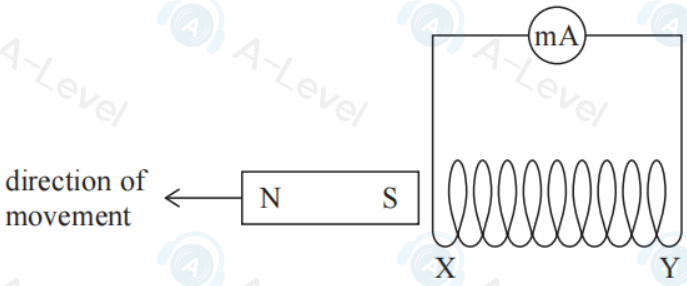
4 Which of the following is a possible unit for magnetic flux?

- ☒ **A** Tm^2
- ☒ **B** Tm^{-2}
- ☒ **C** Wbm^2
- ☒ **D** Wbm^{-2}

(Total for Question 4 = 1 mark)

8 A magnet is moved away from a coil, as shown.



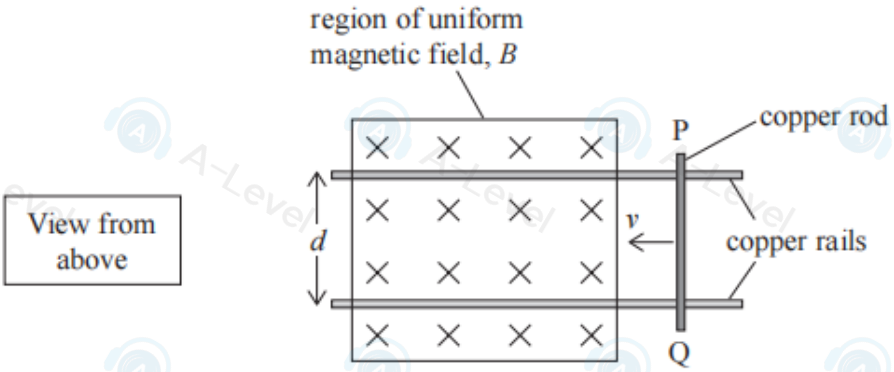
A current is produced in the coil, which creates a magnetic field around the coil.

Which row of the table shows the magnetic pole at X and the magnetic pole at Y?

	Magnetic pole at X	Magnetic pole at Y
☒ **A**	north	north
☒ **B**	north	south
☒ **C**	south	north
☒ **D**	south	south

(Total for Question 8 = 1 mark)

17 A copper rod, PQ, is moved with a velocity v along a pair of copper rails, as shown. The rails are a distance d apart.



The rod and rails are in a uniform magnetic field that is directed vertically downwards.

(a) Calculate the e.m.f. induced across the copper rod.

$B = 150\,\text{mT}$
$v = 3.5 \times 10^{-2}\,\text{m s}^{-1}$
$d = 7.5\,\text{cm}$

(3)

Induced e.m.f. = ...

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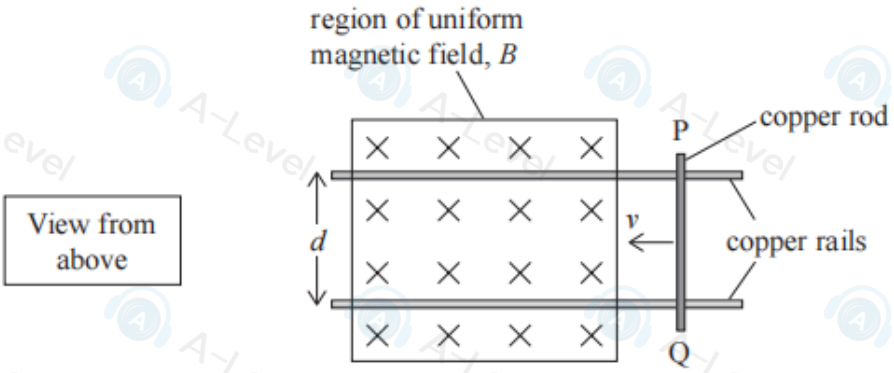

