3. An experiment has been carried out to investigate the temperature dependence of the resistance of a copper wire. A common model is represented by the equation

$$R = R_0(1 + \alpha T)$$

where R is the resistance at temperature T°C, R is the resistance at 0°C, and α is the temperature coefficient of resistance. Observations of R and T were obtained as given in the table at the top of p. 135.

(a) Using the method of least squares (suggested headings under which the calculations can be carried out are given in the first part of the table), obtain the best value for the slope and for the intercept.

(b) Hence obtain the best value for α.

(c) Evaluate the standard deviation for the slope and for the intercept (suggested

Calculation of best values of R_0 and α				Calculation of standard deviations using best values of R_0 and α			
x	y	xy	x^2				
T°C	$R\ \Omega$	TR	T^2	$R_0\alpha T$	Calculated ideal value of R $(=R_0 + R_0\alpha T)$	δR (obs. R − ideal R)	$(\delta R)^2$
10	12.3						
20	12.9						
30	13.6						
40	13.8						
50	14.5						
60	15.1						
70	15.2						
80	15.9						
Σx and $(\Sigma x)^2$	Σy	$\Sigma (xy)$	$\Sigma (x^2)$				$\Sigma (\delta y)^2$ and so s_y

headings for this part of the calculation are given in the second part of the table).

(d) Hence evaluate the standard deviation of α.

(e) State the final result of the experiment with the appropriate number of significant figures.