

P10 Forces and pressure, task 1

P10 Practice Paper 1

Foundation Questions

Q1.

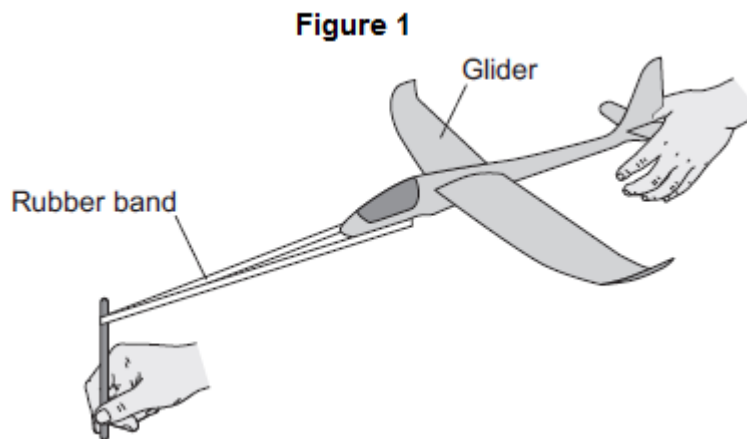
- (a) When a force is applied to a spring, the spring extends by 0.12 m. The spring has a spring constant of 25 N/m.

Calculate the force applied to the spring.

Force = _____ N

(2)

- (b) **Figure 1** shows a toy glider. To launch the glider into the air, the rubber band and glider are pulled back and then the glider is released.



- (i) Use the correct answers from the box to complete the sentence.

chemical	elastic potential	kinetic	thermal
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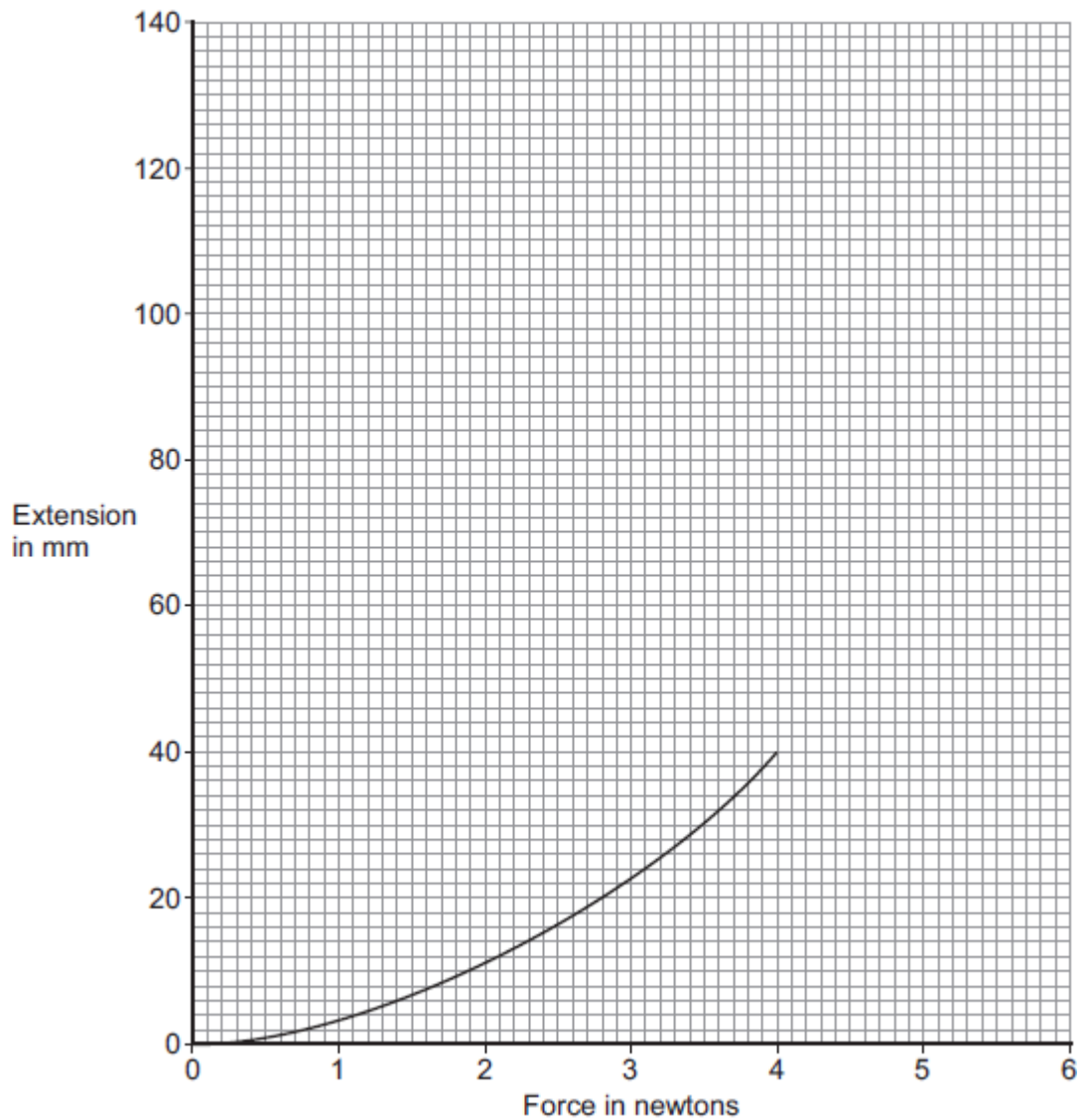
When the glider is released, the _____ energy stored in the rubber band decreases and the glider gains _____ energy.

