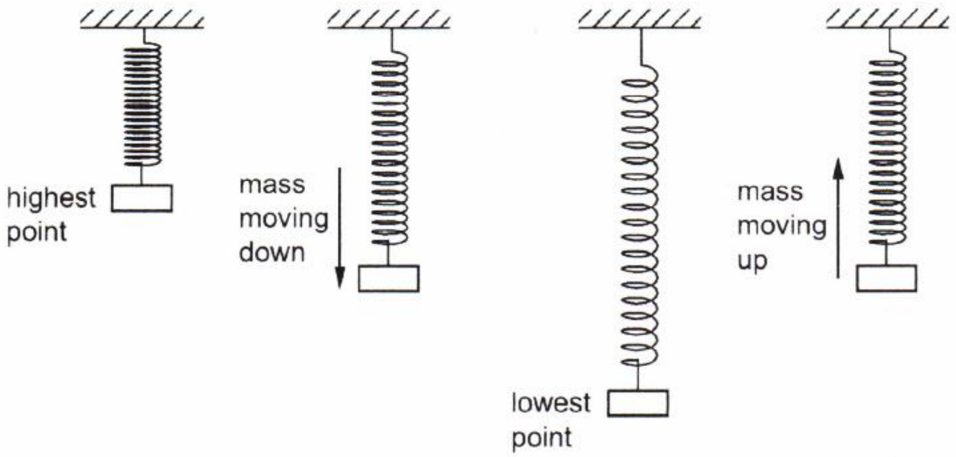
C a parachutist descending vertically at terminal velocity

D a train going up a straight slope at constant speed

- At constant speed, acceleration is zero
- But when moving in a circular motion, resultant force is required to make it change direction each time.

15. June/2020/Paper_23/No.10

A mass bounces up and down on a steel spring. The diagram shows the mass and the spring at different points during the motion.



At which point does the mass have the least gravitational potential energy and at which point is the most elastic energy stored in the spring?

	least amount of gravitational potential energy	most elastic energy stored in spring
A	mass moving down	mass moving up
B	mass moving down	lowest point
C	lowest point	mass moving up
D	lowest point	lowest point

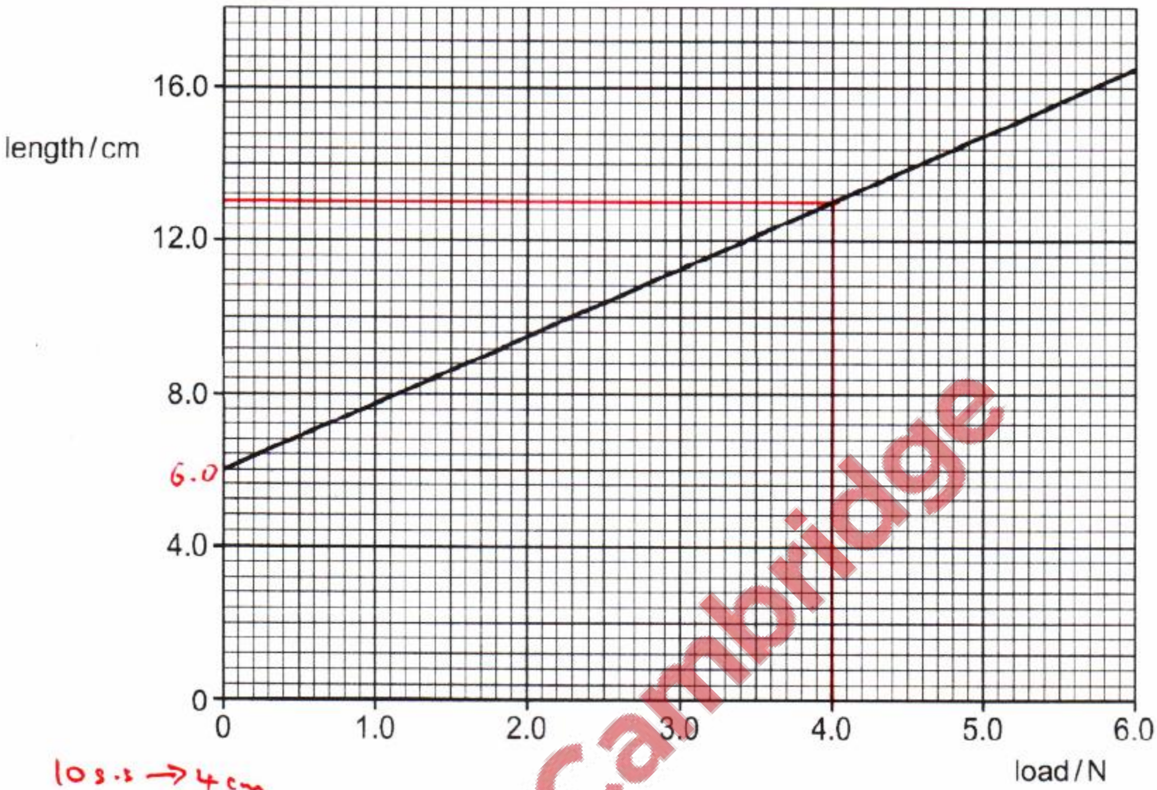
– most elastic energy stored when spring is stretched the most

– least g.p.e at the lowest point.

