

## Mark scheme for Extension Worksheet – Topic 5, Worksheet 2

- 1** If  $S_1$  is open no current leaves the battery and so the power is 0 W. So  $S_1$  must be closed for any power to be dissipated. If  $S_2$  is closed and  $S_3$  is open, the current only goes through resistor X and so the power is 24 W. If  $S_2$  is closed and  $S_3$  is also closed then current goes through X and Z and both are in parallel with 12 V so the total power is 48 W. If  $S_2$  is open and  $S_3$  is closed then current goes through all three resistors. Z is in parallel with 12 V so its power is 24 W. Each of X and Y have 6.0 V across them and the power in each is one fourth of the normal i.e. 6.0 W each. This gives a total of 36 W. Finally, if  $S_2$  and  $S_3$  are both open, current goes through X and Y only and each is at 6.0 V and so the power in each is 6.0 W for a total of 12 W.

$S_1$	$S_2$	$S_3$	Power/W
open	closed	open	0;
closed	closed	open	24;
closed	closed	closed	48;
closed	open	closed	36;
closed	open	open	12;

[5]

- 2** The reading will be the emf  $\mathcal{E} = 6.0 \text{ V}$ ; because there is no current in the circuit the resistance does not drop the voltage so effectively one side of the voltmeter is connected to the 0 V line of the battery and the other side to the 6.0 V line, with a difference therefore of 6.0 V.

[2]

- 3 a** 3.0 V

[1]

- b** As temperature increases the resistance of the thermistor decreases; so the voltage across it decreases; and hence the voltmeter reading increases.

[3]