3IB Physics. Hand in Nov. 2008 TM – *include working!*

1. M04 TZ1 S1: 23

Electric field strength is defined as

A. the force exerted on a test charge.

B. the force per unit positive charge.

C. the force per unit charge.

D. the force per unit charge exerted on a positive test charge.

2. M04 TZ1 S1: 24, H1: 25

Two **positive** point charges P and Q are held a certain distance apart.

At which point(s) could the electric field strength, due to the charges, be zero?

A. X only

B. Y only

C. Z only

D. X and Z only

3. M04 TZ2 S1: 25, H1: 30

A battery is connected in series with a resistor *R*. The battery transfers 2 000 C of charge completely round the circuit. During this process, 2 500 J of energy is dissipated in the resistor *R* and 1 500 J is expended in the battery.

The e.m.f. of the battery is

A. 2.00 V.

B. 1.25 V.

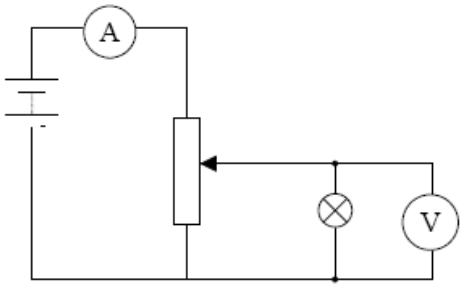
C. 0.75 V.

D. 0.50 V.

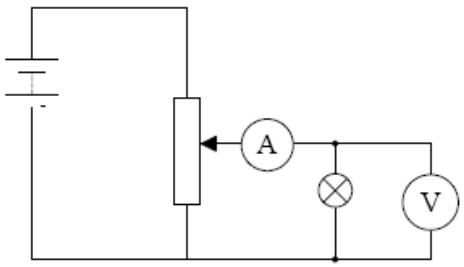
4. M04 TZ1 S1: 26, H1: 27

Which **one** of the following shows a correct circuit, using ideal voltmeters and ammeters, for measuring the *I-V* characteristic of a filament lamp?

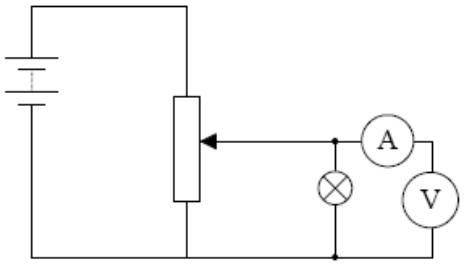
A.



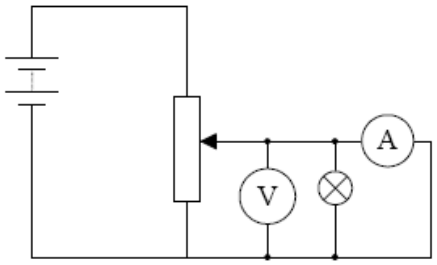
B.



C.

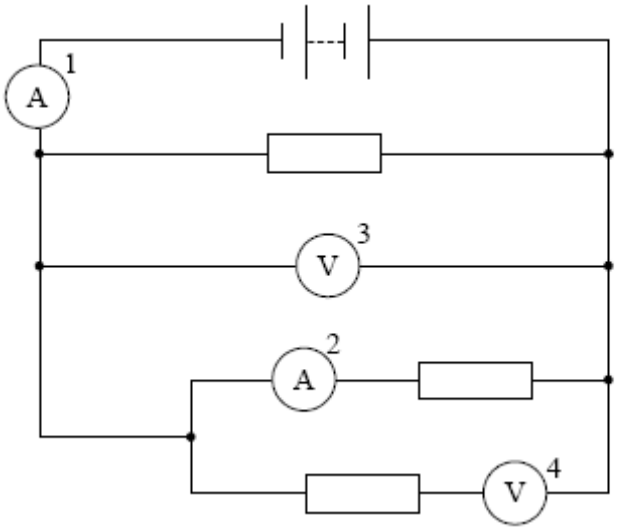


D.



5. M04 TZ2 S1: 26

In the circuit below, which meter is **not** correctly connected?



A. 1. B. 2. C. 3. D. 4.

6. M04 TZ2 S1: 27, H1: 28

A charged particle of mass m and charge q is travelling in a uniform magnetic field with speed v such that the magnetic force on the particle is F. The magnetic force on a particle of mass $2m$, charge q and speed $2v$ travelling in the same direction in the magnetic field is

A. $4F$.

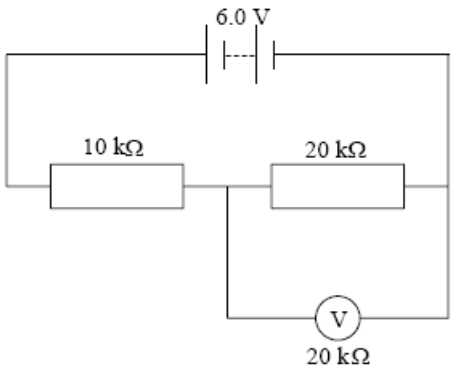
B. $2F$.

