**Name of the Student**:_____

**Max. Marks : 22 Marks** **Time : 22 Minutes**

## Q1.

A door is fitted with a security lens and a lock.

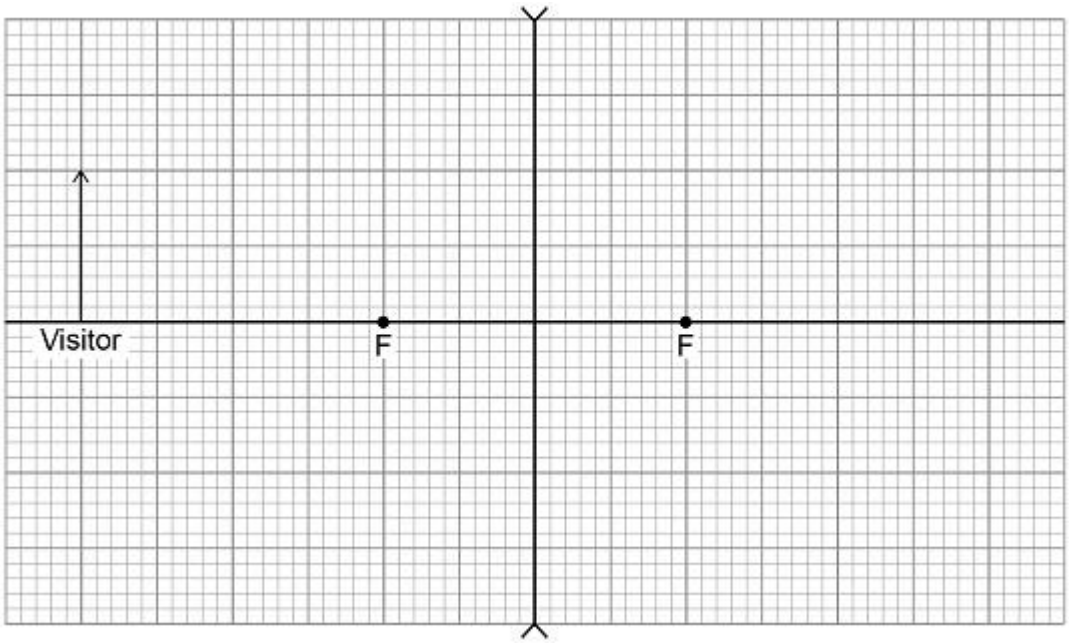
The security lens allows a person to see a visitor before opening the door.

The security lens is concave.

(a) The diagram below is an incomplete ray diagram representing a visitor standing near the security lens.

Complete the diagram to show how an image of the visitor is formed by the concave lens.

Draw an arrow to represent the image.




**(3)**

(b) The visitor moves further away from the security lens in the door.

How does the size of the image change?

Tick (✓) **one** box.

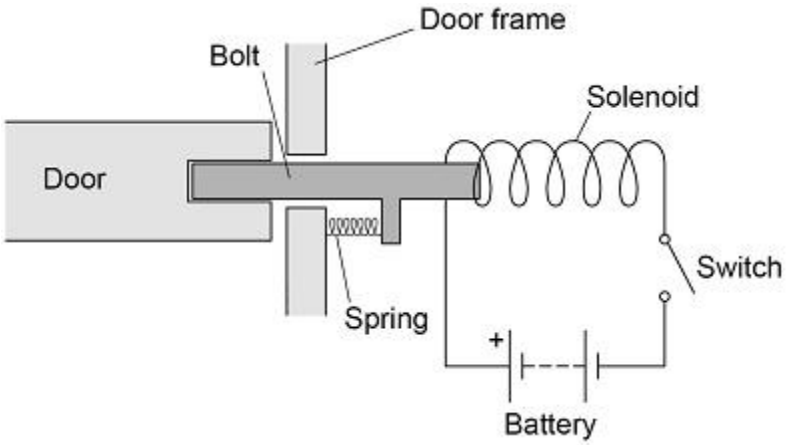
Decreases ☐

Increases ☐

Stays the same ☐

**(1)**

The diagram below shows a diagram of the lock. The door unlocks when the switch is closed.




(c) Which material should the bolt be made from?

Tick (✓) **one** box.