(2)

- (ii) **Figure 2** shows how the extension of the rubber band varies with the force applied to the rubber band.

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Figure 2



What can you conclude, from **Figure 2**, would happen to the extension of the rubber band if the force applied to the rubber band was increased to 6 N?

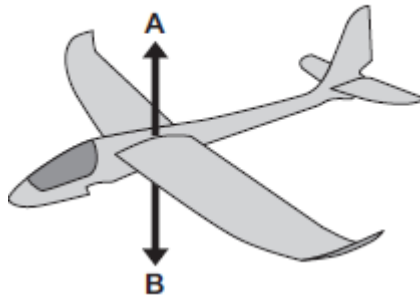
The rubber band does **not** break.

(2)

(c) **Figure 3** shows the vertical forces, **A** and **B**, acting on the glider when it is flying.

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Figure 3



- (i) What name is given to the force labelled **B**?

Draw a ring around the correct answer.

drag

friction

weight

(1)

- (ii) Which **one** of the following describes the downward speed of the glider when force **B** is greater than force **A**?

Tick (✓) **one** box.

Downward speed increases

Downward speed is constant

Downward speed decreases

(1)

(Total 8 marks)

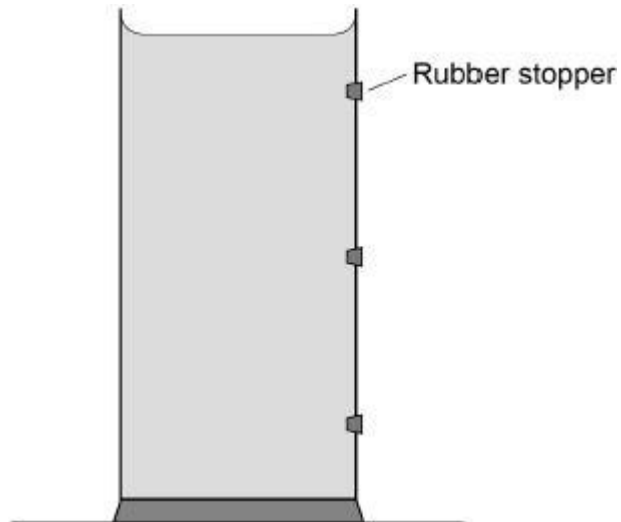
Q2.

Figure 1 shows a container filled with water.

The three holes in the side of the container are sealed with rubber stoppers.

Figure 1

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- (a) The water exerts a force of 27 N on the bottom of the container.
The cross-sectional area of the bottom of the container is 0.009 m².

Calculate the pressure exerted by the water on the bottom of the container.

Use the equation:

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Choose the unit.

kg/m ³	N/m	Pa
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Pressure = _____ Unit = _____

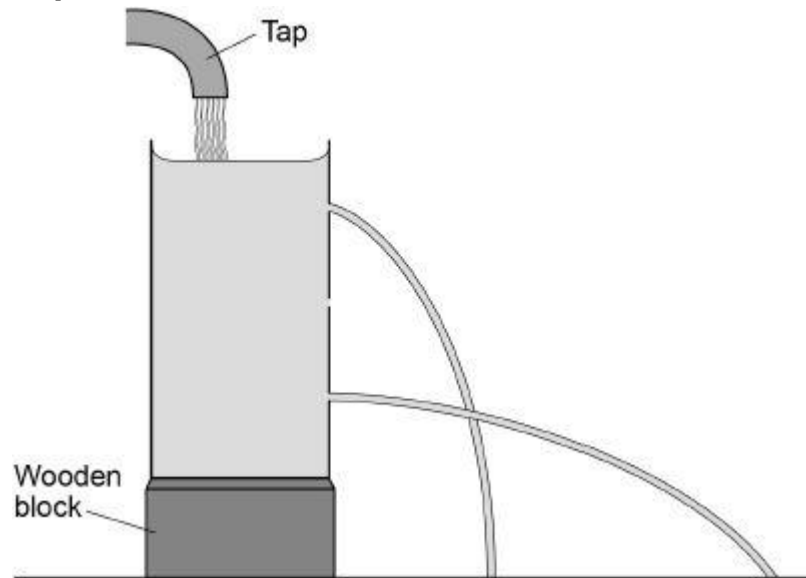
(3)

The container is put under running water from a tap and the three rubber stoppers removed.

