Unit 9: Electricity:

Subunit 9.2: Potential difference and power:

Topical Question No: 1

31 A fixed resistor of resistance $12\,\Omega$ is connected to a battery. There is a current of 0.20 A in the resistor. The current is now doubled.

What is the new power dissipated in the resistor?

A 0.48 W **B** 0.96 W **C** 1.92 W **D** 4.8 W

Topical Question No: 2

33 A 12 V battery is charged for 20 minutes by connecting it to a source of electromotive force (e.m.f.). The battery is supplied with 7.2×10^4 J of energy in this time.

How much charge flows through the battery?

A 5.0 C **B** 60 C **C** 100 C **D** 6000 C

Topical Question No: 3

33 The potential difference across a resistor is 12 V. The current in the resistor is 2.0 A.

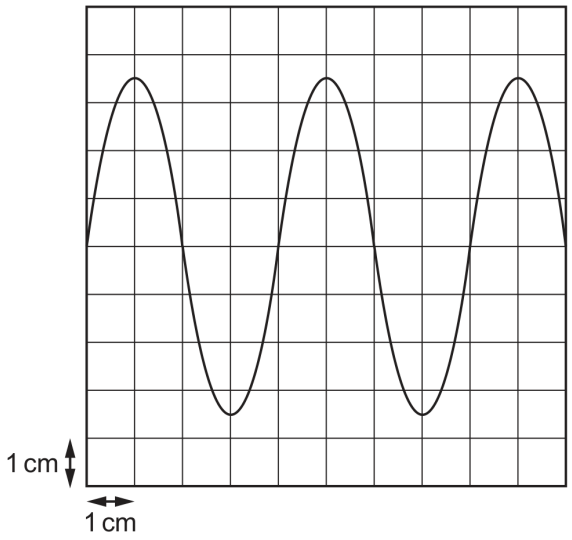
A charge of 4.0 C passes through the resistor.

What is the energy transferred in the resistor and the time taken for the charge to pass through the resistor?

	energy / J	time / s
A	3.0	2.0
B	3.0	8.0
C	48	2.0
D	48	8.0

Topical Question No: 4

6 A cathode-ray oscilloscope (c.r.o.) is connected to an alternating voltage. The following trace is produced on the screen.



The oscilloscope time-base setting is 0.5 ms cm^{-1} and the Y-plate sensitivity is 2 V cm^{-1}.

Which statement about the alternating voltage is correct?

A The amplitude is 3.5 cm.

B The frequency is 0.5 kHz.

C The period is 1 ms.

D The wavelength is 4 cm.

Topical Question No: 5

15 An old-fashioned 60 W lamp converts 95% of its energy supply into heat. A 4.0 W modern lamp has the same power output of light as the old-fashioned lamp.

What is the efficiency of the modern lamp?

A 5.0% **B** 6.7% **C** 75% **D** 95%

Topical Question No: 6

31 Which statement about electric charges in a uniform electric field is **not** correct?

A Electric charges of the same magnitude, whether positive or negative, experience the same magnitude of force when placed in the same uniform electric field.

B The direction of the force on a positive charge placed in a uniform electric field is independent of the magnitude of the charge.

C The magnitude of the force on a positive charge placed in a uniform electric field is proportional to the magnitude of the electric field strength.

D The work done to move a positive charge a certain distance in a uniform electric field is independent of the direction of the movement.

Topical Question No: 7

33 A resistor has resistance R. When the potential difference across the resistor is V, the current in the resistor is I. The power dissipated in the resistor is P. Work W is done when charge Q flows through the resistor.

What is **not** a valid relationship between these variables?

A $I = \frac{P}{V}$ **B** $Q = \frac{W}{V}$ **C** $R = \frac{P}{I^2}$ **D** $R = \frac{V}{P}$

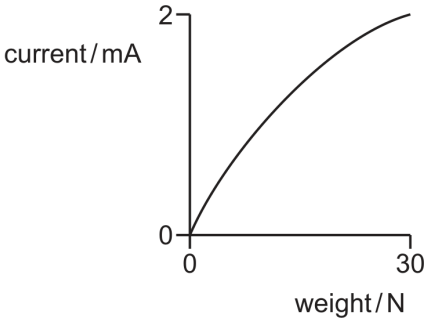
Topical Question No: 8

4 A digital balance is used to weigh ingredients in a laboratory. When a weight is applied to the digital balance, an electronic circuit generates a current which is then converted into a digital readout on the display.

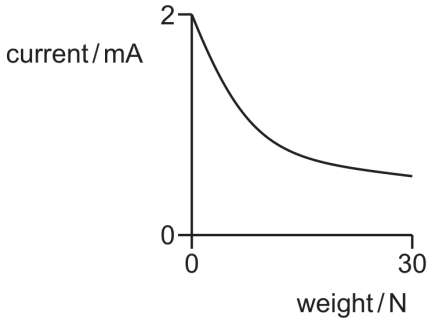
The electronic circuit gives a current of 2.0 mA when a weight of 30 N is applied, and a current of 0.5 mA when a weight of 5 N is applied.