Aluminium ☐

Brass ☐

Copper ☐

Iron ☐

**(1)**

(d) Explain why the door unlocks when the switch is closed.

_____

_____

_____

_____

_____

_____

**(3)**

(e) When the door unlocks, a force of 2.88 N is applied to the spring.

The spring extends by 1.50 cm.

Calculate the spring constant of the spring.

_____

_____

_____

_____

_____

Spring constant = _____ N/m

**(4)**

(f) Give **two** ways the resultant force on the bolt could be increased.

1 _____

_____

2 _____

_____

**(2)**

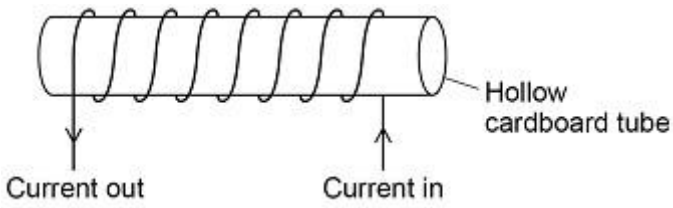
**(Total 14 marks)**

## Q2.

(a) **Figure 1** shows a solenoid.

Draw the magnetic field of the solenoid on **Figure 1**.

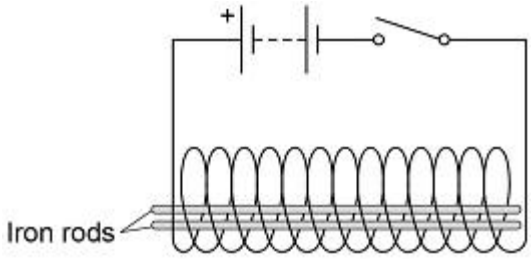
**Figure 1**




**(2)**

(b) **Figure 2** shows two iron rods placed inside a solenoid.

**Figure 2**




Explain why the iron rods move apart when the switch is closed.

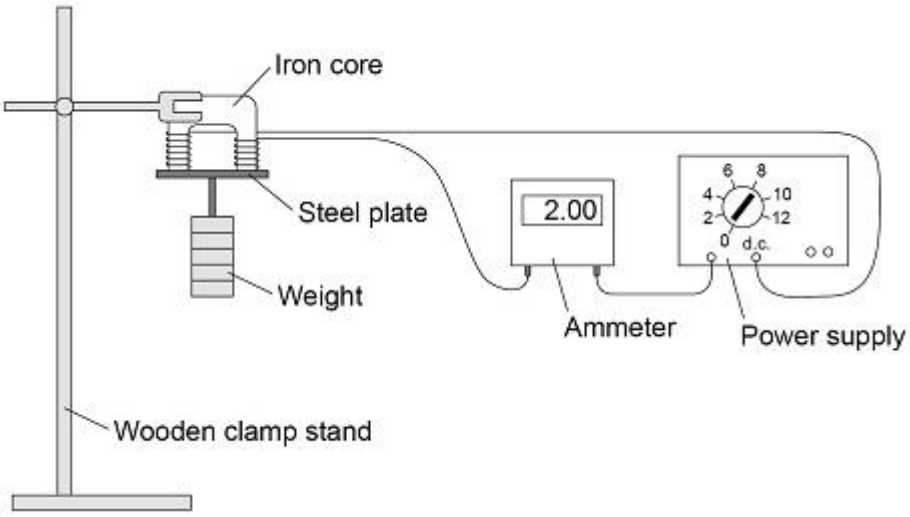
**(2)**

A student investigated the strength of an electromagnet.

The student investigated how the strength depended on:
- the current in the wire
- the number of turns of wire around the iron core.

**Figure 3** shows the equipment used.

**Figure 3**




The student measured the strength of the electromagnet as the maximum weight the electromagnet could hold.

