

NAME: .....

SCHOOL:.....

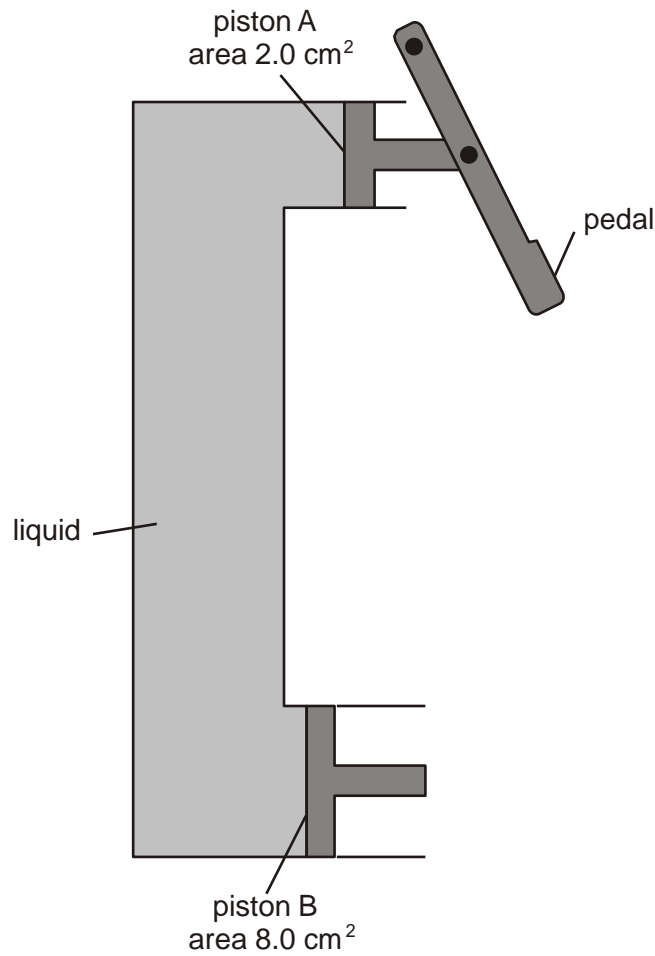
DATE: .....

## **PRESSURE**

### **INSTRUCTIONS TO CANDIDATES**

*Answer **ALL** questions in this paper in the spaces provided.*

1. The diagram below shows a container filled with a liquid.



At each end of the container there is a piston.  
Piston A has a smaller area than piston B.

- (a) (i) Rebekah pushes on the pedal. This produces a force of 200 N on piston A.

Calculate the pressure that piston A exerts on the liquid.  
Give the unit.

.....  
.....

2 marks

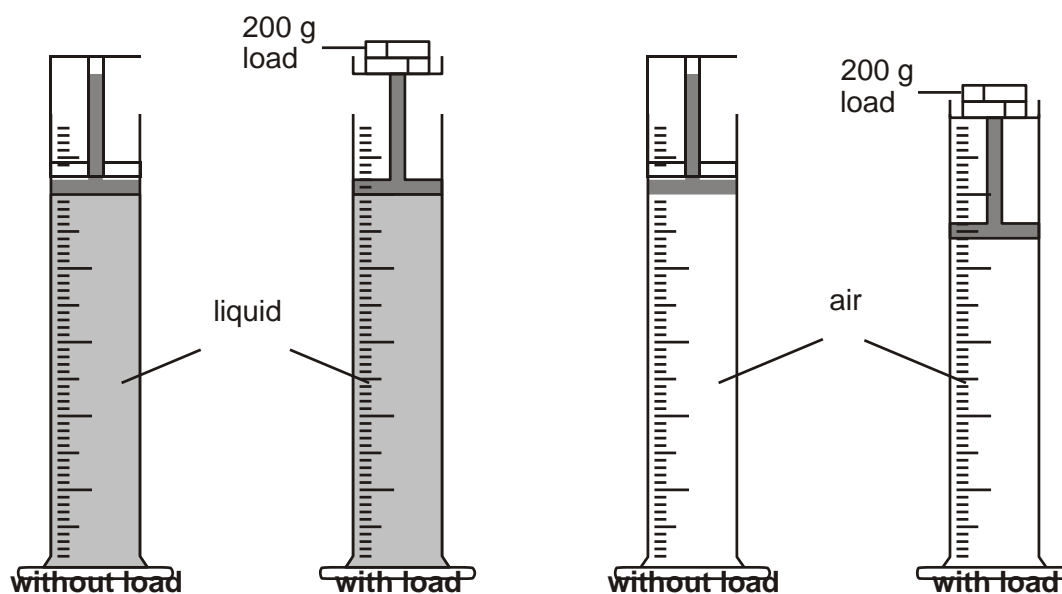
- (ii) The liquid in the container exerts the same pressure on piston B.