16. June/2020/Paper_31/No.2

(a) A student stretches a spring by adding different loads to it. She measures the length of the spring for each load. She plots a graph of the results.

Fig. 2.1 shows the graph of her results.



10 s.s → 4 cm
1 s.s → ?
$\frac{1 \times 4}{10} = 0.4$ cm

Fig. 2.1

Use the graph to determine:

(i) the length of the spring without a load

5 × 0.4 = 2.0
+ 4.0
6.0

length = ...6.0...... cm [1]

(ii) the length of the spring with a load of 4.0 N

2.5 × 0.4 = 1
12 + 1 = 13 cm

length = ...13...... cm [1]

(iii) the extension due to a 4.0 N load.

ext = 13 − 6
= 7 cm

extension = ...7.0...... cm [1]

(b) Complete the sentence about effects of forces. Choose words from the box.

colour	friction	pressure	shape	size	speed

Stretching a spring with a load is an example of how a force can change the

......Shape...... and the ......size...... of an object. [2]

[Total: 5]

17. June/2020/Paper_41/No.2

Fig. 2.1 is the extension–load graph for a light spring S.

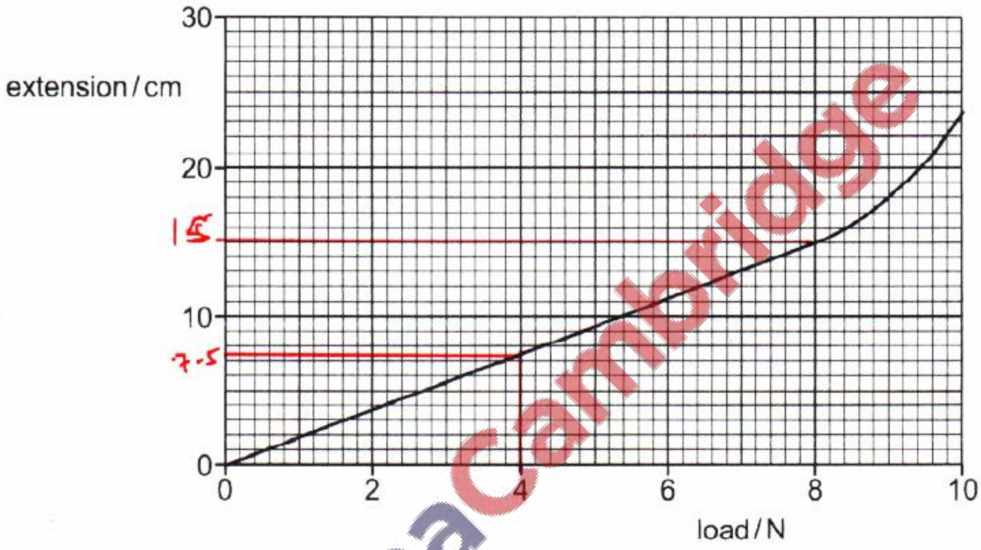


Fig. 2.1

(a) State the range of loads for which S obeys Hooke's law.

- Hooke's law obeyed only in the straight part of graph.

from ......0 N...... to ......8.0 N...... [1]

(b) Using information from Fig. 2.1, determine the spring constant *k* of spring S.

$F = kx$

$k = \frac{F}{x}$

$= \frac{8.0\text{ N}}{15\text{ cm}}$

$= 0.53\text{ N/cm}$

k = ...0.53 N/cm...... [2]

(c) A second spring, identical to spring S, is attached to spring S. The two springs are attached to a rod, as shown in Fig. 2.2. A load of 4.0 N is suspended from the bottom of spring S. The arrangement is in equilibrium.

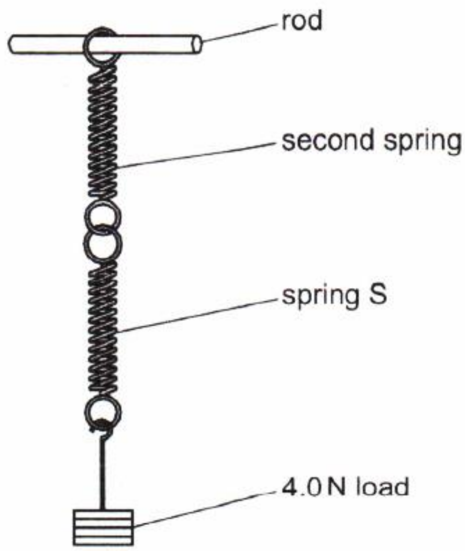


Fig. 2.2

(i) State the name of the form of energy stored in the two springs when they are stretched.

elastic potential energy .... [1]

(ii) Determine the extension of the arrangement in Fig. 2.2.

- From the graph, a 4N load will extend each spring by 7.5 cm

- The springs are identical.
extension = 7.5 × 2
= 15 cm.

extension = 15 cm .... cm [1]

(iii) The load is carefully increased to 6.0 N in total.

Calculate the distance moved by the load to the new equilibrium position as the load increases from 4.0 N to 6.0 N.

$x = \frac{F}{k}$

F = 6.0 − 4.0
= 2.0 N

$x = \frac{2.0\,N}{0.53\,N/cm}$
= 3.77 cm.

- Each spring extends by 3.77 cm.
- total extension = 3.77 × 2
= 7.547

distance moved = 7.5 cm .... [1]

[Total: 6]