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(3)

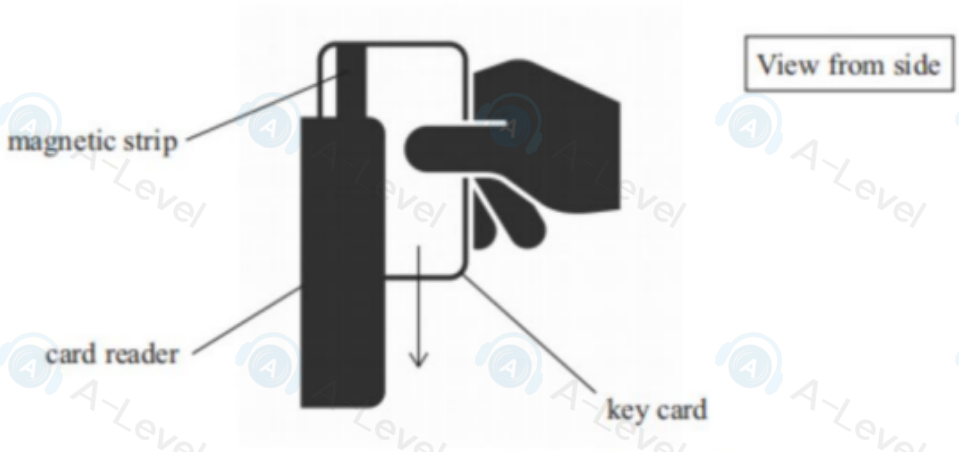
Induced e.m.f. = ...

(b) Explain the direction of the induced e.m.f.

(3)

(Total for Question 17 = 6 marks)

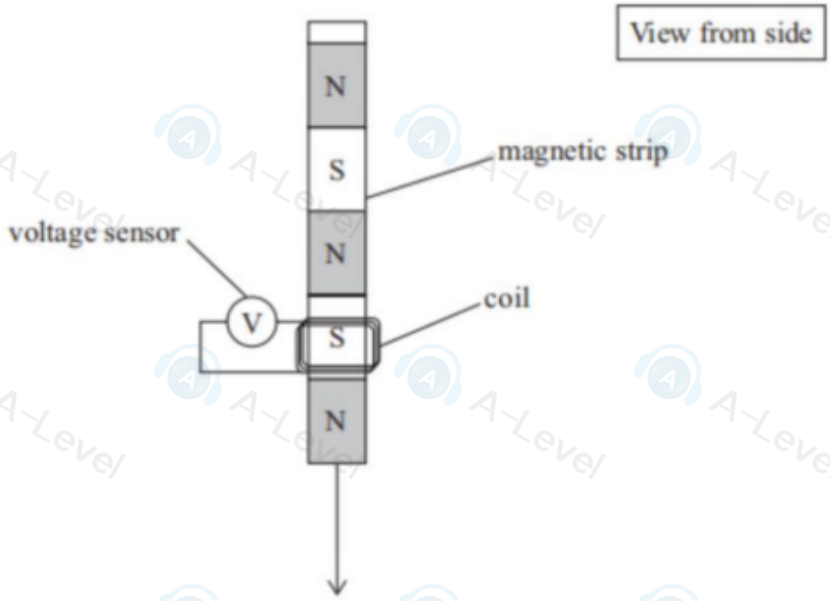
18 The diagram shows a key card and a card reader used to unlock a door. To unlock the door the key card is moved downwards through the card reader.



(Source: © Janis Abolins/Shutterstock)

The key card contains a magnetic strip consisting of many tiny bar magnets arranged side by side. The orientation of the magnetic poles of the bar magnets stores the code to unlock the door.

In the card reader there is a coil connected to a voltage sensor, as shown below.



(a) Explain how the voltage sensor detects the orientation of the magnetic poles.