Use this pressure to calculate the force on piston B.

.....  
..... N

1 mark

- (b) Rebekah set up a different experiment as shown below. She measured the volume of the liquid and the air in the cylinders before and after a 200 g load was added to the piston.



- (i) When the loads were added to the pistons, the volume of the liquid did **not** change but the volume of the air decreased.

Explain why this happened.

.....  
.....

1 mark

- (ii) The diagram on the opposite page represents the way the brake system of a car works.  
The brake pedal pushes piston A.  
Piston B pushes the brakes on.

If air bubbles get into the liquid, the brakes do **not** work properly.  
Explain why.  
Use the diagrams above to help you.

.....  
.....

1 mark

maximum 5 marks

2. Tom tries on four types of footwear in a sports shop.



ski boot



trainer



ice skate



walking boot

(a) (i) When Tom tries on the footwear, which one sinks into the carpet the most?

.....

1 mark

(ii) When Tom tries on the footwear, what is the same for each type of footwear? Tick the correct box.

the area of the footwear

Tom's weight on the footwear

the material of the footwear

the weight of the footwear

1 mark

(b) The drawing below shows a snowshoe.



How do snowshoes help people to walk in deep snow?

.....  
.....

1 mark

(c) Choose the correct word from the list to complete the sentence below.

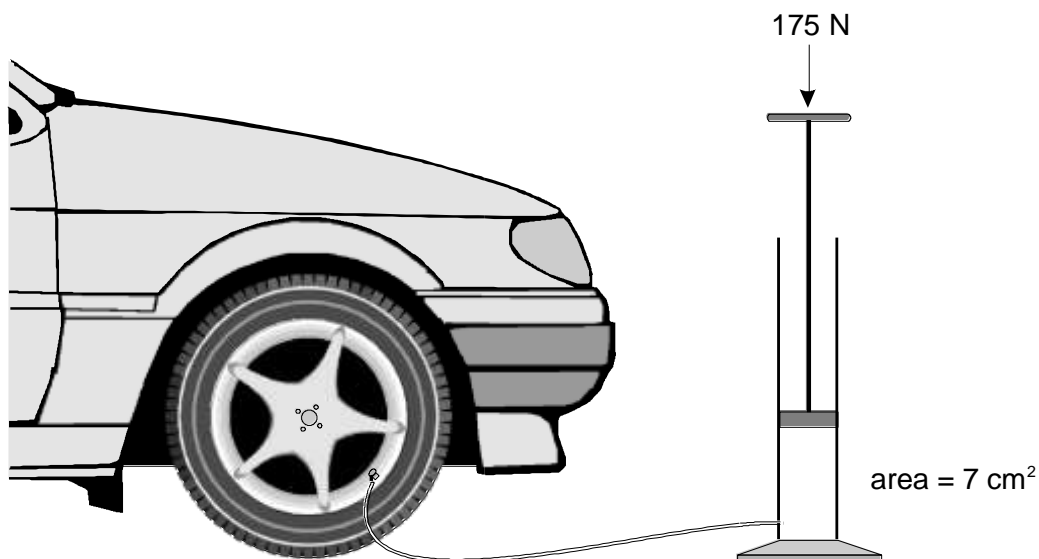
**air resistance      friction      gravity      magnetism**

When Tom is ice skating the force of .....  
between the skate and the ice is less than when he is walking on a carpet.