Figure 2 shows the path taken by the water escaping from the top and bottom holes.

Figure 2

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- (b) Complete **Figure 2** to show the path taken by the water escaping from the centre hole. (1)

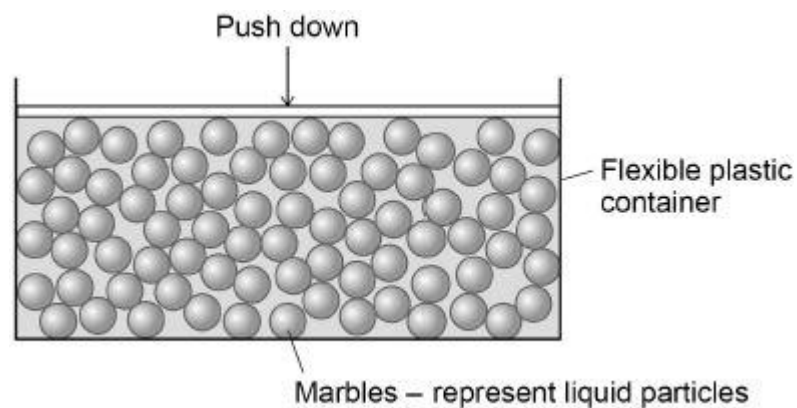
- (c) What can be concluded from **Figure 2** about the pressure in a liquid?

(1)

- (d) **Figure 3** shows a simple model of a liquid.

When a force pushes down on the marbles, the marbles push the sides and bottom of the container outwards.

Figure 3



What can be concluded from this model about the pressure in a liquid?

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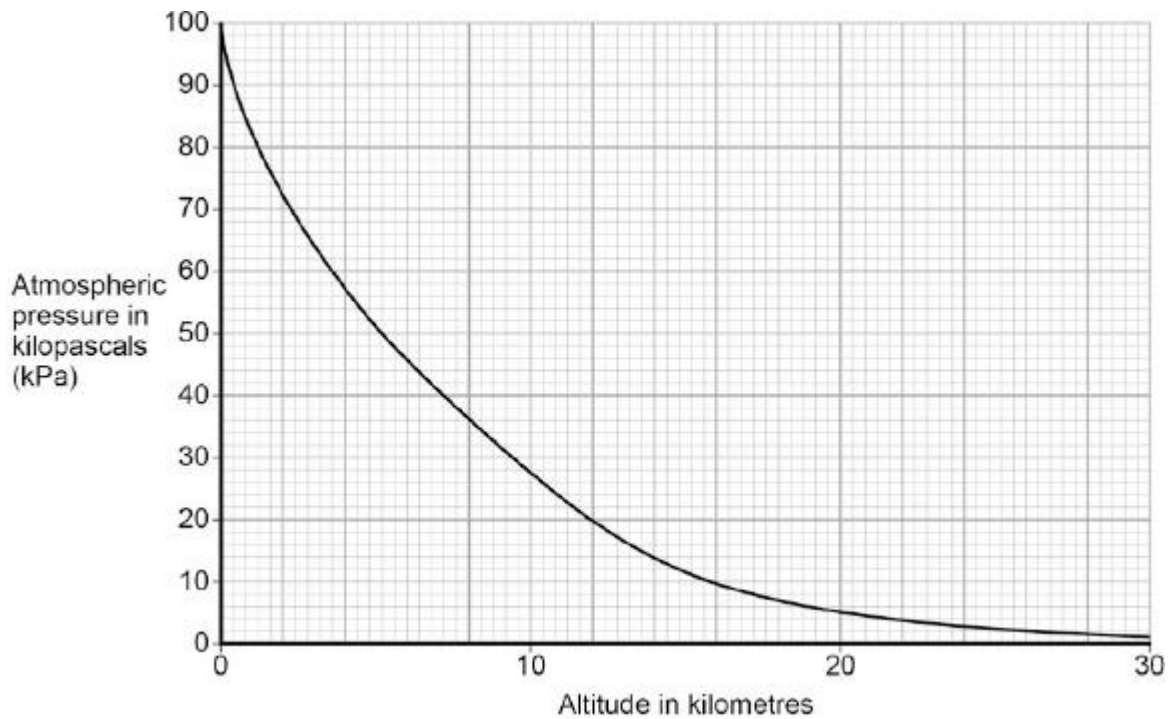
(1)
(Total 6 marks)

Higher Questions

Q3.