(c) The following table shows the results.

| Current in amps | Number of turns of wire | Maximum weight in newtons |
|---|---|---|
| 1.0 | 30 | 6.5 |
| 1.5 | 20 | 6.4 |
| 2.0 | 10 | 3.7 |

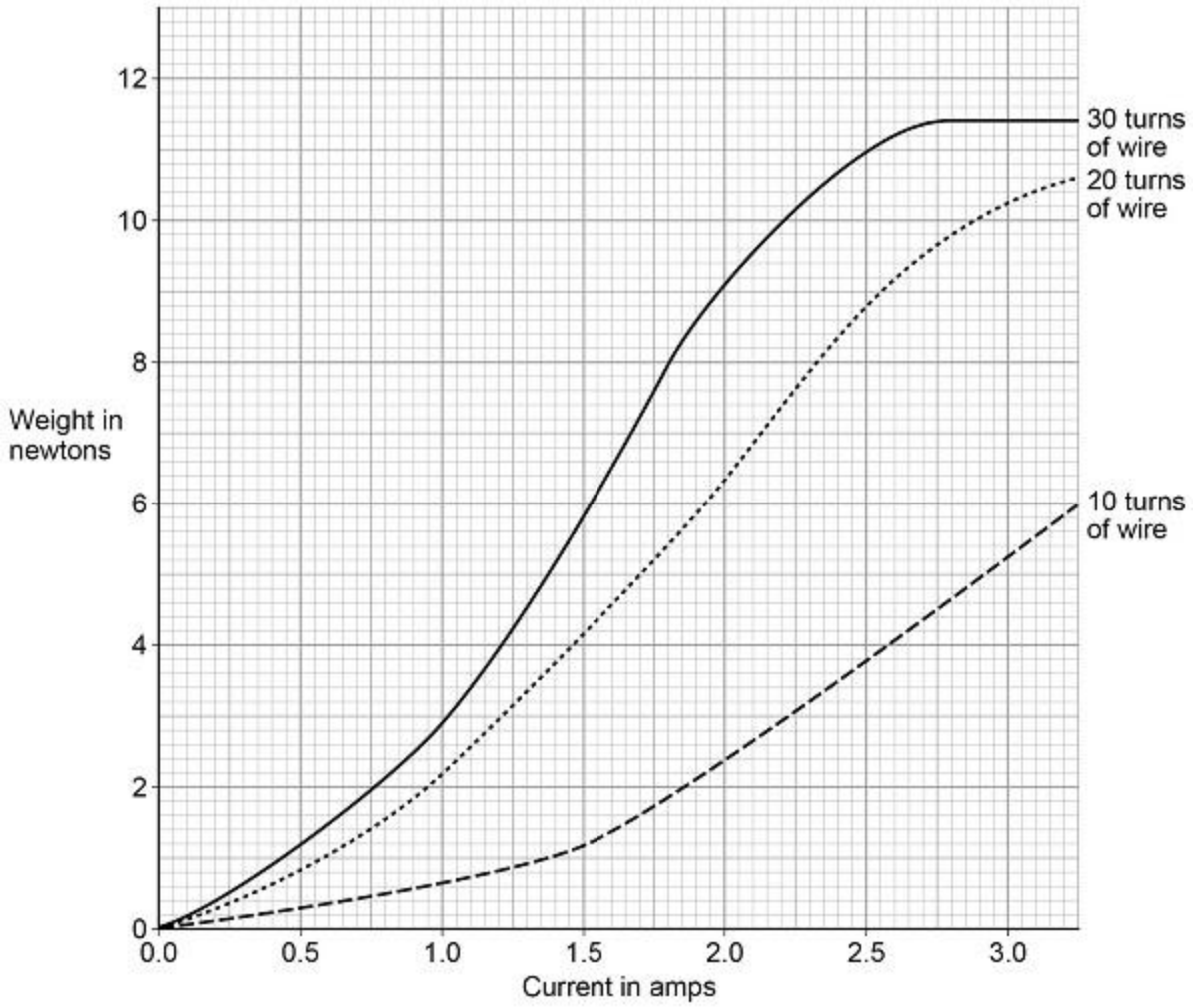
Explain why the method used by the student is **not** valid for this investigation.

**(2)**

A second student repeated the investigation using the same equipment.

**Figure 4** shows the second student's results.

**Figure 4**




(d) How does increasing the current in the wire affect the strength of the electromagnet, when the electromagnet has 30 turns of wire?

**(1)**

(e) How does increasing the number of turns of wire from 10 to 20 affect the strength of the electromagnet, compared to increasing the number of turns of wire from 20 to 30?

_____

_____

_____

**(1)**

**(Total 8 marks)**