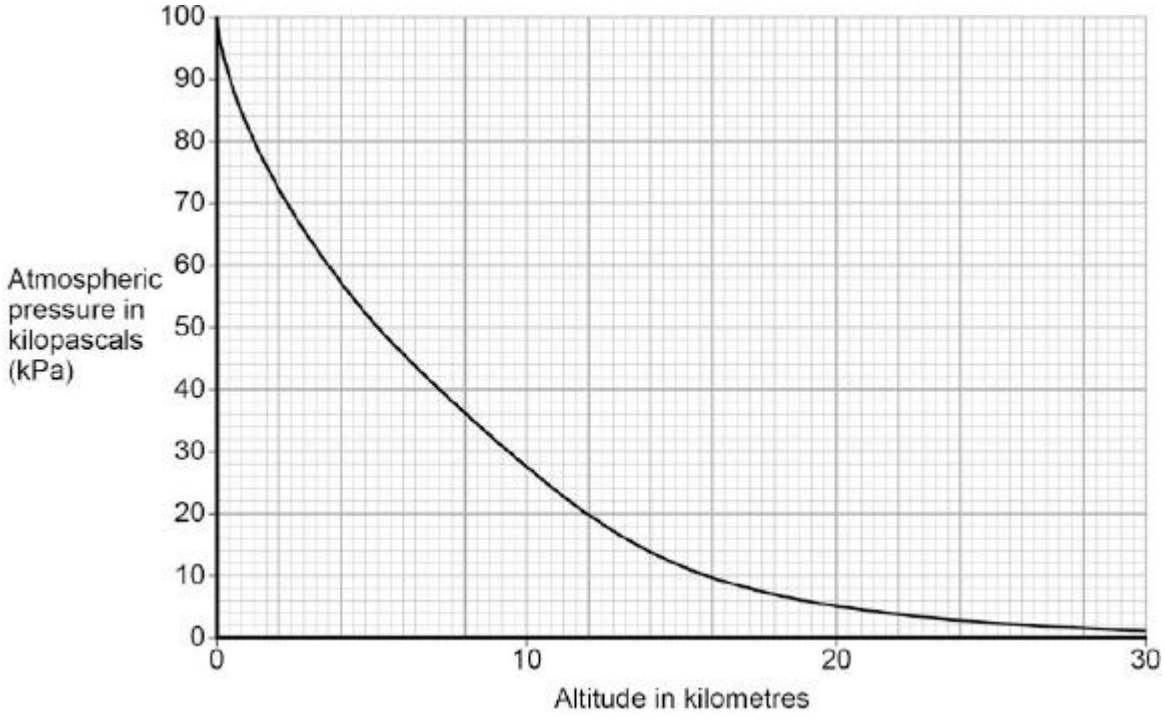
**Q1.Figure 1** shows how atmospheric pressure varies with altitude.

**Figure 1**




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

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**(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 $cm^2$.

Use data from **Figure 1** to calculate the resultant force acting on an aircraft window when the aircraft is flying at an altitude of 12 km.

Give your answer to two significant figures

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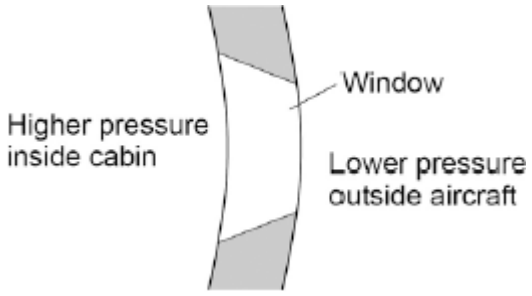
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Resultant force = ..... N

