

# Alternating Current & Transformers

## TOPIC QUESTIONS

<b>Level</b>	<b>AS Level</b>
<b>Subject</b>	<b>Physics</b>
<b>Exam Board</b>	<b>AQA</b>
<b>Paper Type</b>	<b>Multiple Choice</b>

Time Allowed : 30min



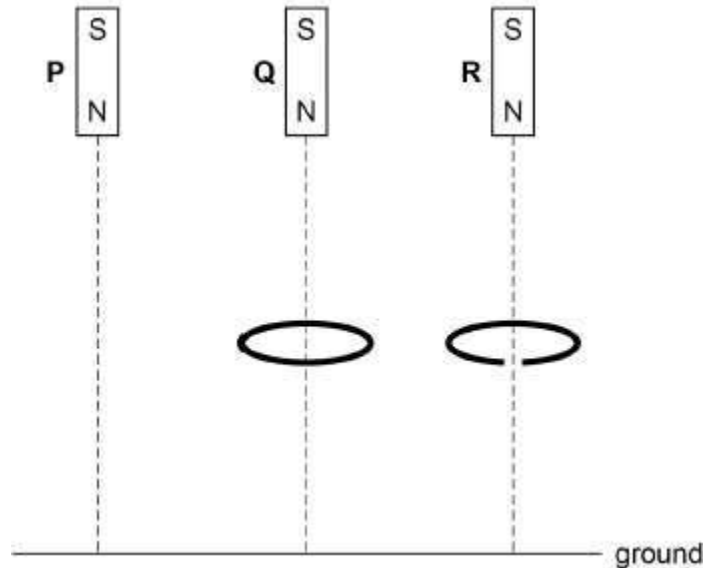
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1. Three identical magnets **P**, **Q** and **R** are released simultaneously from rest and fall to the ground from the same height.

**P** falls directly to the ground.

**Q** falls through the centre of a thick horizontal conducting ring.

**R** falls through a similar ring that has a gap cut into it.



In which order do the magnets reach the ground?

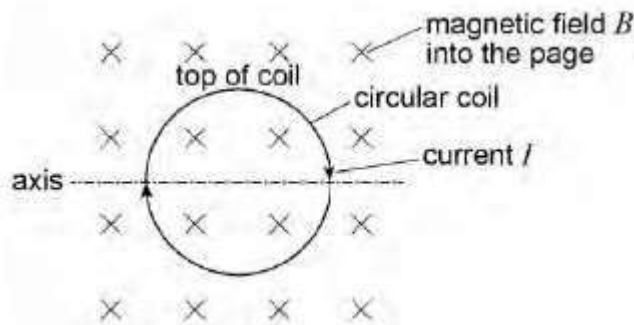
- A **P** and **R** arrive together, followed by **Q**.
- B **P** and **Q** arrive together, followed by **R**.
- C **P** arrives first, followed by **Q** which is followed by **R**.
- D All three magnets arrive simultaneously.

2. A transformer has an efficiency of 80%  
 It has 7000 turns on its primary coil and 175 turns on its secondary coil. When the primary of the transformer is connected to a 240 V ac supply, the secondary current is 8.0 A

What are the primary current and secondary voltage?

	Primary current / mA	Secondary voltage / V
<b>A</b>	250	6.0
<b>B</b>	160	6.0
<b>C</b>	250	9600
<b>D</b>	160	9600

3. The diagram shows a clockwise current  $I$  in a circular coil placed in a uniform magnetic field  $B$  with the plane of the coil perpendicular to the magnetic field.



What is the effect on the coil of the interaction between the current and the magnetic field?

- A** It rotates about the axis with the top moving out of the page.
- B** It rotates about the axis with the top moving into the page.
- C** It causes an increase in the diameter of the coil.

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D It causes a decrease in the diameter of the coil.

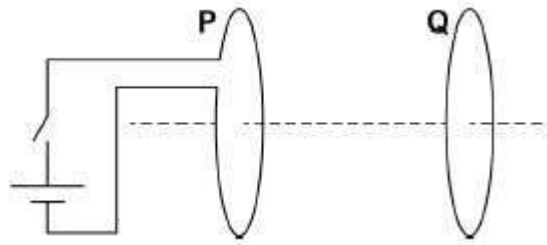


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4. A coil **P** is connected to a cell and a switch.