(4)

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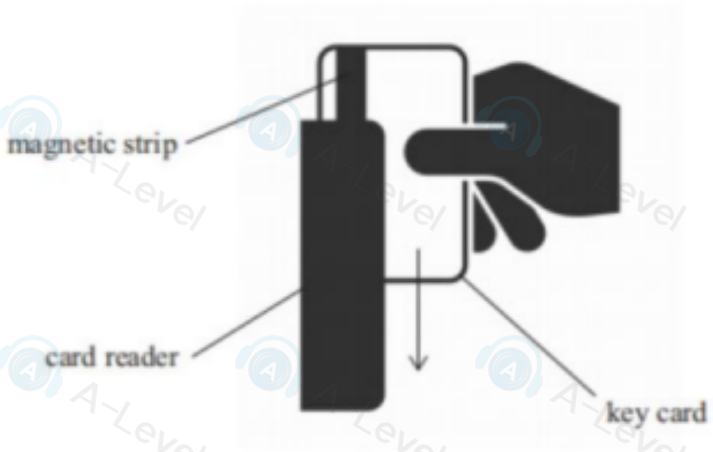

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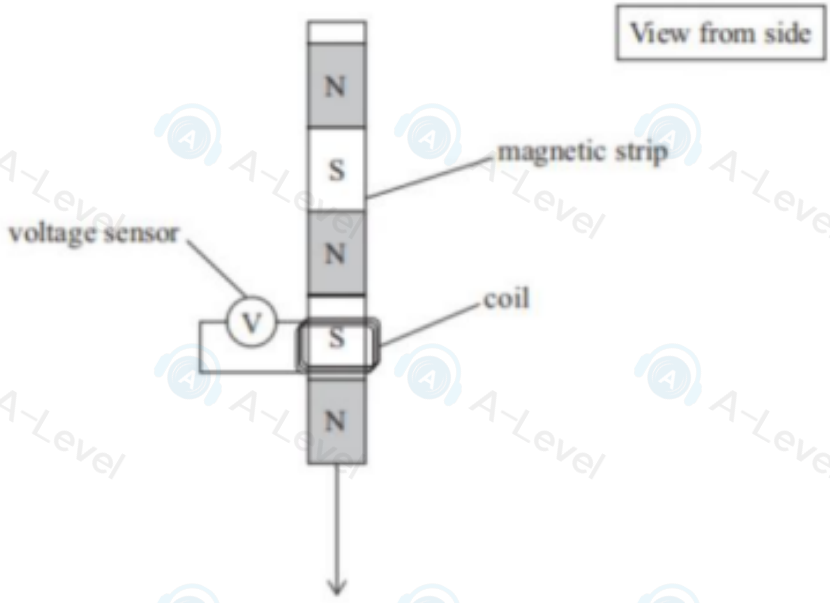


(a) Explain how the voltage sensor detects the orientation of the magnetic poles.

(4)

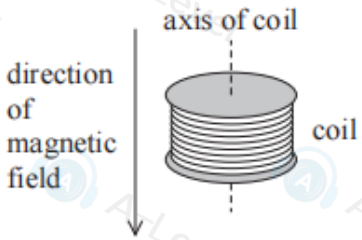
(b) The card reader can determine the orientation of a magnetic pole if the reading on the voltage sensor is greater than 1.5×10^{-6} V.

The key card is moved down a distance of 9.0 cm through the card reader in a time

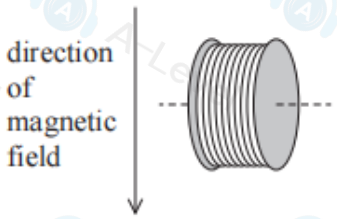
16 A search coil is used to investigate magnetic fields.

The search coil consists of a coil of thin copper wire connected to two output terminals, as shown.

A student placed the coil in a magnetic field with the axis parallel to the direction of the field, as shown.



The coil was rotated through 90° so the axis was perpendicular to the direction of the field, as shown.



As the coil was rotated, a potential difference (p.d.) was detected across the terminals.

(a) Explain why a p.d. was produced as the coil was rotated.

(2)

.....

.....

.....

.....