**(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.

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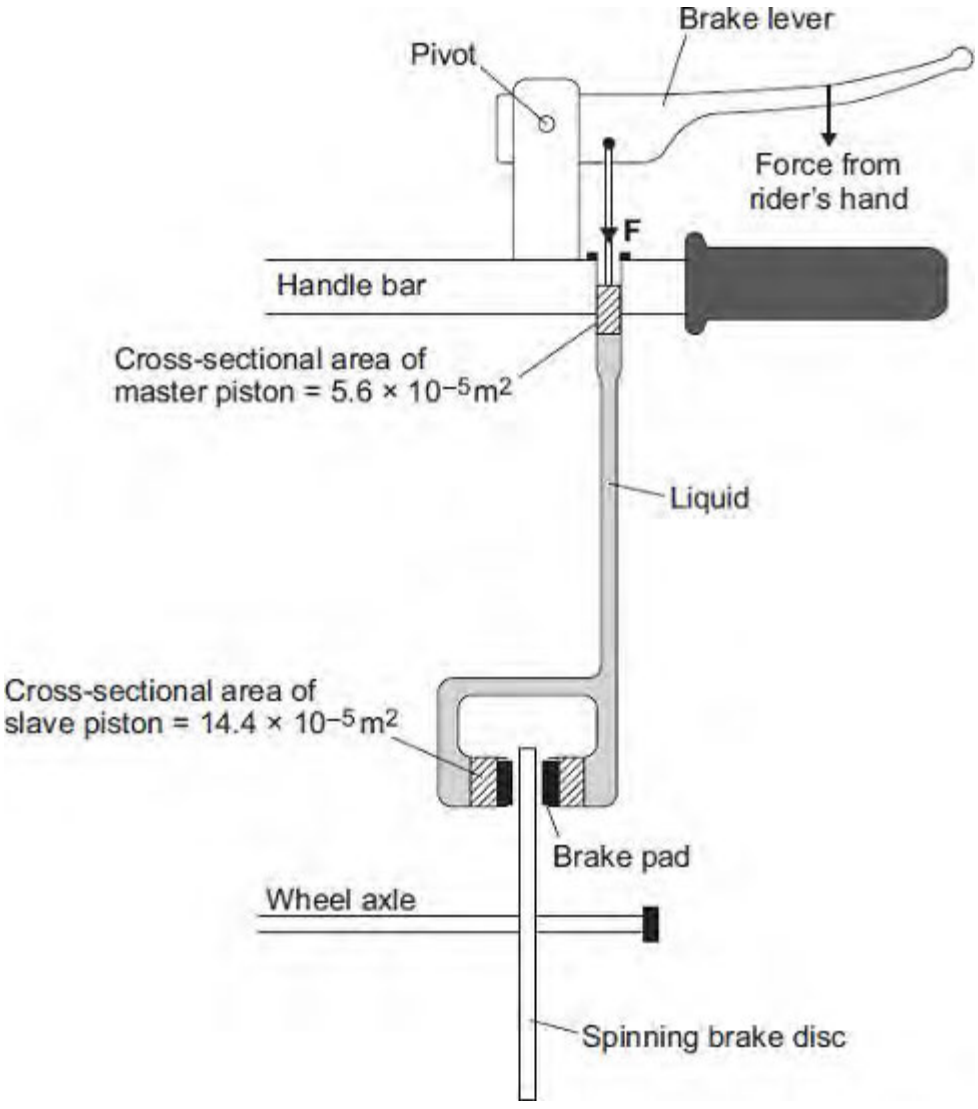
**(2)**
**(Total 10 marks)**

**Q2.**Mountain bike riders use brakes to slow down.



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Some mountain bikes have hydraulic brakes.



(a) What property of a liquid enables a hydraulic brake system to work?

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**(1)**

(b) When the rider's hand pulls on the brake lever, the master piston applies a pressure of $1.5 \times 10^6$ pascals to the liquid.

Using information from the diagram, calculate the force **F** exerted on the liquid by the master piston.

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Force **F** = ..... N

**(2)**

(c) The pressure in the liquid applies a force to move each slave piston.

How does the size of this force compare to the force **F** applied by the master piston?

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.....

Give a reason for your answer.

.....

.....

**(2)**

**(Total 5 marks)**

**Q3.** Some students fill an empty plastic bottle with water.
The weight of the water in the bottle is 24 N and the cross-sectional area of the bottom of the bottle is 0.008 $m^2$.

(a) Calculate the pressure of the water on the bottom of the bottle and give the unit.

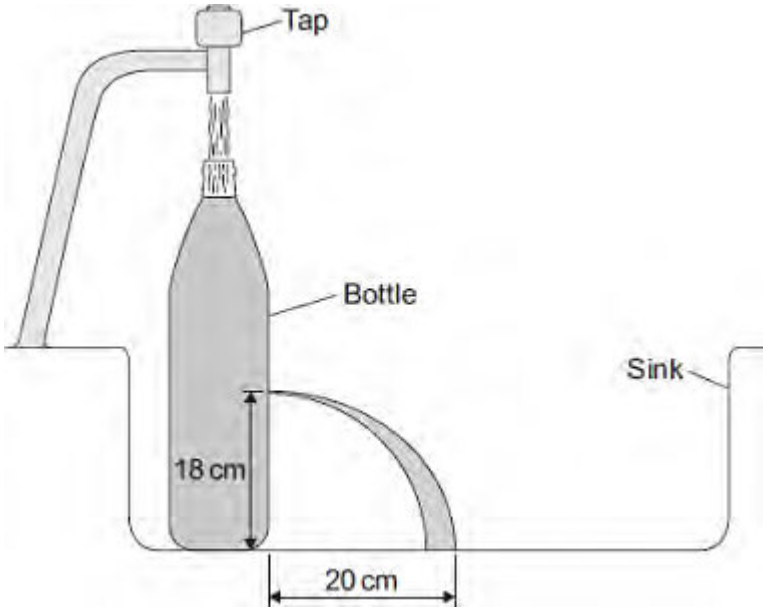
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Pressure = .....

**(3)**

(b) The students made four holes in the bottle along a vertical line.
They put the bottle in a sink. They used water from a tap to keep the bottle filled to the top.




The students measured and recorded the vertical heights of the holes above the sink.
They also measured the horizontal distances the water landed away from the bottle.
A pair of measurements for one of the holes is shown in the diagram.

