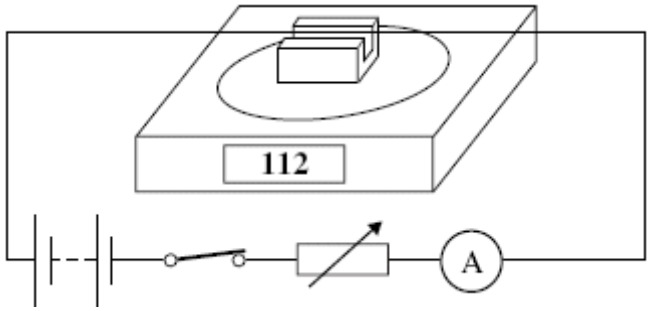
**Q1.** The diagram shows a rigidly-clamped straight horizontal current-carrying wire held mid-way between the poles of a magnet on a top pan balance. The wire is perpendicular to the magnetic field direction.




The balance, which was zeroed before the switch was closed, reads 112 g after the switch is closed. If the current is reversed and doubled, what will be the new reading on the balance?

**A** –224 g

**B** –112 g

**C** zero

**D** 224 g

**(Total 1 mark)**

**Q2.** An electron moving with a constant speed enters a uniform magnetic field in a direction at right angles to the field. What is the subsequent path of the electron?

**A** A straight line in the direction of the field.

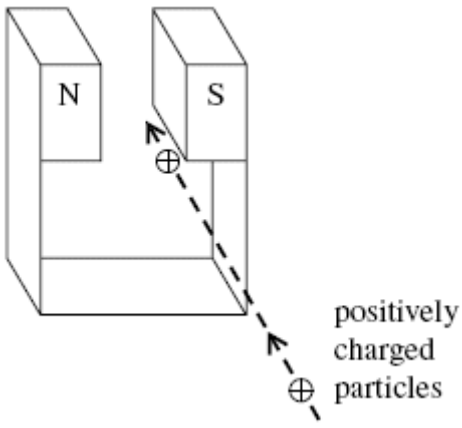
**B** A straight line in a direction opposite to that of the field.

**C** A circular arc in a plane perpendicular to the direction of the field.

**D** An elliptical arc in a plane perpendicular to the direction of the field.

**(Total 1 mark)**

**Q3.** A jet of air carrying positively charged particles is directed horizontally between the poles of a strong magnet, as shown in the diagram.




In which direction are the charged particles deflected?

**A** upwards

**B** downwards

**C** towards the N pole of the magnet

**D** towards the S pole of the magnet

**(Total 1 mark)**

**Q4.** Which one of the following could **not** be used as a unit of force?

**A** A T m

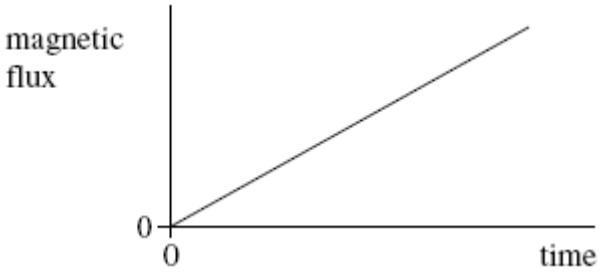
**B** W $s^{-2}$

**C** kg m $s^{-2}$

**D** J $m^{-1}$

**(Total 1 mark)**

**Q5.** The graph shows how the magnetic flux passing through a loop of wire changes with time.




What feature of the graph represents the magnitude of the emf induced in the coil?

**A** the area enclosed between the graph line and the time axis

**B** the area enclosed between the graph line and the magnetic flux axis

**C** the inverse of the gradient of the graph

**D** the gradient of the graph

**(Total 1 mark)**

**Q6.** A coil rotating in a magnetic field produces the following voltage waveform when connected to an oscilloscope.


With the same oscilloscope settings, which one of the following voltage waveforms would be produced if the coil were rotated at twice the original speed?