1 mark

Maximum 4 marks

3. Karen wants to pump up her car tyre.  
Her pump has a piston with an area of  $7 \text{ cm}^2$ .



Karen pushes the handle down with a force of 175 N.

- (a) What pressure does she exert on the air in the pump?

.....  
..... N/cm<sup>2</sup>

1 mark

- (b) The air pressure in the tyre is 27 N/cm<sup>2</sup>.  
What pressure would be needed **in the pump** in order to pump more air into the tyre?

.....  
.....

1 mark

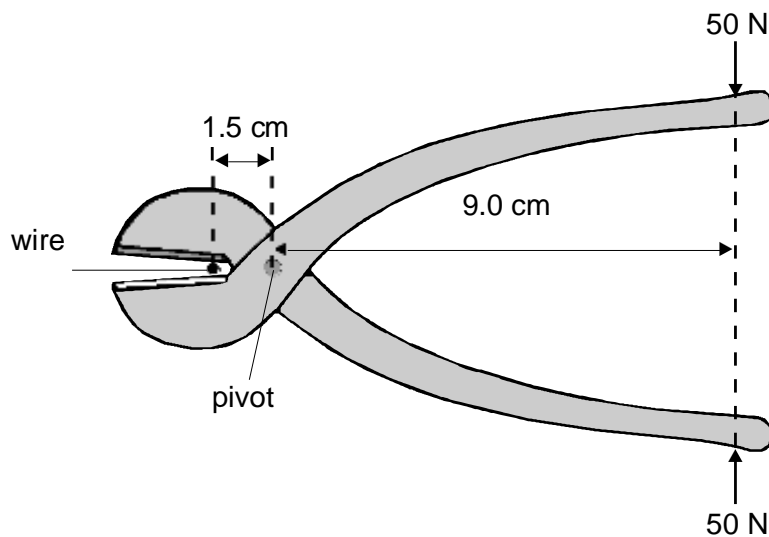
- (c) Another of Karen's car tyres exerts a pressure of 30 N/cm<sup>2</sup> on the road. The area of the tyre in contact with the road is 95 cm<sup>2</sup>  
What is the force exerted by the tyre on the road?

..... N

1 mark

Maximum 3 marks

4. (a) James is cutting a piece of wire with a pair of wire cutters.





James exerts a force of 50 N on each of the handles.

- (i) What is the turning moment about the pivot, on **each** handle?  
Give the unit.

.....  
.....

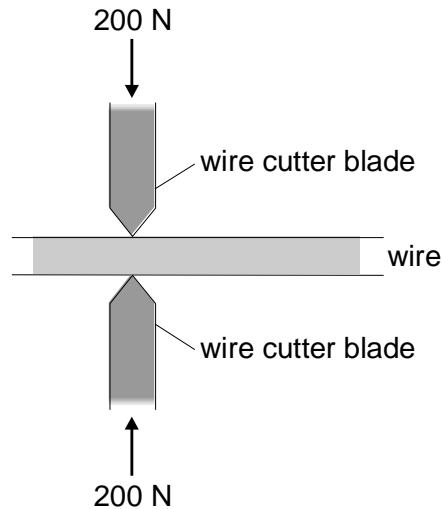
2 marks

- (ii) What force is applied, by **each** blade, on the wire?

.....  
..... N

1 mark

- (b) Stephanie uses the same pair of wire cutters. The diagram below is an end-on view of the blades as they begin to cut the wire.



Stephanie exerts a force of 200 N on the wire with each blade.  
The area of contact of each blade on the wire is 0.0005 cm<sup>2</sup>.

- (i) What is the pressure of **each** blade on the wire? Give the unit.

.....  
.....