Figure 1 shows how atmospheric pressure varies with altitude.

Figure 1



(a) Explain why atmospheric pressure decreases with increasing altitude.

(3)

(b) When flying, the pressure inside the cabin of an aircraft is kept at 70 kPa.

The aircraft window has an area of 810 cm².

Use data from **Figure 1** to calculate the resultant force acting on an aircraft window

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when the aircraft is flying at an altitude of 12 km.

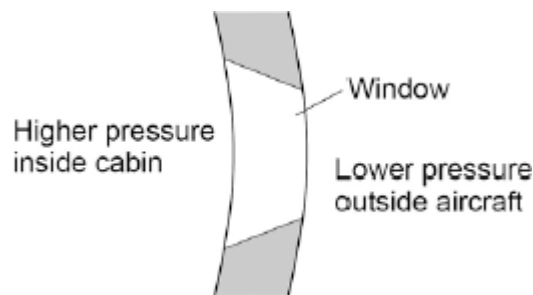
Give your answer to two significant figures

Resultant force = _____ N

(5)

(c) **Figure 2** shows the cross-section of one type of aircraft window.

Figure 2



Explain why the window has been designed to have this shape.

(2)

(Total 10 marks)

Q4.

A paintball gun is used to fire a small ball of paint, called a paintball, at a target.

The figure below shows someone just about to fire a paintball gun.

The paintball is inside the gun.

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- (a) What is the momentum of the paintball before the gun is fired?

Give a reason for your answer.

(2)

- (b) The gun fires the paintball forwards at a velocity of 90 m / s.

The paintball has a mass of 0.0030 kg.

Calculate the momentum of the paintball just after the gun is fired.

Momentum = _____ kg m / s

(2)

- (c) The momentum of the gun and paintball is conserved.

Use the correct answer from the box to complete the sentence.

equal to

greater than

less than

The total momentum of the gun and paintball just after the gun is fired

will be _____ the total momentum of the gun and

paintball before the gun is fired.

(1)

(Total 5 marks)

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Mark schemes

Q1.

(a) 3 (.0)

*allow 1 mark for correct substitution i.e. 25×0.12 provided
no subsequent step*

2

(b) (i) elastic potential
correct order only

1

kinetic

1

(ii) increases

1

to 80 (mm) (or more)

accept any number greater than 75

an answer 'it (more than) doubles' gains both marks

1

(c) (i) weight

1

(ii) downward speed increases

1

[8]

Q2.

(a) $p = \frac{27}{0.009}$

1

$p = 3000$

1

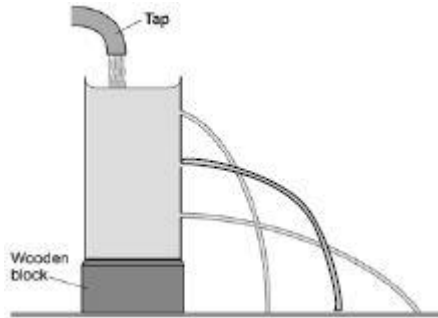
Pa

1

an answer of 3000 scores 2 marks

(b)

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the water path hits the surface somewhere between the other two paths

1

- (c) pressure increases with depth
allow when the pressure is higher, the water travels further

1

- (d) pressure acts in all directions
or
 pressure causes a force on (all) the surfaces
ignore liquids cannot be compressed

1

[6]

Q3.

- (a) air molecules colliding with a surface create pressure

1

at increasing altitude distance between molecules increases

or

at increasing altitude fewer molecules (above a surface)

1

so number of collisions with a surface decreases

or

or so always less weight of air than below (the surface)

1

- (b) atmospheric pressure = 20 kPa from graph **and** conversion of 810 cm² to 0.081 m²
allow ecf for an incorrect value clearly obtained from the graph

1

$$5 \times 10^4 = \underline{F}$$

$$0.081$$

1

$$F = 5 \times 10^4 \times 0.081$$

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- 4050 1
- 4100 (N) 1
- allow 4100 (N) with no working shown for 5 marks*
allow 4050 with no working shown for 4 marks
- (c) force from air pressure acting from inside to outside bigger than force acting inwards 1
- so keeps the window in position 1
- [10]

Q4.

- (a) Zero / 0 1
- Accept none*
Nothing is insufficient
- velocity / speed = 0 1
- accept it is not moving*
paintball has not been fired is insufficient
- (b) 0.27 2
- allow 1 mark for correct substitution, ie $p = 0.003(0) \times 90$*
provided no subsequent step
- (c) equal to 1
- [5]