

# 5.3 Electric Cells

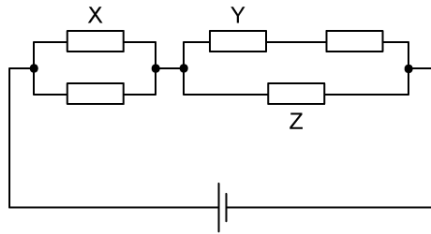
## Question Paper

Course	DPIB Physics
Section	5. Electricity & Magnetism
Topic	5.3 Electric Cells
Difficulty	Hard

**Time allowed:** 20  
**Score:** /10  
**Percentage:** /100

### Question 1

Five resistors of equal resistance are connected to a cell as shown.



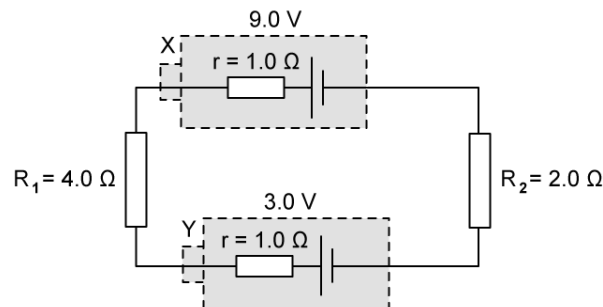
Which of the following is correct about the power dissipated  $P_X$ ,  $P_Y$  and  $P_Z$  in resistors X, Y and Z respectively?

	$P_X$	$P_Y$	$P_Z$
A.	$I^2 R$	$\frac{1}{3} I^2 R$	$\frac{2}{3} I^2 R$
B.	$\frac{1}{4} I^2 R$	$\frac{1}{3} I^2 R$	$\frac{4}{9} I^2 R$
C.	$I^2 R$	$\frac{1}{9} I^2 R$	$\frac{2}{3} I^2 R$
D.	$\frac{1}{4} I^2 R$	$\frac{1}{9} I^2 R$	$\frac{4}{9} I^2 R$

[1 mark]

### Question 2

Two cells, X and Y, each with internal resistance  $1.0 \Omega$ , are connected in a circuit with two resistors as shown.



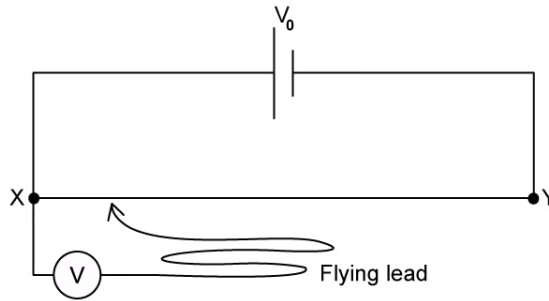
Which of the following statements is not correct?

- A. The circuit charges cell X
- B. The power dissipated in cell X is greater than the power dissipated in cell Y
- C. The charging current is  $3.0 \text{ A}$
- D. The circuit charges cell Y

[1 mark]

**Question 3**

A cell with e.m.f.  $V_0$  and negligible internal resistance is connected across a uniform resistance wire of length  $XY$ .



The flying lead connected at  $X$  and is able to connect to  $XY$  at any distance  $r$  from  $X$ .

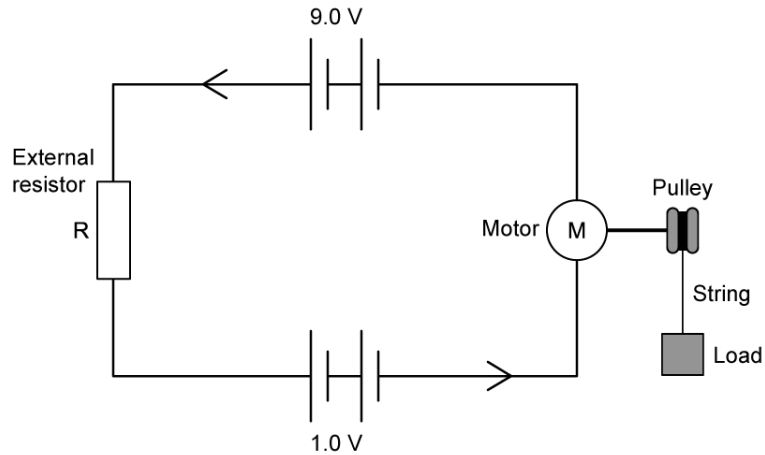
Which expression correctly determines the reading on the voltmeter,  $V$ ?

- A.  $r$
- B.  $V_0 r$
- C.  $\frac{r}{XY}$
- D.  $\frac{V_0 r}{XY}$

[1 mark]

### Question 4

A circuit contains two batteries, an external resistor and a motor, which is attached to a pulley that lifts a load. The direction of current in the circuit is indicated.



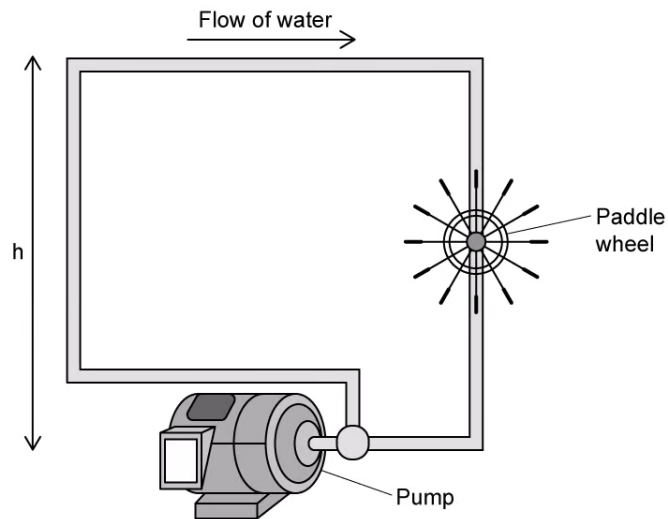
Which of the following energy transformations most accurately describes the behaviour of the circuit?