A second closed coil **Q** is parallel to **P** and is arranged on the same axis.

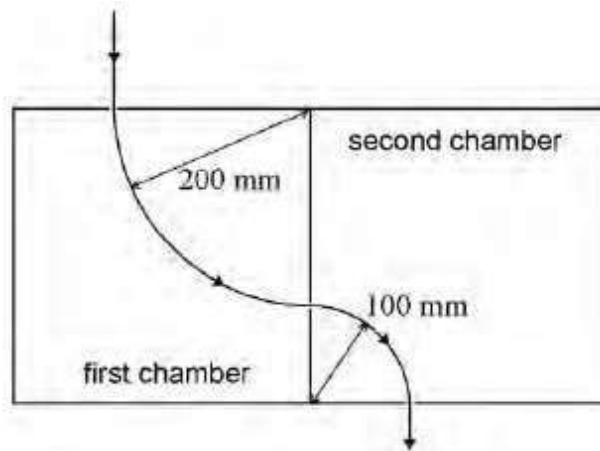


When the switch is closed, coil **Q** experiences a force.

Which row describes the force on **Q**?

	Force	Direction of force
<b>A</b>	increases to constant value	to left
<b>B</b>	increases to constant value	to right
<b>C</b>	increases then decreases	to left
<b>D</b>	increases then decreases	to right

5. Different magnetic fields are present in the two chambers shown. A particle enters the first chamber at a velocity of  $80 \text{ m s}^{-1}$  and is deflected into a circular path of radius  $200 \text{ mm}$ . In the second chamber it follows a circular path of radius  $100 \text{ mm}$ .



The particle leaves the second chamber at a speed of

- A**  $20 \text{ m s}^{-1}$                       **B**  $40 \text{ m s}^{-1}$                       **C**  $80 \text{ m s}^{-1}$                       **D**  $160 \text{ m s}^{-1}$

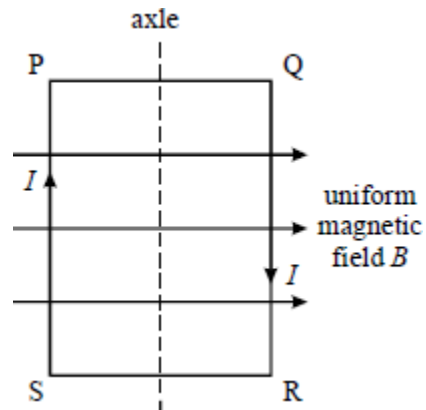
6. An electron moves due North in a horizontal plane with uniform speed. It enters a uniform magnetic field directed due South in the same plane. Which one of the following statements concerning the motion of the electron in the magnetic field is correct?

- A** It continues to move North with its original speed.  
**B** It slows down to zero speed and then accelerates due South.  
**C** It is accelerated due West.  
**D** It is accelerated due North.

7. Which line, **A** to **D**, gives correct units for both magnetic flux and magnetic flux density?

	magnetic flux	magnetic flux density
<b>A</b>	$\text{Wb m}^{-2}$	$\text{Wb}$
<b>B</b>	$\text{Wb}$	$\text{T}$
<b>C</b>	$\text{Wb m}^{-2}$	$\text{T m}^{-2}$
<b>D</b>	$\text{T m}^{-2}$	$\text{Wb m}^{-2}$

8.

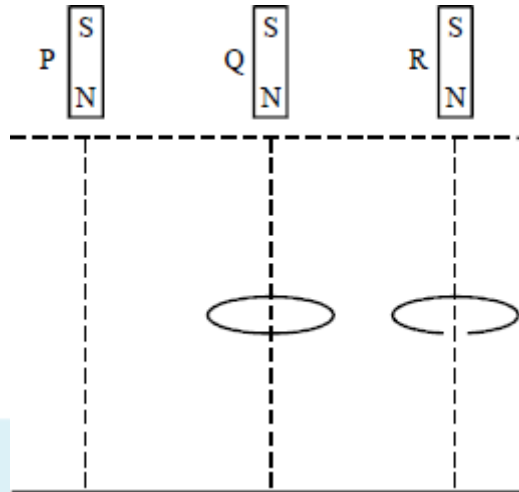


A coil, mounted on an axle, has its plane parallel to the flux lines of a uniform magnetic field  $B$ , as shown. When a current  $I$  is switched on, and before the coil is allowed to move,

- A there are no forces due to  $B$  on the sides SP and QR.
- B there are no forces due to  $B$  on the sides PQ and RS.
- C sides SP and QR tend to attract each other.
- D sides PQ and RS tend to attract each other.