The complete data from the experiment is shown in the table.

| Hole | Vertical height in cm | Horizontal distance in cm |
|---|---|---|
| **J** | 24 | 15 |
| **K** | 18 | 20 |
| **L** | 12 | 30 |
| **M** | 6 | 40 |

(i) Which hole is shown in the diagram?

Draw a ring around the correct answer.

**J** **K** **L**

**(1)**

(ii) On the diagram, draw the path of the water coming out of hole **M**.

Use the information in the table to help you.

**(2)**

(c) Suggest **one** problem that might arise from trying to collect data from a fifth hole with a vertical height of 1 cm above the sink.

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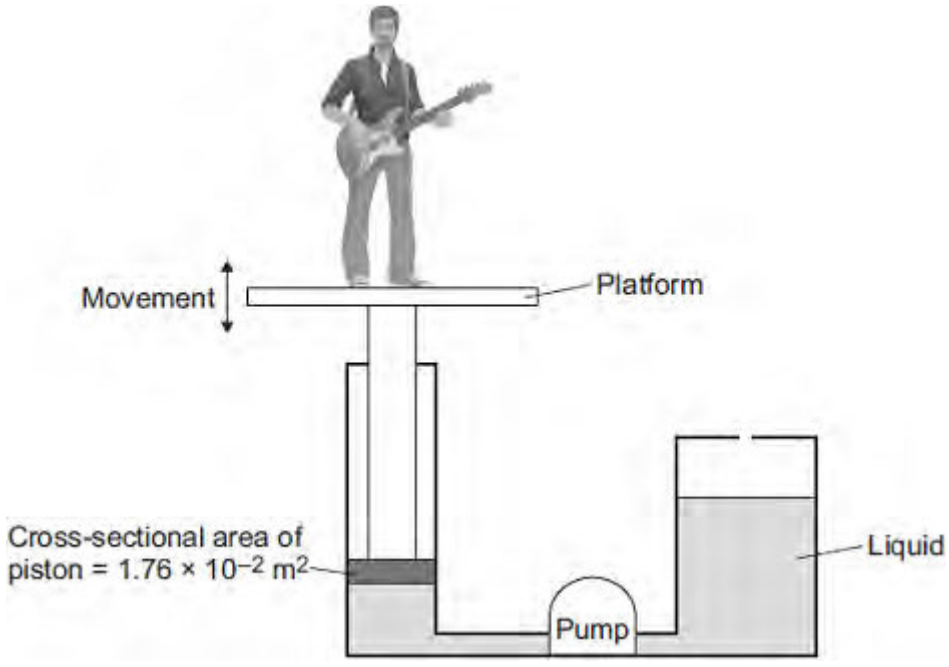
**(1)**

**(Total 7 marks)**

**Q4.**Musicians sometimes perform on a moving platform.

**Figure 1** shows the parts of the lifting machine used to move the platform up and down.

**Figure 1**




(a) What type of system uses a liquid to transmit a force?

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**(1)**

(b) The pump creates a pressure in the liquid of 8.75 x $10^4$ Pa to move the platform upwards.

Calculate the force that the liquid applies to the piston.

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Force = ..... N

**(2)**

(c) The liquid usually used in the machine is made by processing oil from underground wells. A new development is to use plant oil as the liquid.

Extracting plant oil requires less energy than extracting oil from underground wells.

Suggest an environmental advantage of using plant oil.

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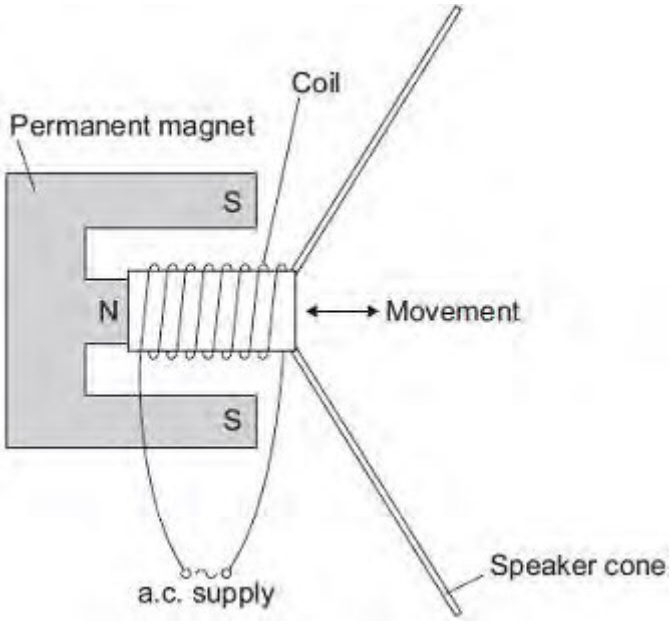
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**(1)**

(d) Musicians often use loudspeakers.

**Figure 2** shows how a loudspeaker is constructed.

**Figure 2**




The loudspeaker cone vibrates when an alternating current flows through the coil.

Explain why.

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**(4)**
**(Total 8 marks)**