C. F.

D. $\frac{1}{2}F$.

7. M04 TZ2 H1: 29

In the circuit shown, the voltmeter has a resistance of 20 kΩ and the battery has an e.m.f. of 6.0 V and negligible internal resistance.



The reading on the voltmeter is

A. 2.0 V.

B. 3.0 V.

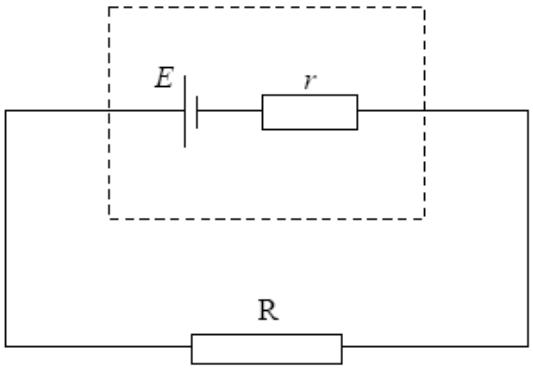
C. 4.0 V.

D. 6.0 V.

8. M04 TZ1 S2: B1, H2: B1

Current electricity

A cell of electromotive force (e.m.f.) E and internal resistance r is connected in series with a resistor R, as shown below.



The cell supplies 8.1×10^{3} J of energy when 5.8×10^{3} C of charge moves completely round the circuit. The current in the circuit is constant.

(c) (i) Calculate the e.m.f. E of the cell.

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(ii) The resistor R has resistance 6.0 Ω. The potential difference between its terminals is 1.2 V. Determine the internal resistance r of the cell.

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(iii) Calculate the total energy transfer in the resistor R.

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(iv) Describe, in terms of a simple model of electrical conduction, the mechanism by which the energy transfer in the resistor R takes place.

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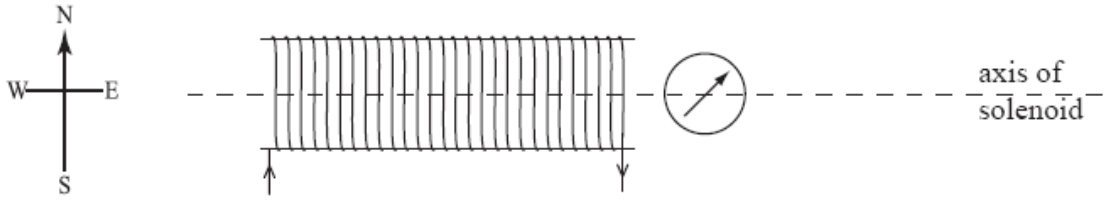
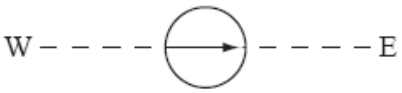
9. N04 S1: 27

A current-carrying solenoid is placed with its axis pointing east-west as shown below. A small compass is situated near one end of the solenoid.



The axis of the needle of the compass is approximately 45° to the axis of the solenoid. The current in the solenoid is then doubled. Which of the following diagrams best shows the new position of the compass needle?

A.


B.

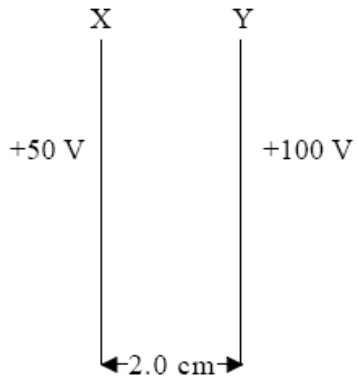

C.


D.


The reminder of this paper is HL only

10. M04 TZ1 H1: 29

The diagram below shows two lines of equipotential in a region of a uniform electric field. Line X has a potential of +50 V and line Y has a potential of +100V. The distance between X and Y is 2.0 cm.

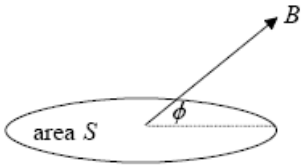


Which **one** of the following correctly gives the direction of the electric field and its strength?

	Direction	Strength / V cm^{-1}
A.	X → Y	25
B.	X → Y	100
C.	Y → X	25
D.	Y → X	100

11. M04 TZ1 H1: 30

A uniform magnetic field of strength B completely links a coil of area S. The field makes an angle ϕ to the plane of the coil.