**A**


**B**


**C**


**D**


**(Total 1 mark)**

**Q7.** A 230 V, 60 W lamp is connected to the output terminals of a transformer which has a 200 turn primary coil and a 2000 turn secondary coil. The primary coil is connected to an ac source with a variable output pd. The lamp lights at its normal brightness when the primary coil is supplied with an alternating current of 2.7 A.

What is the percentage efficiency of the transformer?

**A** 3%

**B** 10%

**C** 97%

**D** 100%

**(Total 1 mark)**

**Q8.** 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 accelerated due West.

**B** It slows down to zero speed and then accelerates due South.

**C** It continues to move North with its original speed.

**D** It is accelerated due North.

**(Total 1 mark)**

**Q9.** Particles of mass *m*, each carrying charge *Q* and travelling with speed *v*, enter a magnetic field of flux density *B* at right angles. Which one of the following changes would produce an increase in the radius of the path of the particles?

**A** an increase in *Q*

**B** an increase in *m*

**C** a decrease in *v*

**D** an increase in *B*

**(Total 1 mark)**

**Q10.** The magnetic flux through a coil of *N* turns is increased uniformly from zero to a maximum value in a time *t*. An emf, *E*, is induced across the coil.
What is the maximum value of the magnetic flux through the coil?

**A** $\frac{Et}{N}$

**B** $\frac{N}{Et}$

**C** $E\,t\,N$

**D** $\frac{E}{Nt}$

**(Total 1 mark)**

**Q11.** An aircraft, of wing span 60 m, flies horizontally at a speed of 150 m $s^{-1}$, If the vertical component of the Earth's magnetic field in the region of the plane is $1.0 \times 10^{-5}$ T, what emf is induced across the wing tips of the plane?

**A** 0.09 V

**B** 0.90 V

**C** 9.0 V

**D** 90 V

**(Total 1 mark)**

**Q12.** Particles of mass *m* carrying a charge *Q* travel in a circular path of radius *r* in a magnetic field of flux density *B* with a speed *v*. How many of the following quantities, if changed one at a time, would change the radius of the path?

- *m*
- *Q*
- *B*
- *v*

**A** one

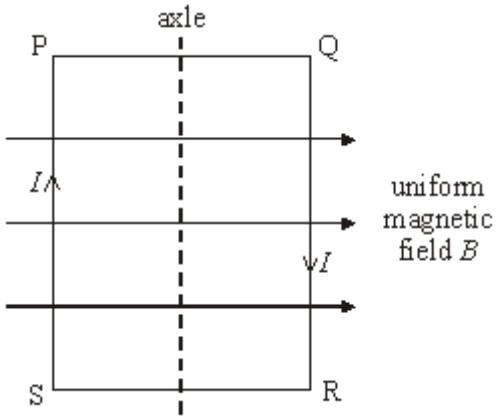
**B** two

**C** three

**D** four

**(Total 1 mark)**

**Q13.**




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 PQ and RS.

**B** there are no forces due to *B* on the sides SP and QR.

**C** sides SP and QR attract each other.

**D** sides PQ and RS attract each other.

**(Total 1 mark)**

**Q14.** Protons, each of mass *m* and charge *e*, follow a circular path when travelling perpendicular to a magnetic field of uniform flux density *B*. What is the time taken for one complete orbit?

**A** $\frac{2\pi eB}{m}$

**B** $\frac{m}{2\pi eB}$

**C** $\frac{eB}{2\pi m}$

**D** $\frac{2\pi m}{eB}$

**(Total 1 mark)**

**Q15.** The path followed by an electron of momentum $p$, carrying charge $-e$, which enters a magnetic field at right angles, is a circular arc of radius $r$.

What would be the radius of the circular arc followed by an α particle of momentum $2p$, carrying charge $+2e$, which entered the same field at right angles?