Which calibration curve could represent this circuit?

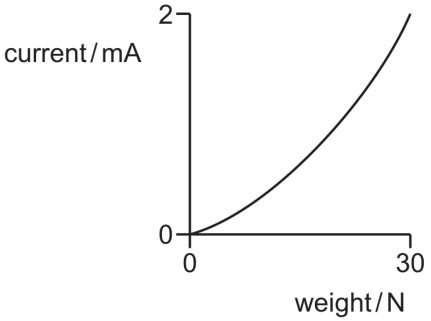
A



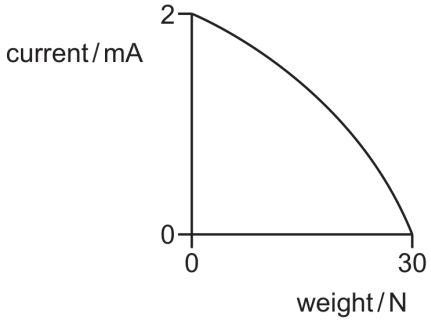
B



C



D



Topical Question No: 9

16 A crane is being used to lift containers off a ship. One container has a mass of 14 000 kg and is being lifted vertically with a speed of 3.2 m s^{-1}.

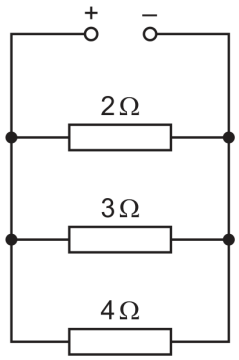
The electric motor being used to supply the power to lift the container is using a current of 240 A at a potential difference of 2200 V.

What is the efficiency of the system?

A 8.1% **B** 8.5% **C** 48% **D** 83%

Topical Question No: 10

33 Three resistors are connected in parallel across a power supply, as shown.



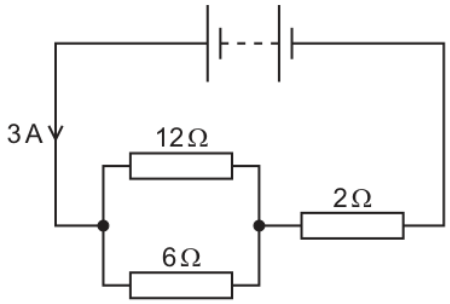
The power dissipated in each of the resistors of resistance 2Ω, 3Ω and 4Ω is P_2, P_3 and P_4 respectively.

What is the ratio $P_2 : P_3 : P_4$?

A 2:3:4 **B** 4:3:2 **C** 6:4:3 **D** 36:16:9

Topical Question No: 11

33 A battery is connected to three resistors of resistances 12Ω, 6Ω and 2Ω, as shown.



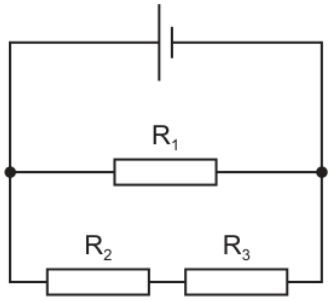
The current from the battery is 3A.

What is the value of the ratio $\frac{\text{power dissipated in the resistor of resistance } 6\Omega}{\text{power dissipated in the resistor of resistance } 2\Omega}$?

A $\frac{1}{3}$ **B** $\frac{4}{3}$ **C** $\frac{2}{1}$ **D** $\frac{3}{1}$

Topical Question No: 12

33 A cell of negligible internal resistance is connected to resistors R_1, R_2 and R_3, as shown. The cell provides power to the circuit and power is dissipated in the resistors.



Which word equation **must** be correct?

A power dissipated in R_1 = power dissipated in R_2 + power dissipated in R_3

B power dissipated in R_2 = power dissipated in R_3

C power output of cell = power dissipated in R_1 + power dissipated in R_2 + power dissipated in R_3

D power output of cell = power dissipated in R_1

Topical Question No: 13

35 An electrical cable consists of seven strands of copper wire, each of diameter 0.30 mm, connected in parallel.

The resistivity of copper is $1.72 \times 10^{-8}\,\Omega\,\text{m}$. The current in the cable is 13 A.

What is the potential difference (p.d.) between two points on the cable a distance of 1.0 m apart?

A 0.0045 V **B** 0.11 V **C** 0.45 V **D** 3.2 V

Topical Question No: 14

32 What are the definitions of potential difference (p.d.) and electromotive force (e.m.f.), in terms of energy transfer W and charge q?

	p.d.	e.m.f.
A	$\frac{W}{q}$	$\frac{W}{q}$
B	$\frac{W}{q}$	Wq
C	Wq	$\frac{W}{q}$
D	Wq	Wq

Topical Question No: 15

34 A resistor dissipates 25 W of power when there is a potential difference (p.d.) of 4.0 V across it.

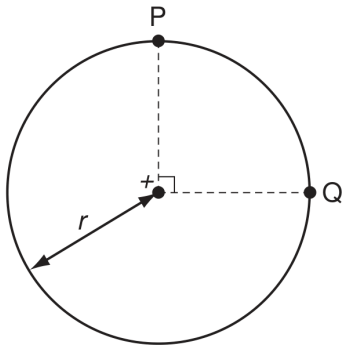
What is the resistance of the resistor?