- A. chemical  $\rightarrow$  electrical + thermal + mechanical
- B. chemical + electrical  $\rightarrow$  mechanical + thermal
- C. chemical  $\rightarrow$  electrical + thermal + mechanical + gravitational
- D. chemical + electrical  $\rightarrow$  thermal + mechanical + gravitational

[1 mark]

**Question 5**

A pump is designed to move water through a certain height  $h$  such that the water flows back down, turning a paddle wheel. Such a system is often used to explain the operation of a battery in an electric circuit.



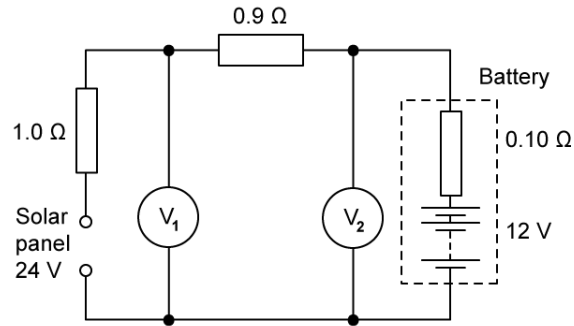
Which row in the table below best contrasts the work done by the pump and a battery?

	<b>Pump</b>	<b>Battery</b>
<b>A.</b>	Does work on the water flowing in the pump	Does work on the current flowing in the wires
<b>B.</b>	Does work on the water flowing in pipes	Does work on the current flowing in the wires
<b>C.</b>	Does work on the water flowing in the pump	Does work on the ions in the battery
<b>D.</b>	Does work on the water flowing in the pipes	Does work on the ions in the battery

[1 mark]

**Question 6**

A 24 V solar panel charges a 12 V battery with internal resistance  $0.10 \Omega$ .



Which of the following is correct?

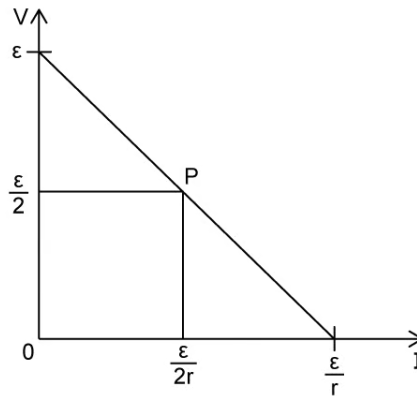
	$V_1$	$V_2$
A.	18	12.6
B.	30	-12.6
C.	18	-12.6
D.	30	12.6

[1 mark]

### Question 7

A cell has internal resistance  $r$ .

A graph of terminal potential difference  $V$  across the cell against current drawn from the cell  $I$  is shown. The scales are such that the length  $O\varepsilon$  is equal to the length  $O(\varepsilon/r)$ . A point  $P$  is chosen on the graph, such that  $(O)(\varepsilon/2)(P)(\varepsilon/2r)$  is a square.



Which of the following statements is correct?

- A.  $P$  is the point at which the load resistance is maximum
- B.  $P$  is the point at which maximum power is delivered by the cell
- C.  $P$  is the point at which minimum power is delivered by the cell
- D.  $P$  is the point at which the internal resistance of the cell reduces to zero

[1 mark]

### Question 8

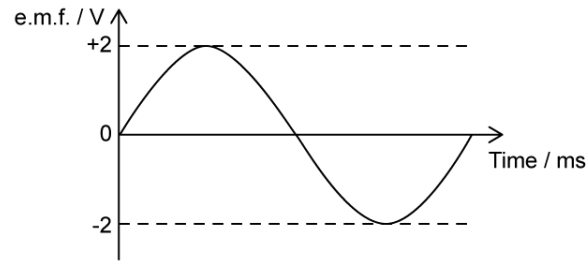
Which of the following correctly describes the electromotive force of a cell?

- A. The difference in energy between that needed to drive unit charge through the load resistance and through the cell
- B. The energy used to drive unit charge through the load resistance
- C. The energy used to drive unit charge through the cell's internal resistance
- D. The total energy used to drive unit charge round the complete circuit

[1 mark]

### Question 9

The figure shows how the e.m.f. of a simple generator varies with time.



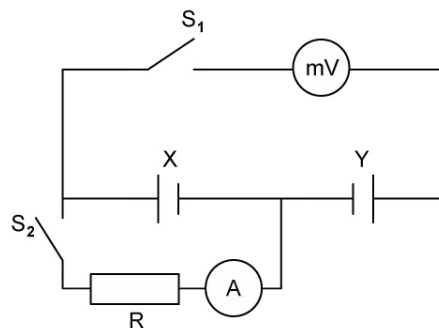
Which of the following statements is incorrect?

- A. The alternating e.m.f. does not affect the internal resistance of the generator
- B. The frequency of the e.m.f. is 200 Hz
- C. The internal resistance of the generator alternates with a frequency of 200 Hz
- D. The internal resistance of a power supply depends on its capacity

[1 mark]

### Question 10

Two almost identical lead-acid accumulator batteries, X and Y, are connected in a circuit as shown.



The following information is provided:

- When  $S_1$  is closed and  $S_2$  remains open, the millivoltmeter reads 60 mV
- When both  $S_1$  and  $S_2$  are closed, the reading on the millivoltmeter changes by 20 mV and the ammeter reads 5.0 A

What is the resistance of  $R$ ?

- A. 2.0 m $\Omega$
- B. 2.0  $\Omega$
- C. 2.0 k $\Omega$
- D. 20 k $\Omega$



[1 mark]