**A** $\frac{r}{2}$

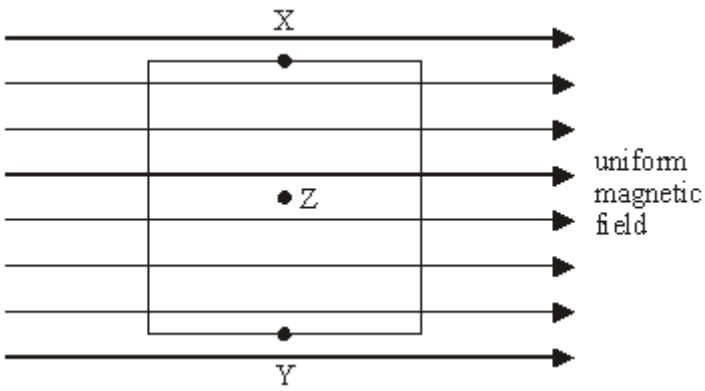
**B** $r$

**C** $2r$

**D** $4r$

**(Total 1 mark)**

**Q16.**




The diagram shows a square coil with its plane parallel to a uniform magnetic field. Which one of the following would induce an emf in the coil?

**A** movement of the coil slightly to the left

**B** movement of the coil slightly downwards

**C** rotation of the coil about an axis through XY

**D** rotation of the coil about an axis perpendicular to the plane of the coil through Z

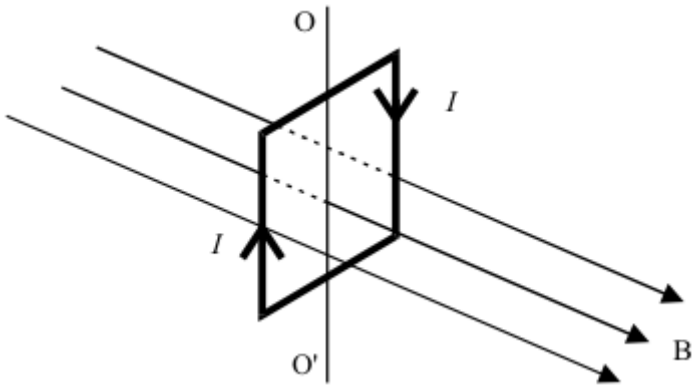
**(Total 1 mark)**

**Q17.** Which line, **A** to **D**, correctly describes the trajectory of charged particles which enter, at right angles, (a) a uniform electric field, and (b) a uniform magnetic field?

| | (a) uniform electric field | (b) uniform magnetic field |
|---|---|---|
| **A** | circular | circular |
| **B** | circular | parabolic |
| **C** | parabolic | circular |
| **D** | parabolic | parabolic |

**(Total 1 mark)**

**Q18.** The diagram shows a vertical square coil whose plane is at right angles to a horizontal uniform magnetic field B. A current, *I*, flows in the coil, which can rotate about a vertical axis OO'.




Which one of the following statements is correct?

**A** The forces on the two vertical sides of the coil are equal and opposite.

**B** A couple acts on the coil.

**C** No forces act on the horizontal sides of the coil.

**D** If the coil is turned through a small angle about OO', it will remain in position.

**(Total 1 mark)**

**Q19.** An α particle and a $\beta^-$ particle both enter the same uniform magnetic field, which is perpendicular to their direction of motion. If the $\beta^-$ particle has a speed 15 times that of the α particle, what is the value of the ratio

$$\frac{\text{magnitude of force on } \beta^- \text{particle}}{\text{magnitude of force on } \alpha \text{ particle}}$$ ?