The magnetic flux linking the coil is

A. BS.

B. $BS\cos\phi$.

C. $BS\sin\phi$.

D. $BS\tan\phi$.

12. M04 TZ1 H1: 31

A resistor is connected in series with an alternating current supply of negligible internal resistance. The **peak value** of the supply voltage is V_0 and the **peak value** of the current in the resistor is I_0. The **average power** dissipation in the resistor is

A. $\frac{V_0 I_0}{2}$.

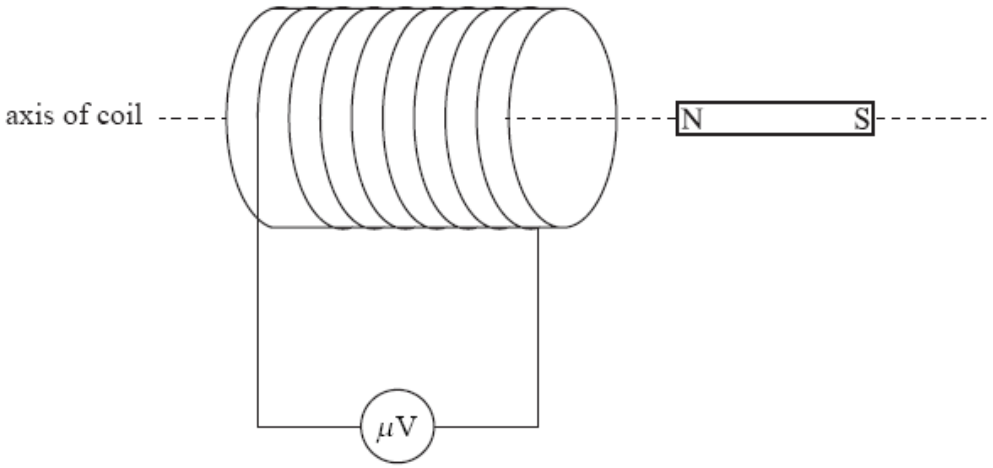
B. $\frac{V_0 I_0}{\sqrt{2}}$.

C. $V_0 I_0$.

D. $2V_0 I_0$.

13. N04 H1: 32

The north pole of a permanent bar magnet is pushed along the axis of a coil as shown below.



The pointer of the sensitive voltmeter connected to the coil moves to the right and gives a maximum reading of 8 units. The experiment is repeated but on this occasion, the south pole of the magnet enters the coil at twice the previous speed.

Which of the following gives the maximum deflection of the pointer of the voltmeter?

A. 8 units to the right

B. 8 units to the left

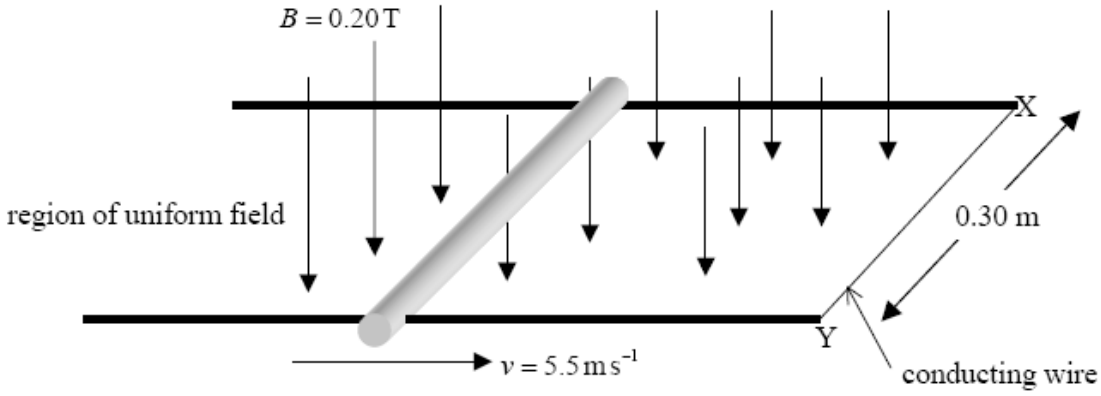
C. 16 units to the right

D. 16 units to the left

14. M04 TZ2 H2: A4

This question is about induced e.m.f.'s.

In the diagram below, a thin rod made of conducting material is moved along the conducting rails X and Y at constant speed. The rails are in a region of uniform magnetic field of strength B that is directed at right angles to the plane of the rails. A conducting wire is connected between the rails as shown.



The distance between the rails, X and Y is 0.30 m, the magnetic field strength is 0.20 T and the speed v of the rod is $5.5\,\text{m s}^{-1}$.

(a) On the diagram above, draw arrows to show the direction of

(i) the force on the electrons in the rod (label this F_E).

(ii) the force on the rod due to the induced current (label this F_M).

(b) (i) Calculate the e.m.f. induced in the rod.

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(ii) Calculate the force required to move the rod at constant speed due to an induced current in the rod of 0.80 A.

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(c) Deduce that the mechanical power required to move the rod at the constant speed of $5.5\,\text{m s}^{-1}$ is equal in value to the electrical power dissipated in the rod.

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