9 9.

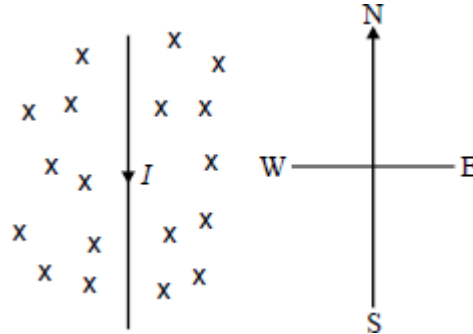


Three identical magnets P, Q and R are released simultaneously from rest and fall to the ground from the same height. P falls directly to the ground, Q falls through the centre of a thick conducting ring and R falls through a ring which is identical except for a gap cut into it. Which one of the statements below correctly describes the sequence in which the magnets reach the ground?

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- A P and R arrive together followed by Q.
- B P and Q arrive together followed by R.
- C P arrives first, followed by Q which is followed by R.
- D All three magnets arrive simultaneously.

10.



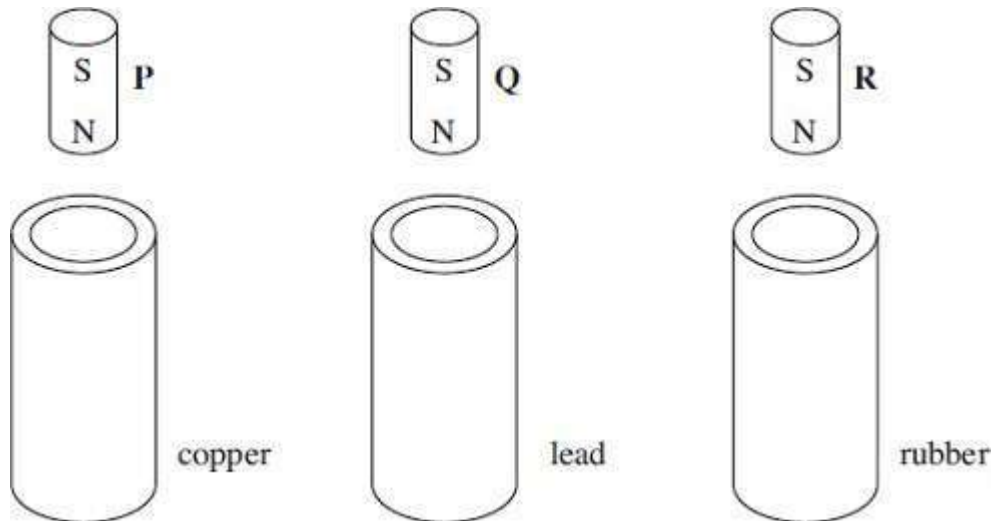
The diagram shows a wire carrying a current,  $I$ , in the plane of the paper and in the south direction. A magnetic field is applied perpendicularly to the paper and acts into the paper. What is the direction of the force acting on the wire?

- A north
- B south
- C east



D west

11. Three vertical tubes, made from copper, lead and rubber respectively, have identical dimensions. Identical, strong, cylindrical magnets P, Q and R are released simultaneously from the same distance above each tube. Because of electromagnetic effects, the magnets emerge from the bottom of the tubes at different times.



