

Question 35 (Answer: D)

- Adding an identical resistor in parallel halves the external resistance.
- The total circuit resistance falls, so the battery current rises – the ammeter reads more.
- A larger current through r means a larger p.d. across it, so both quantities increase.

Question 34 (Answer: D)

- E.m.f. is the total energy the cell converts per unit charge.
- So EQ is the *total* energy, including what is dissipated inside the cell itself.
- The external circuit receives only VQ , which is less by the I^2r lost internally.

Question 33 (Answer: A)

- A potentiometer uses all three terminals: the whole track across the supply, and the slider as the output.
- The ammeter has to be in series with the LDR so that the LDR's current passes through it.
- So look for the track connected across the supply with the ammeter in the LDR branch.

Question 37 (Answer: A)

- Closing the switch brings the second resistor into the circuit in parallel, lowering the external resistance.
- A lower total resistance means a larger current from the battery.
- More current means more lost across r , so the terminal p.d. the voltmeter reads falls.

5(a)	<u>sum of</u> current(s) into junction = <u>sum of</u> current(s) out junction or (algebraic) sum of current(s) at a junction is zero
5(b)(i)	$(V =) E - Ir$
	$(V =) 5.0 - (38 \times 10^{-3} \times 4.7) = 4.8 \text{ (V)}$
5(b)(ii)	$R_{(Z)} = 120 \Omega$
	$I_2 = 38 \times 10^{-3} - (4.8 / (100 + 120))$
	$I_2 = 0.016 \text{ A}$
	or
	$R_{(Z)} = 120 \Omega$
	$R_{(\text{EXT})} = 4.8 / 38 \times 10^{-3}$
	$(= 126 \Omega)$
	$1 / R_{(Y)} = 1 / 126 + 1 / (120 + 100)$
	$(R_{(Y)} = 297 \Omega)$
	$I_2 = 4.8 / 297$
	$I_2 = 0.016 \text{ A}$

5(b)(iii)	$P = IV$ or $P = I^2 R$ or $P = V^2 / R$
	$P = 0.016 \times 4.8$ or $P = 0.016^2 \times (4.8 / 0.016)$ or $P = 4.8^2 / (4.8 / 0.016)$ $P = 0.077 \text{ W}$
5(b)(iv)	resistance of the LDR / Z increases (as light intensity decreases)
	<u>total</u> resistance (of the circuit) increases or current <u>in the battery</u> decreases
	(potential difference across the internal resistor decreases so) the terminal potential difference increases

Question 37 (Answer: C)

- The terminal p.d. obeys $V = E - Ir$, so a graph of V against I is a straight line of gradient $-r$.
- The line falls from 1.6 V at zero current to zero at 80 mA.
- $r = 1.6 / (80 \times 10^{-3}) = 20 \Omega$; B is the intercept, which is the e.m.f., not a resistance.

Question 35 (Answer: D)

- With $2.0R$ the current is $E/3.0R$ and the terminal p.d. is $\frac{2}{3}E$.
- With $4.0R$ the total is $5.0R$, so the current falls to $E/5.0R$.
- Less current means less lost across the internal $1.0R$, so the terminal p.d. rises to $\frac{4}{5}E$.

Question 36 (Answer: C)

- The terminal p.d. is $V = E - Ir$.
- E and r are properties of the battery and do not change when the resistor is adjusted.
- A larger I means a larger Ir lost inside, so V falls.

Question 33 (Answer: A)

- The cell has negligible internal resistance, so anything connected straight across it always gets the full e.m.f.
- A lamp in parallel with the variable resistor therefore keeps the same p.d. however the resistor is set.
- Same p.d. across the same lamp means the same power; in the other circuits the resistor takes a share of the lamp's current or voltage.

Question 34 (Answer: B)

- A loudspeaker (the horn), a bell and a buzzer (the two dome shapes) all work by pushing a diaphragm against the air.
- That is why each of their symbols opens outwards – the shape represents the radiating surface.
- The remaining symbol is a plain rectangular element with no diaphragm, so it is not designed to emit sound.

Question 36 (Answer: B)

- With the switch open no current flows, so nothing is lost across r and $V = E$.
- Closing the switch drives a current, so now Ir is dropped inside the cell.
- The terminal p.d. falls to $V = E - Ir$.

7(a)(i)	(V =) $1.50 - 1.36$ (= 0.14 V)
	current = V / R $= 0.14 / 0.28 = 0.50 \text{ A}$
7(a)(ii)	resistance = V / I
	$= 1.36 / 0.50$ $= 2.7 \Omega$
7(a)(iii)	$R = 2.7 - 1.0$ $= 1.7 \Omega$
7(b)(i)	two resistors correctly shown in parallel with cell and no other components
7(b)(ii)	(external) resistance is now smaller and (so) current (in cell) is greater / (external) resistance smaller fraction of total resistance / internal resistance larger fraction of total resistance
	(greater p.d. across internal resistance so) terminal p.d. is less