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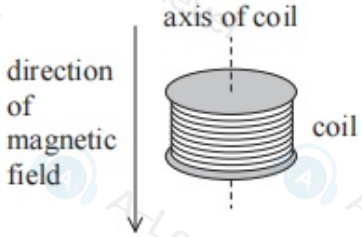

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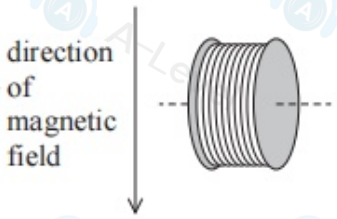

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(a) Explain why a p.d. was produced as the coil was rotated.

(2)

(b) Show that the initial value of magnetic flux in the coil is about 9×10^{-5} Wb.

diameter of coil = 25 mm
magnetic flux density = 0.18 T

(3)

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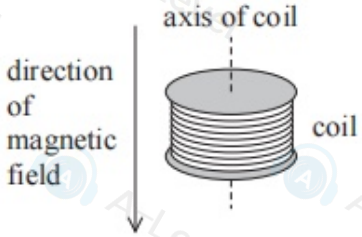

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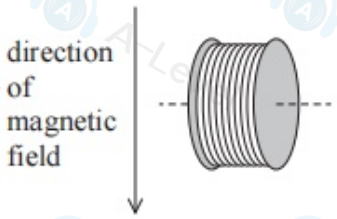

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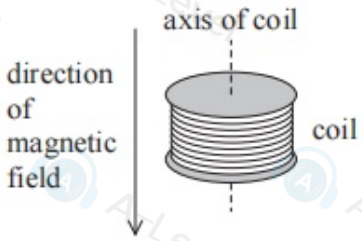

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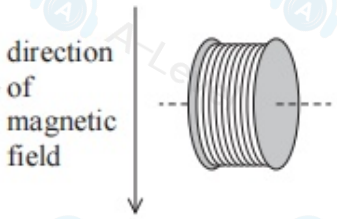

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(2)

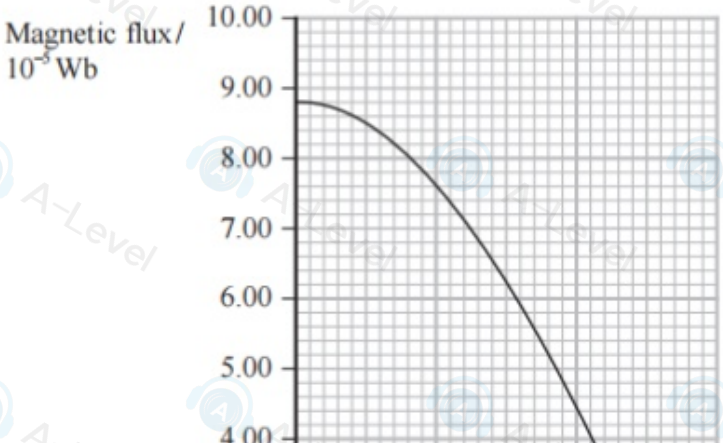
.....

.....

.....

.....

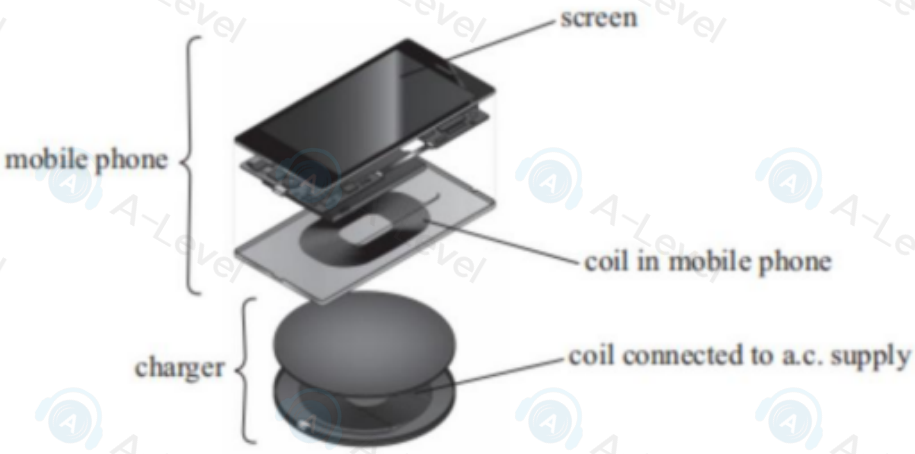
(c) The graph shows the magnetic flux in the coil while the coil was being rotated.