Which line, A to D, in the table shows the correct order in which they will

emerge? resistivity of copper =  $1.7 \times 10^{-8} \Omega\text{m}$

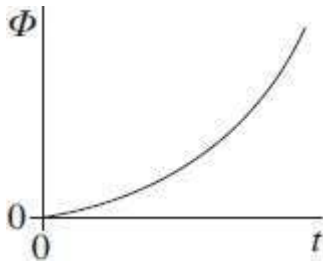
resistivity of lead =  $22 \times 10^{-8}$

$\Omega\text{m}$  resistivity of rubber =  $50 \times$

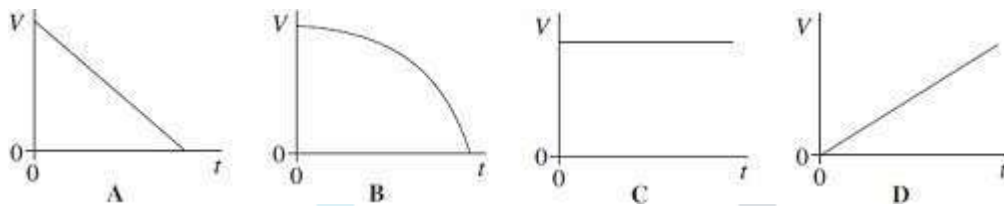
$10^{13} \Omega\text{m}$

	emerges first	emerges second	emerges third
A	P	Q	R
B	R	P	Q
C	P	R	Q
D	R	Q	P

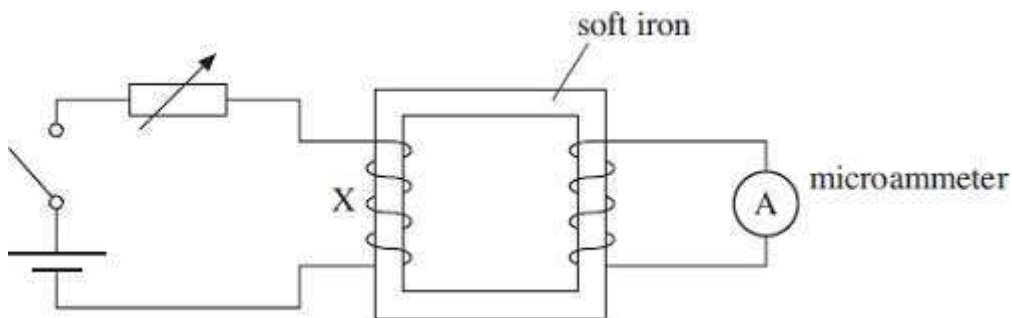
12. The graph shows how the magnetic flux,  $\Phi$ , passing through a coil changes with time,  $t$ .



Which one of the following graphs could show how the magnitude of the emf,  $V$ , induced in the coil varies with  $t$ ?



13. Using the circuit shown, and with the switch closed, a small current was passed through the coil X. The current was slowly increased using the variable resistor. The current reached a maximum value and was then switched off.



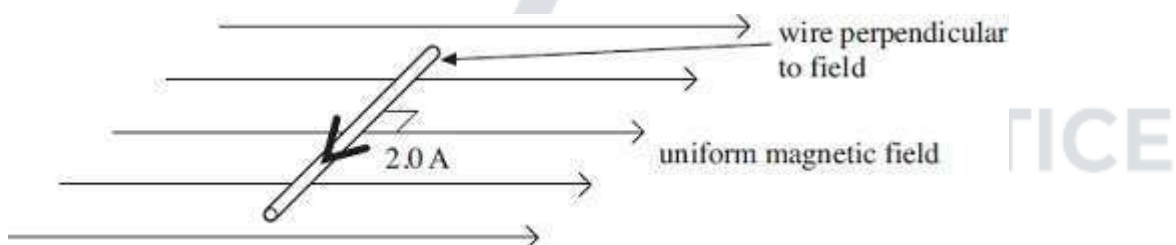
The maximum reading on the microammeter occurred when

- A the small current flowed at the start.
- B the current was being increased.
- C the current was being switched off.
- D the current in X was zero.

14. When a mobile phone is being recharged, the charger heats up. The efficiency of the transformer in the charger can be as low as 15% when drawing a current of 50 mA from a 230 V mains supply. If the charging current required is 350 mA, what is the approximate output voltage at this efficiency?