**A** 3.7

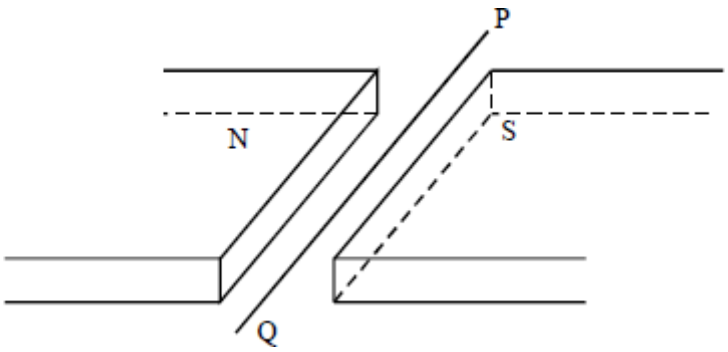
**B** 7.5

**C** 60

**D** 112.5

**(Total 1 mark)**

**Q20.**




A wire lies perpendicularly across a horizontal uniform magnetic field of flux density $20 \times 10^{-3}$ T so that 0.30 m of the wire is effectively subjected to the field. If the force exerted on this length of wire due to a current in it is $30 \times 10^{-3}$ N downward, what is the current in the wire?

**A** 0.45 A from P to Q

**B** 0.45 A from Q to P

**C** 5.0 A from P to Q

**D** 5.0 A from Q to P

**(Total 1 mark)**

**Q21.** 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.

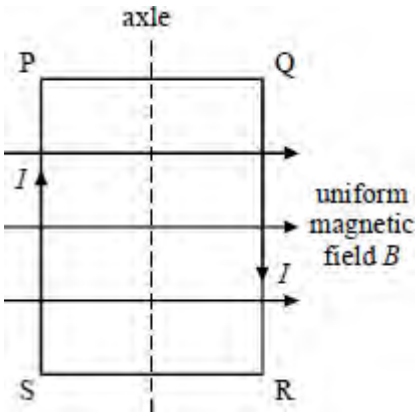
**(Total 1 mark)**

**Q22.**Which line, **A** to **D**, gives correct units for both magnetic flux and magnetic flux density?

| | magnetic flux | magnetic flux density |
|---|---|---|
| **A** | Wb $m^{-2}$ | Wb |
| **B** | Wb | T |
| **C** | Wb $m^{-2}$ | T $m^{-2}$ |
| **D** | T $m^{-2}$ | Wb $m^{-2}$ |

**(Total 1 mark)**

**Q23.**




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.

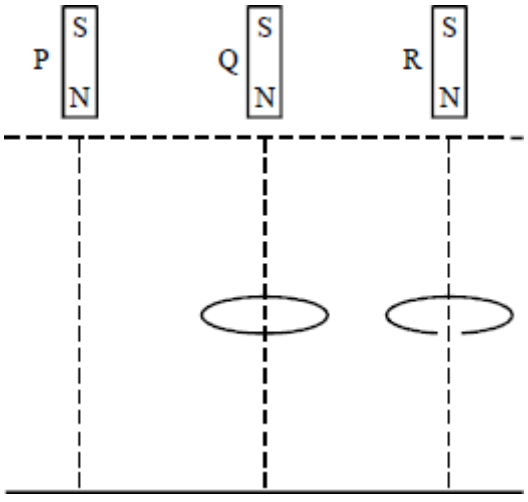
**B** there are no forces due to $B$ on the sides PQ and RS.

**C** sides SP and QR tend to attract each other.

**D** sides PQ and RS tend to attract each other.

**(Total 1 mark)**

**Q24.**




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?

**A** P and R arrive together followed by Q.

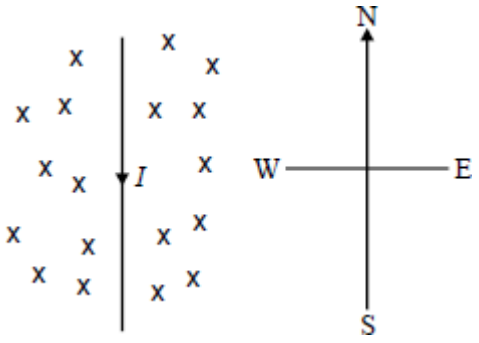
**B** P and Q arrive together followed by R.

