Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
1a	$\log_{10} c = 1.89 - 0.0131t$ $c = 10^{1.89-0.0131t}$ $c = 77.6 \times 0.970^t$ (3 s.f.)	**M1** **M1** **A1**	1.1a 1.1b 1.1b	6th Understand exponential models in bivariate data.
		(3)		
1b	b is the proportional rate at which the temperature changes per minute.	**A1**	3.2a	6th Understand exponential models in bivariate data.
		(1)		
1c	Extrapolation/out of the range of the data.	**A1**	2.4	4th Understand the concepts of interpolation and extrapolation.
		(1)		
				(5 marks)
Notes				

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
2a	$\log n = 0.7606 + 0.0635t$ $c = 10^{0.7606+0.0635t}$ $c = 5.76 \times 1.16^t$ (3 s.f.)	**M1** **M1** **A1**	1.1a 1.1b 1.1b	6th Understand exponential models in bivariate data.
		(3)		
2b	a is a constant of proportionality.	**A1**	3.2a	6th Understand exponential models in bivariate data.
		(1)		
2c	Extrapolation/out of the range of the data.	**A1**	2.4	4th Understand the concepts of interpolation and extrapolation.
		(1)		
				(5 marks)
Notes				

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
3a	The data seems to follow an exponential distribution.	**B1**	2.4	6th Understand exponential models in bivariate data.
		(1)		
3b	$r = 0.9735$ is close to 1	**B1**	2.2a	2nd Know and understand the language of correlation and regression.
	which gives a strong positive correlation.	**B1**	2.4	
		(2)		
3c	Model is a good fit with a reason. For example, Very strong positive linear correlation between t and $\log_{10} p$. The **transformed data points** lie close (enough) to a straight line.	**B2**	3.2a	6th Understand exponential models in bivariate data.
		(2)		
				(5 marks)

Notes

3c

B0 for just stating the model is a good fit with no reason.

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
4a	$H_0 : \rho = 0$, $H_1 : \rho < 0$ Critical value = −0.6319 −0.6319 < −0.136 no evidence to reject H_0 (test statistic not in critical region) There is insufficient evidence to suggest that the weight of chickens and average weight of eggs are negatively correlated.	**B1** **M1** **A1**	2.5 1.1a 2.2b	6th Carry out a hypothesis test for zero correlation.
		(3)		
4b	Sensible explanation. For example, correlation shows there is no (or extremely weak) linear realtionship between the two variables.	**B1**	1.2	7th Interpret the results of a hypothesis test for zero correlation.
	For example, there could be a non-linear relationship between the two variables.	**B1**	3.5b	
		(2)		
				(5 marks)
Notes				

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
5a	A critical value is the point (or points) on the scale of the test statistic beyond which we reject the null hypothesis.	**B1**	1.2	5th Understand the language of hypothesis testing.
		(1)		
5b	$H_0 : \rho = 0$, $H_1 : \rho > 0$ Critical value = 0.5494 0.714 > 0.5494 (test statistic in critical region) There is evidence to reject H_0 There is evidence that there is a positive correlation between the number of vehicles and road traffic accidents.	**B1** **M1** **A1**	2.5 1.1b 2.2b	6th Carry out a hypothesis test for zero correlation.
		(3)		
5c	$r = -7.0 + 0.02v$	**B1**	1.2	4th Make predictions using the regression line within the range of the data.
		(1)		
5d	Road fatalities per 100 000 population.	**B1**	1.2	2nd Know and understand the language of correlation and regression.
		(1)		
5e	Outside the range of the data used in the model. or This would require extrapolation.	**B1**	3.5b	4th Understand the concepts of interpolation and extrapolation.
		(1)		
				(7 marks)
Notes				

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
6a	Linear association between *e* and *f*.	**B1**	1.2	2nd Know and understand the language of correlation and regression.
		(1)		
6b	It requires extropolation and hence it may be unreliable.	**B1**	1.2	4th Understand the concepts of interpolation and extrapolation.
		(1)		
6c	Fuel consumption (*f*)	**B1**	1.2	2nd Know and understand the language of correlation and regression.
		(1)		
6d	A hypothesis test is a statistical test that is used to determine whether there is enough evidence in a sample of data to infer that a certain condition is true for the entire population.	**B1**	1.2	5th Understand the language of hypothesis testing.
		(1)		
6e	$H_0 : \rho = 0$, $H_1 : \rho < 0$ Critical value = −0.3665 −0.803 < −0.3665 (test statistic in critical region) Reject H_0 There is evidence that the product moment correlation coeficient for CO_2 emissions and fuel consumption is less than zero.	**B1** **M1** **A1**	2.5 1.1b 2.2b	6th Carry out a hypothesis test for zero correlation.
		(3)		
				(7 marks)
Notes				

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
7a	A statistic that is calculated from sample data in order to test a hypothesis about a population.	**B1**	1.2	5th Understand the language of hypothesis testing.
		(1)		
7b	$H_0 : \rho = 0$, $H_1 : \rho \neq 0$ p-value < 0.05 There is evidence to reject H_0 There is evidence (at 5% level) of a correlation between the daily mean temperature and daily mean pressure.	**B1** **M1** **A1**	2.5 1.1b 2.2b	6th Carry out a hypothesis test for zero correlation.
		(3)		
7c	Two sensible interpretations or observations. For example, Two distinct distributions Similar gradients of regression line. Similar correlations for each season. Lower temperaure in autumn. More spread for the daily mean pressure in autumn.	**B2**	3.2a	4th Use the principles of bivariate data analysis in the context of the large data set.
		(2)		
				(6 marks)
Notes				

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
8a	Linear association between two variables.	**B1**	1.2	2nd Know and understand the language of correlation and regression.
		(1)		
8b	Negative correlation.	**B1**	1.2	2nd Know and understand the language of correlation and regression.
		(1)		
8c	As daily mean pressure increases (rises) daily mean wind speed decreases (falls) in Hurn May to October in 2015. or As daily mean pressure decreases (falls) daily mean wind speed increases (rises) in Hurn May to October in 2015.	**B1**	3.2	5th Interpret the PPMC as a measure of correlation.
		(1)		
8d	$H_0 : \rho = 0$, $H_1 : \rho < 0$ p-value < 0.05 There is evidence to reject H_0. There is (strong) evidence of negative correlation between the daily mean wind speed and daily mean pressure.	**B1** **M1** **A1**	2.5 1.1b 2.2b	6th Carry out a hypothesis test for zero correlation.
		(3)		
8e	Daily mean wind speed = 180 − 0.170 × daily mean pressure.	**B2**	1.1b	4th Use the principles of bivariate data analysis in the context of the large data set.
		(2)		

8f	The regression model suggests for every hPa increase in daily mean pressure the daily mean wind speed decreases by 0.1694 knots. or The regression model suggests for every hPa decrease in daily mean pressure the daily mean wind speed increases by 0.1694 knots.	**B1**	3.2	4th Use the principles of bivariate data analysis in the context of the large data set.
		(1)		
8g	Sensible comment. For example, Not very accurate as very few or no points Not very accurate as near the bottom range for the data.	**B1**	3.5b	4th Make predictions using the regression line within the range of the data.
		(1)		
				(10 marks)

Notes

8e

B1 $y = 180.0 - 0.1694x$ unless x and y are defined.