- A 4.9 V
- B 11 V
- C 28 V
- D 33 V

15. A horizontal straight wire of length 0.30 m carries a current of 2.0 A perpendicular to a horizontal uniform magnetic field of flux density  $5.0 \times 10^{-2}$  T. The wire 'floats' in equilibrium in the field.

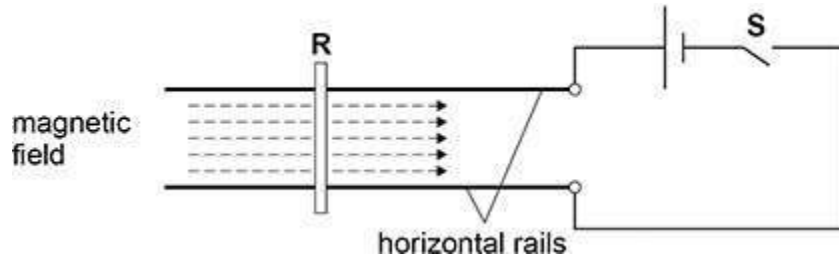


What is the mass of the wire?

- A  $8.0 \times 10^{-4}$  kg
- B  $3.1 \times 10^{-3}$  kg
- C  $3.0 \times 10^{-2}$  kg

D  $8.2 \times 10^{-1} \text{ kg}$

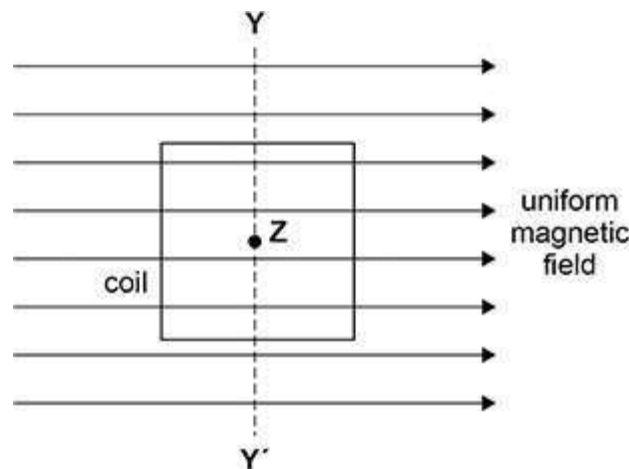
16. A short copper rod **R** is placed on a pair of thick horizontal parallel copper rails. A horizontal magnetic field exists in the direction shown by the dashed arrows. The diagram shows the apparatus when viewed from directly above.



When switch **S** is closed, **R** will tend to

- A lift upwards away from the rails.
- B move to the left.
- C move to the right.
- D be pressed downwards onto the rails.

17. The diagram shows a square coil with its plane parallel to a uniform magnetic field.



The coil always remains within the magnetic field.  
There are four possible changes to the position of the coil:

- moving it to the left
- moving it towards **Y**

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- rotating it about the axis  $YY'$
- rotating it about an axis  $Z$  that is at its centre and perpendicular to the plane of the coil.



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How many of these changes will result in an induced emf in the coil while the change occurs?

- A one
- B two
- C three
- D four

18. Mains electricity is rated 230 V in the UK. Which is correct?

- A The mean voltage is 163 V.
- B The peak voltage is 230 V.
- C The root mean square voltage is 325 V.
- D The peak-to-peak voltage is 650 V.

19. In a resistor of resistance  $R$ , a steady current  $I$  dissipates a power  $P$ .

In a resistor of resistance  $\frac{R}{2}$  there is an alternating current of root mean square value  $3I$ .

What is the mean power dissipated in the resistor of resistance  $\frac{R}{2}$ ?

- A  $9P$
- B  $\frac{9}{2}P$
- C  $\frac{9}{4}P$
- D  $\frac{3}{2}P$



20. The primary winding of a transformer has 200 turns and the secondary winding has 1600 turns. A root mean square (rms) alternating voltage of 25 V is applied to the primary winding causing a primary rms current of 4.0 A. The transformer is 90% efficient.

What are the rms values of the secondary voltage and the secondary current?

	Secondary voltage / V	Secondary current / A
<b>A</b>	200	0.50
<b>B</b>	200	0.45
<b>C</b>	180	0.50
<b>D</b>	3.1	29.0