**C** P arrives first, followed by Q which is followed by R.

**D** All three magnets arrive simultaneously.

**(Total 1 mark)**

**Q25.**




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

**(Total 1 mark)**

**Q26.** The magnetic flux threading a coil of 100 turns drops from $5 \times 10^{-3}$ Wb to zero in 0.1 s. The average induced e.m.f., in V, is

**A** 0.05

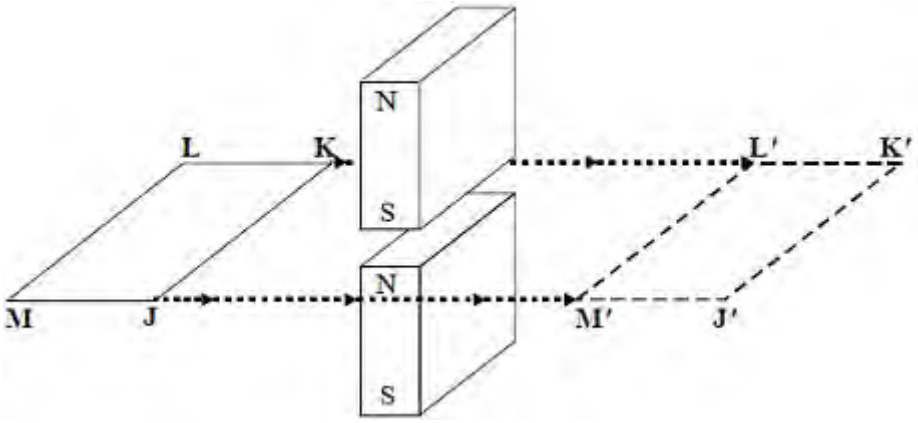
**B** 0.5

**C** 5

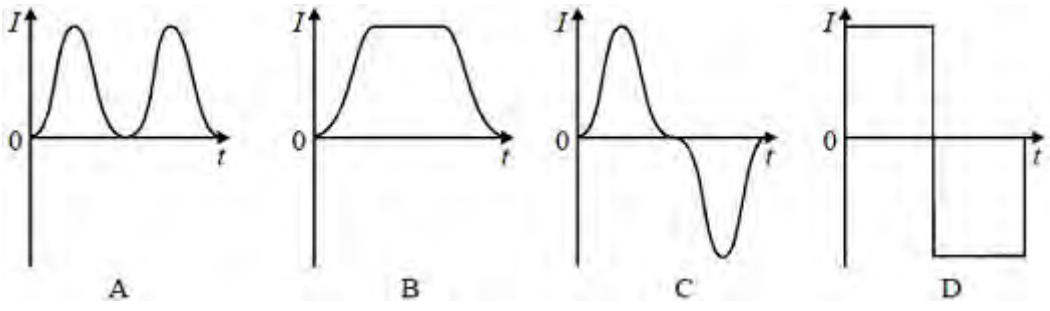
**D** 20

**(Total 1 mark)**

**Q27.** A rectangular conducting loop is pulled horizontally through the gap between two vertical magnets as shown in the diagram.

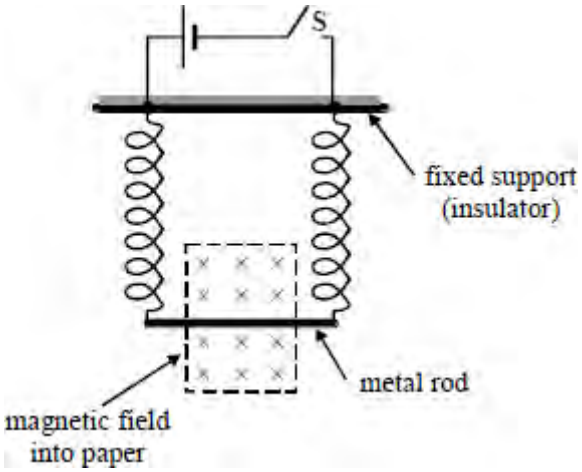



Which one of the graphs best represents the variation of loop current *I* with time *t* as the loop moves at a constant speed from **JKLM** to **J'K'L'M'**?