A 0.16 Ω **B** 0.64 Ω **C** 100 Ω **D** 400 Ω

Topical Question No: 16

28 The diagram shows two points P and Q which lie, 90° apart, on a circle of radius *r*.

A positive point charge at the centre of the circle creates an electric field of magnitude *E* at both P and Q.



Which expression gives the work done in moving a unit positive charge from P to Q?

A 0 **B** $E \times r$ **C** $E \times \left(\frac{\pi r}{2}\right)$ **D** $E \times (\pi r)$

Space for working

Topical Question No: 17

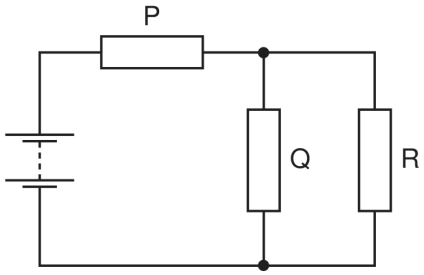
31 In terms of energy transfer *W* and charge *q*, what are the definitions of potential difference (p.d.) and electromotive force (e.m.f.)?

	p.d.	e.m.f.
A	$\frac{W}{q}$	$\frac{W}{q}$
B	$\frac{W}{q}$	Wq
C	Wq	$\frac{W}{q}$
D	Wq	Wq

Space for working

Topical Question No: 18

34 The resistors P, Q and R in the circuit have equal resistance.



The battery, of negligible internal resistance, supplies a total power of 12 W.

What is the power dissipated by heating in resistor R?

A 2 W **B** 3 W **C** 4 W **D** 6 W

Topical Question No: 19

32 A battery is marked 9.0 V.

What does this mean?

A Each coulomb of charge from the battery supplies 9.0 J of electrical energy to the whole circuit.

B The battery supplies 9.0 J to an external circuit for each coulomb of charge.

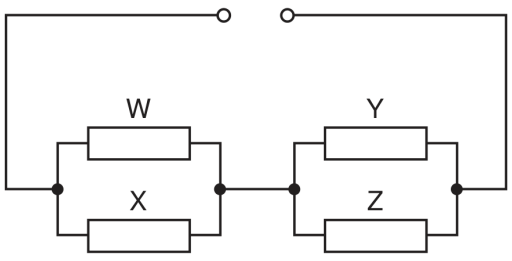
C The potential difference across any component connected to the battery will be 9.0 V.

D There will always be 9.0 V across the battery terminals.

Space for working

Topical Question No: 20

36 Four resistors of equal value are connected as shown.



How will the powers to the resistors change when resistor W is removed?

A The powers to X, Y and Z will all increase.

B The power to X will decrease and the powers to Y and Z will increase.

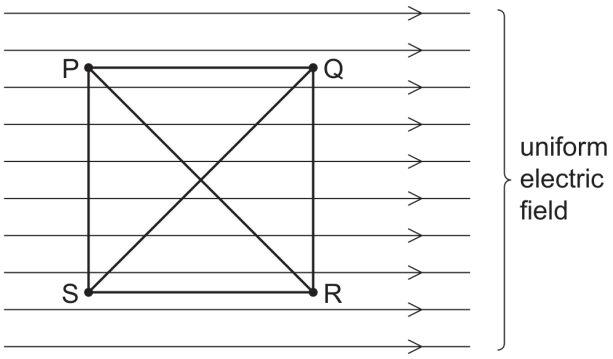
C The power to X will increase and the powers to Y and Z will decrease.

D The power to X will increase and the powers to Y and Z will remain unaltered.

Space for working

Topical Question No: 21

13 A small positive charge can move inside a uniform electric field.



The charge moves along different straight paths between points P, Q, R and S.

Which row gives two paths that result in the same total work done on the charge?

	path 1	path 2
A	P to R	Q to S
B	P to R	P to S
C	S to Q	S to R
D	S to Q	R to P

Topical Question No: 22

32 The potential difference between point X and point Y in a circuit is 20V. The time taken for charge carriers to move from X to Y is 15 s. In this time, the energy of the charge carriers changes by 12 J.

What is the current between X and Y?

A 0.040 A **B** 0.11 A **C** 9.0 A **D** 25 A

Space for working

Topical Question No: 23

32 A fixed resistor of resistance 12 Ω is connected to a battery. There is a current of 0.20 A in the resistor. The current is now doubled.

What is the new power dissipated in the resistor?

A 0.48 W **B** 0.96 W **C** 1.9 W **D** 4.8 W

Answer Key

1. N/A
2. N/A
3. N/A
4. N/A
5. N/A
6. N/A
7. N/A
8. N/A
9. N/A
10. N/A
11. B
12. C
13. C
14. A
15. B
16. N/A
17. N/A
18. N/A
19. N/A
20. N/A
21. N/A
22. N/A
23. N/A