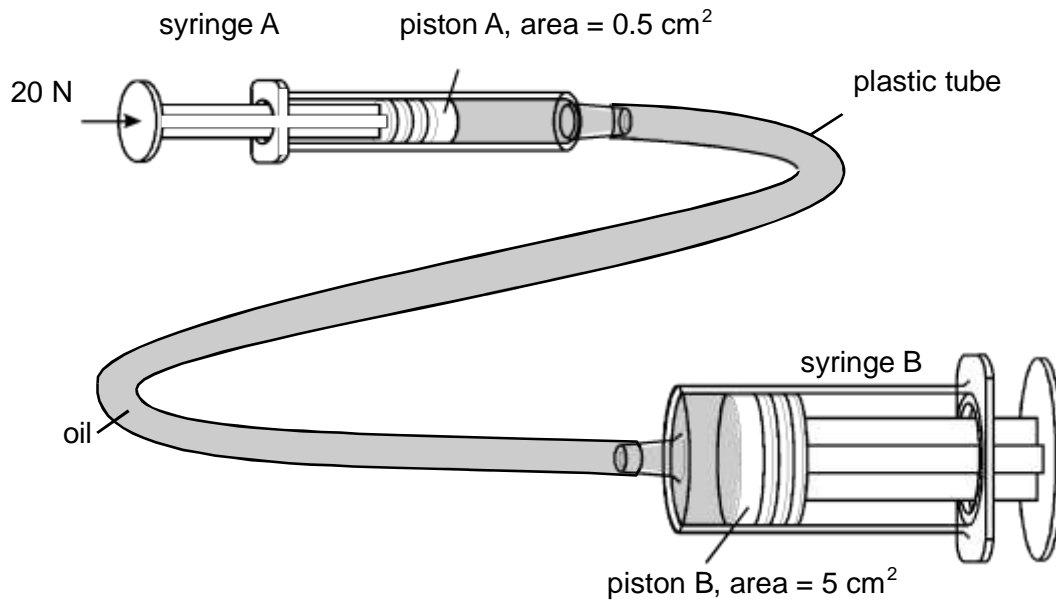
2 marks

- (ii) As the blades sink deeper into the wire, the pressure of the blades on the wire decreases.  
Explain why the pressure on the wire decreases.

.....  
.....

1 mark  
Maximum 6 marks

5. (a) Two syringes are connected together as shown in the diagram below.



A force of 20 N is applied to the piston in syringe A.

- (i) Calculate the pressure that the piston in syringe A exerts on the oil. Give the units.

.....  
.....

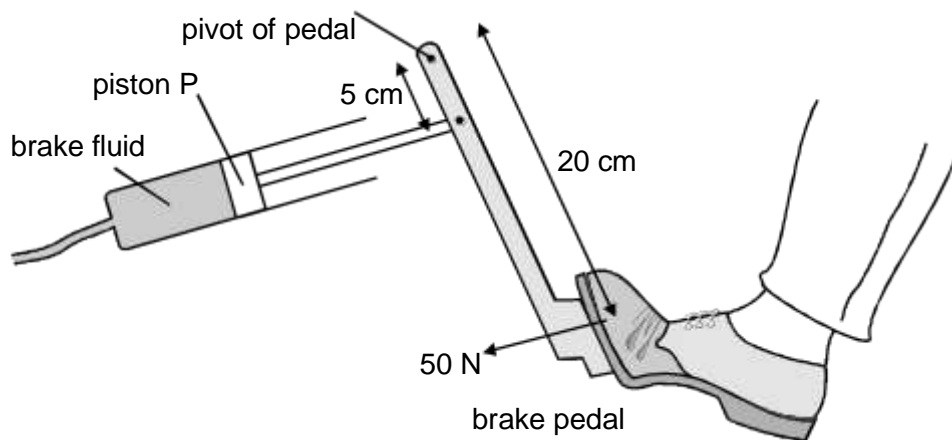
1 mark

- (ii) Calculate the force needed to just prevent the piston in syringe B from moving out. Give the unit.

.....  
.....

1 mark

- (b) The diagram below shows the brake pedal used to operate the brakes in a car. The foot applies a force of 50 N.