**(Total 1 mark)**

**Q28.** The diagram shows a metal rod suspended in a magnetic field by two vertical conducting springs. The cell and rod have negligible resistance. When the switch **S** is closed the effect of the magnetic field is to displace the rod vertically a distance *y*.




When both the spring constant and electrical resistance of **each** spring is doubled, closing the switch would now cause the rod to be displaced a distance

**A** $\frac{y}{2}$

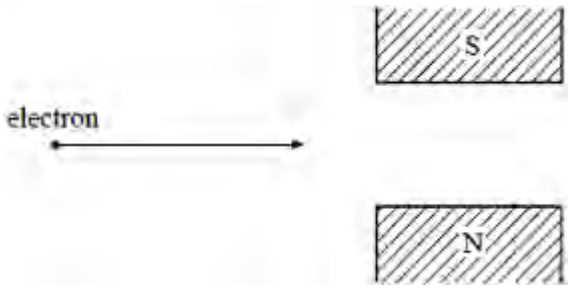
**B** $\frac{y}{4}$

**C** $y$

**D** $4y$

**(Total 1 mark)**

**Q29.** An electron moves into a region of uniform magnetic flux density between the poles of a magnet as shown in the diagram.




The deflection of the electron will be

**A** towards the pole marked **S**

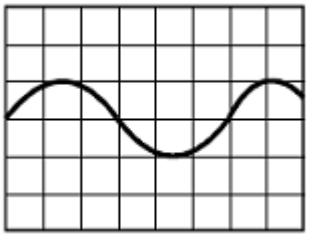
**B** towards the pole marked **N**

**C** perpendicular to the plane of the paper towards you

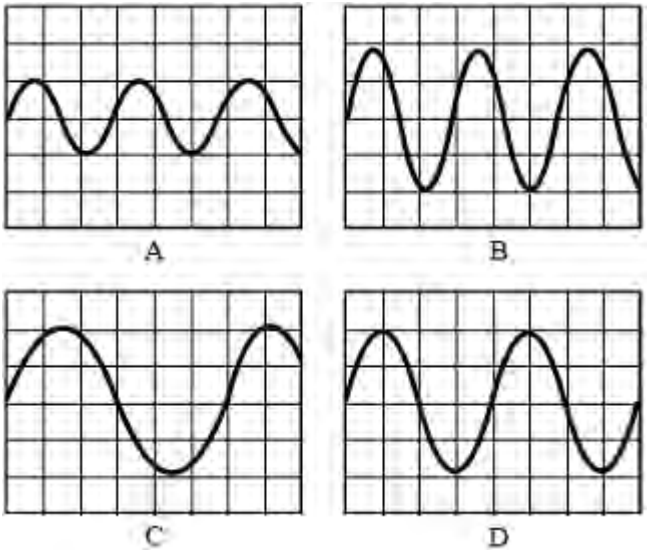
**D** perpendicular to the plane of the paper away from you

**(Total 1 mark)**

**Q30.** The diagram below shows the waveform obtained when the output of an alternator is connected to a cathode ray oscilloscope.



Which one of the following best represents the output when the speed of rotation of the generator is doubled and no adjustment is made to the oscilloscope?




**(Total 1 mark)**

**Q31.** An alpha particle moves at one-tenth the velocity of a beta particle. They both move through the same uniform magnetic field at right angles to their motion.

The magnitude of the ratio $\frac{\text{force on the alpha particle}}{\text{force on the beta particle}}$ is

**A** $\frac{1}{4}$

**B** $\frac{1}{5}$

**C** $\frac{1}{10}$

**D** $\frac{1}{20}$

**(Total 1 mark)**