18: Some mobile phones can be charged using a 'wireless' charger. To charge the mobile phone, the charger is connected to a power supply. The mobile phone is placed near to the charger, as shown.

(Source: © Lee Charlie/Shutterstock)

There is an alternating current (a.c.) in a coil in the charger. There is a second coil of wire in the mobile phone. A diagram of the charger and mobile phone is shown below.



(Source: © Zern Liew/Shutterstock)

(a) Explain how the mobile phone charges when placed near to the charger.

(4)

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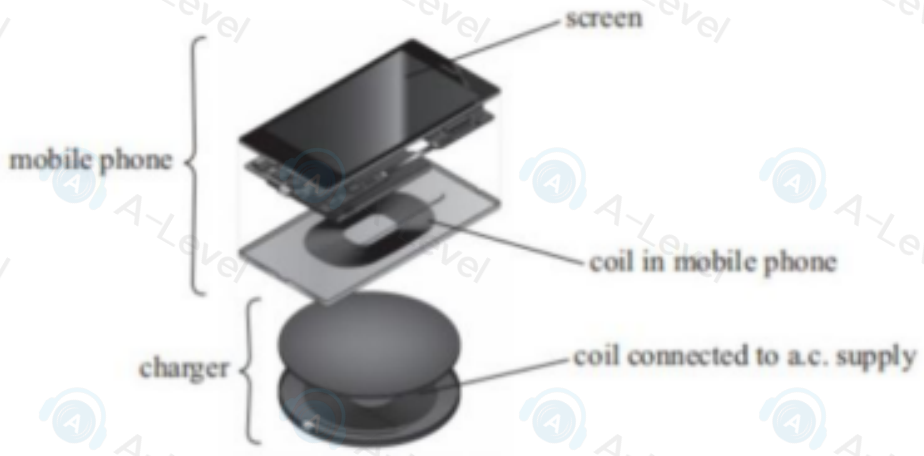

(Source: © Zern Liew/Shutterstock)

(a) Explain how the mobile phone charges when placed near to the charger.

(4)

(b) A teacher demonstrated a simplified version of the charger to her class. She used two identical coils. She attached one coil to an a.c. supply and the other coil to a digital voltmeter.

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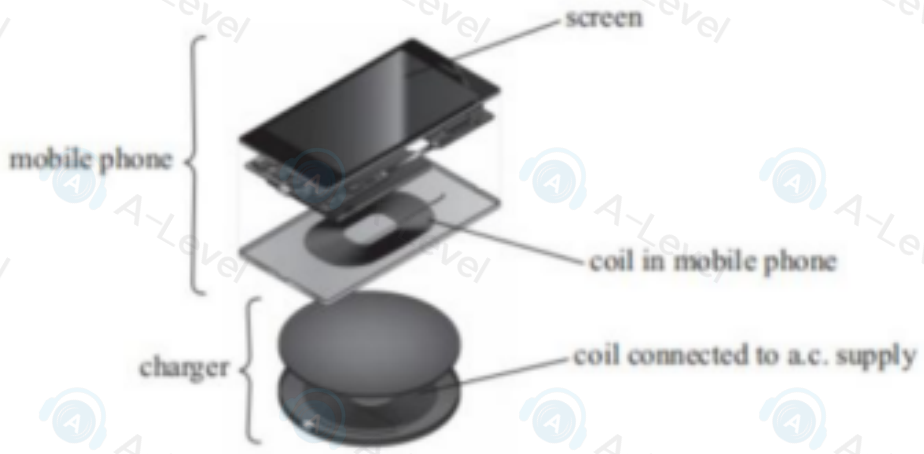

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