Specific heat capacity of an aluminium block.

Experiment to find the specific heat capacity of an aluminium block.

DATA COLLECTION:

Mass(m) (kg) (5dp)	Current(I) (A) (2dp)	Voltage (V) (2dp)	Time(t) (s) (0dp)	Initial temp(T_1) (ºC) (2sf)	Final temp(T_2) (ºC) (2sf)
+/-(5*10^ -4) %	+/- (1*10^ -1) %	+/- (4*10^ -2) %	+/- (5*10^-1)s	+/- 0.5 ºC	+/- (5*10^ -1) ºC
0.99577	3.70	12.07	0	16.0	16.0
0.99577	3.70	12.08	60	16.0	18.0
0.99577	3.68	12.10	120	16.0	20.0
0.99577	3.66	12.11	180	16.0	22.0
0.99577	3.68	12.10	240	16.0	25.0
0.99577	3.64	12.08	300	16.0	27.0
0.99577	3.64	12.08	360	16.0	30.0
0.99577	3.65	12.03	420	16.0	33.0

DATA PROCESSING AND PRESENTATION:

As $Q=m.c.(T_2-T_1)$

Where Q= energy transfer

C= specific heat capacity

We can rearrange this to give:

$C= Q/(m(T_2-T_1))$

And as power = energy/time

Therefore $E= Pt = Q$

And $P = IV$ therefore $Q = IVt$

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Hence $C = IVt/(m(T_2-T_1))$

Which is rearranged to the form $y=px + c$ to give:

$T_2 = (IVt / (m.C)) + T_1$.

Where p is the gradient, and equals 1/C, therefore $x = IVt/m = Q/m$, and $y = T_2$ the y intercept is equal to T_1

Therefore I have calculated this table:

Energy transfer (Q) (J) (0dp)	Errors (J) (0dp)	Q/m (j/kg) (0dp)	Errors(J/kg) (0dp)	Final temp(T_2) (ºC) (2sf) +/- (5*10^ -1) ºC
0	+/- 0	0	+/- 0	16.0
2682	+/- 27	2693	+/- 30	18.0
5343	+/- 32	5366	+/- 30	20.0
7978	+/- 36	8012	+/- 40	22.0
10687	+/- 41	10732	+/- 40	25.0
13191	+/- 46	13247	+/- 50	27.0
15830	+/- 50	16897	+/- 50	30.0
18442	+/- 55	18520	+/- 60	33.0

The errors were calculated as follows:

(% error in Q) = (% error in V) + (% error in I) + (% error t)

(%error in Q/m) = (%error in Q) + (%error in m)

= (% error in V) + (% error in I) + (% error t) + (%error in m)

= 0.04% + 0.1% + 0.8% + 0.0004%

= 0.3404%

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CONCLUSION AND EVALUATION:

As the accepted value for the specific heat capacity for aluminium is 910 J/kg^{o}C it would seem that my result of 1029 +/- 350 J/kg^{o}C is accurate, as it easily encompasses the accepted value when the error is taken into account.

There were a number of weaknesses with this experiment, the first being the possible accuracy of measuring temperature, as all that was available was a thermometer which allowed you to measure in whole degrees, the way to improve the experiment could be to use a digital thermometer. It was also difficult to keep the current and voltage constant, therefore a resistor could be used to control them. It was also difficult to make sure you took all the readings at the same time, i.e. temperature, current and voltage at the correct time interval. Therefore, if I were to repeat the experiment, I may get a computer to measure these variables, that way the computer would not have the human error reaction times when measuring time and would be able to do a number of readings within a few milliseconds. The procedure undertaken produced fairly accurate results, as it was systematic, however the results could be improved by repeating the experiment again, therefore getting rid of any anomalies that were not picked up by doing just one experiment.