- (i) Calculate the force applied to the piston P. Give the unit.

.....  
.....

1 mark

- (ii) The brake fluid pushes another piston, Q, which is attached to the car's brakes.  
Piston Q has an area which is eight times larger than piston P.

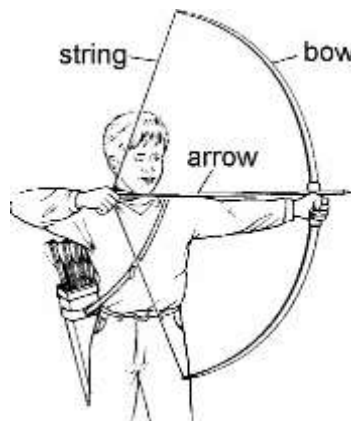
Calculate the force on the car's brakes. Give the unit.

.....  
.....

1 mark

Maximum 4 marks

- 6. The drawing shows a boy with a bow and arrow. He is holding the **arrow** and pulling it back.



- (a) Two horizontal forces act on the arrow. These are the force exerted by the boy's hand and the force exerted by the string. The arrow is **not** moving.

The boy pulls the arrow with a force of 150 N. What is the size of the force exerted by the string on the arrow?

..... N

1 mark

(b) When the boy lets go of the arrow, it starts to move forward.

Explain why it starts to move.

.....  
.....

1 mark

(c) The arrow flies across a field and hits a target.

Two forces act on the arrow while it is in the air. Air resistance acts in the opposite direction to the movement, and gravity acts downwards. These two forces **cannot** balance each other, even when they are the same size. Why is this?

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1 mark

(d) The arrow has a sharp pointed end. When the arrow hits the target, the sharp point exerts a very large pressure on the target.

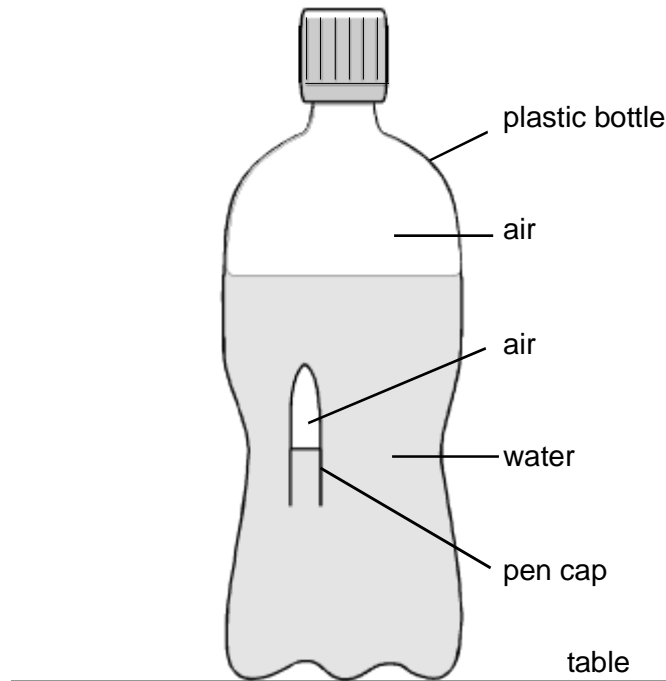
Why does a sharp pointed end exert a larger pressure than a blunt end?

.....  
.....

1 mark

Maximum 4 marks

7. A pen cap floats in a plastic lemonade bottle three-quarters full of water. If you squeeze the bottle the pen cap sinks to the bottom. If you then let go of the bottle, the pen cap floats to the surface.



(a) When the bottle is squeezed what, if anything, happens to:

(i) the distance between the air molecules inside the bottle?  
.....

1 mark

(ii) the distance between the water molecules inside the bottle?  
.....

1 mark

(iii) the pressure of the air trapped inside the pen cap?  
.....

1 mark

(iv) the volume of the air trapped inside the pen cap?  
.....

1 mark

(b) Explain why the pen cap sinks when you squeeze the bottle.

.....

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2 marks

Maximum 6 marks