Eton College King's Scholarship Examination 2021

SCIENCE 2 (Data Analysis)

(30 minutes)

Candidate Number: _____

Remember to write your candidate number on every sheet in the space provided.

*You should attempt **ALL** the questions. Write your answers in the spaces provided.*

The maximum mark for each question or part of a question is shown in square brackets.

Calculators are allowed. In questions involving calculations, all your working must be shown.

Total Marks Available: 30

For examiners' use only.

Total [30]	

Do not turn over until told to do so.

A new coronavirus disease was named COVID-19 by the World Health Organization (WHO) in February 2020. The disease is caused by a novel coronavirus called SARS-CoV-2, which has since spread rapidly across the globe. Patients with COVID-19 show symptoms of respiratory illness including fever, cough, fatigue and radiographic evidence of pneumonia, such as inflammation and damage to lung tissue. Most patients show only modest symptoms, but some become severely sick, requiring hospital admission and, in some cases, intensive care unit (ICU) treatment.

This question is about two scientific studies, both carried out in 2020, into the role of vitamin D in preventing and treating COVID-19. As well as having an important role in bone formation, vitamin D is important in the proper functioning of the immune system and can help to reduce excessive inflammation in the body.

The first study proposed an hypothesis that there is a potential association between mean levels of vitamin D in various countries and the number of cases of COVID-19.

(a) What do you understand by the term *hypothesis*?

_____

_____ **[1]**

To investigate this hypothesis the researchers focussed on European countries only, searching the records for mean blood levels of vitamin D in each country and using the number of cases of COVID-19 per 1 M population in each of the countries up to 8th April 2020. The data are set out in the table below:

European Country	Mean vitamin D (nmol/L)	Cases of COVID-19 per 1 M population
Belgium	49.3	2019
Czech Rep	62.5	488
Denmark	65.0	933
Finland	67.7	449
France	60.0	1671
Germany	50.1	1309
Hungary	60.6	93
Iceland	57.0	4736
Ireland	56.4	1230
Italy	50.0	2306
Netherlands	59.5	1199
Norway	65.0	1123
Portugal	39.0	1289
Slovakia	81.5	125
Spain	42.5	3137
Sweden	73.5	834
Switzerland	46.0	2686
UK	47.4	895

(b) Vitamin D level was measured in units of nmol/L. What do you understand by this unit of measurement?

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_____ **[2]**

(c) Why are cases of COVID-19 measured ' (/1 M)' – per million - of the population?

_____

_____ **[1]**

(d) Suggest a possible reason for focussing only on European countries in this study.

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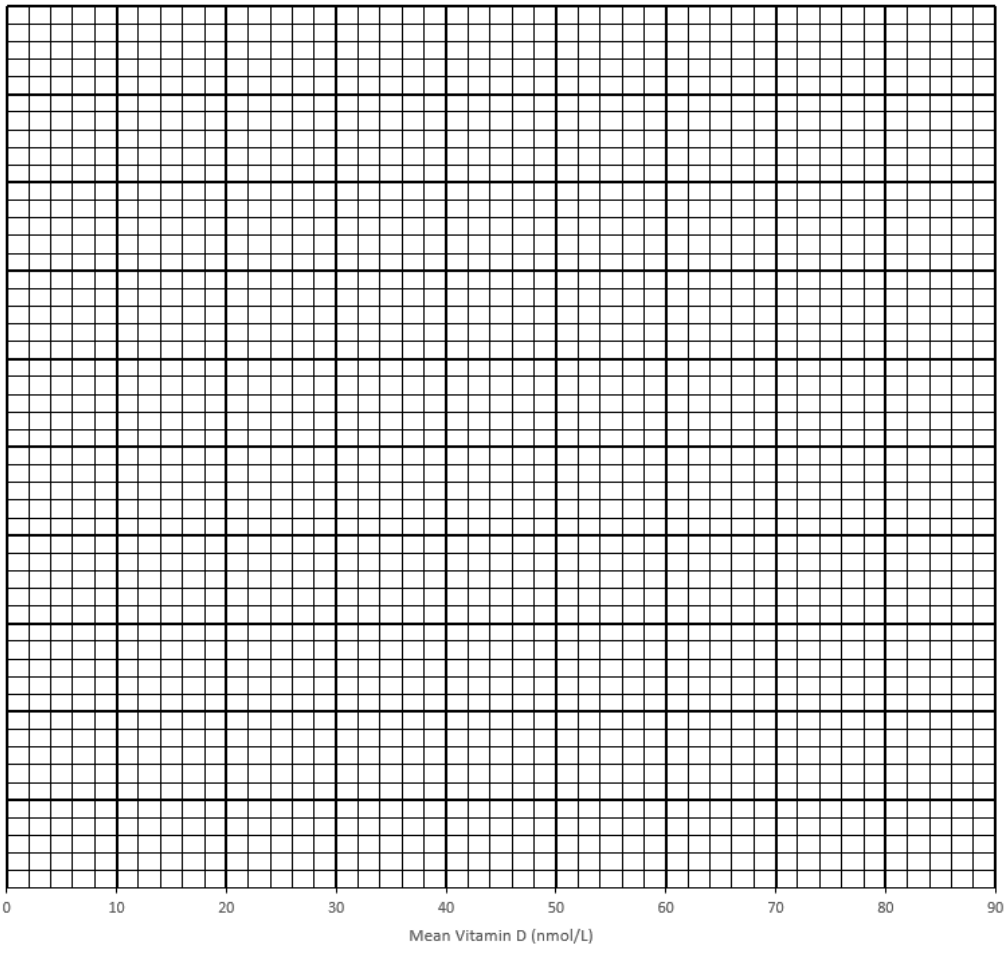
_____ **[2]**

(e) Using the grid below, plot the data in the table as a scatter graph, where each point plotted represents a country. Draw a **single** straight line of best fit through the plotted points.
[There is no need to label each point with the name of the country] **[4]**



(f) Looking carefully at the data and graph, discuss whether it is fair to conclude that higher levels of vitamin D in the blood cause reduced rates of infection with SARS-CoV-2.

[4]

(g) Discuss the reliability of these data. Suggest ways in which the data may be unreliable and discuss the implications of this when drawing conclusions from the study.

[3]

The second study (a randomised, double-blind clinical trial) investigated whether vitamin D might be an effective treatment in those admitted to hospital with COVID-19. 76 patients displaying symptoms of viral pneumonia and testing positive for SARS-CoV-2 were admitted to hospital in Cordoba, Spain. 50 patients received dosages of vitamin D over the next 7 days, compared to 26 control patients who did not.

(h) The study was *a randomised, double-blind clinical trial*. Using the information in the above paragraph, explain what is meant by this.

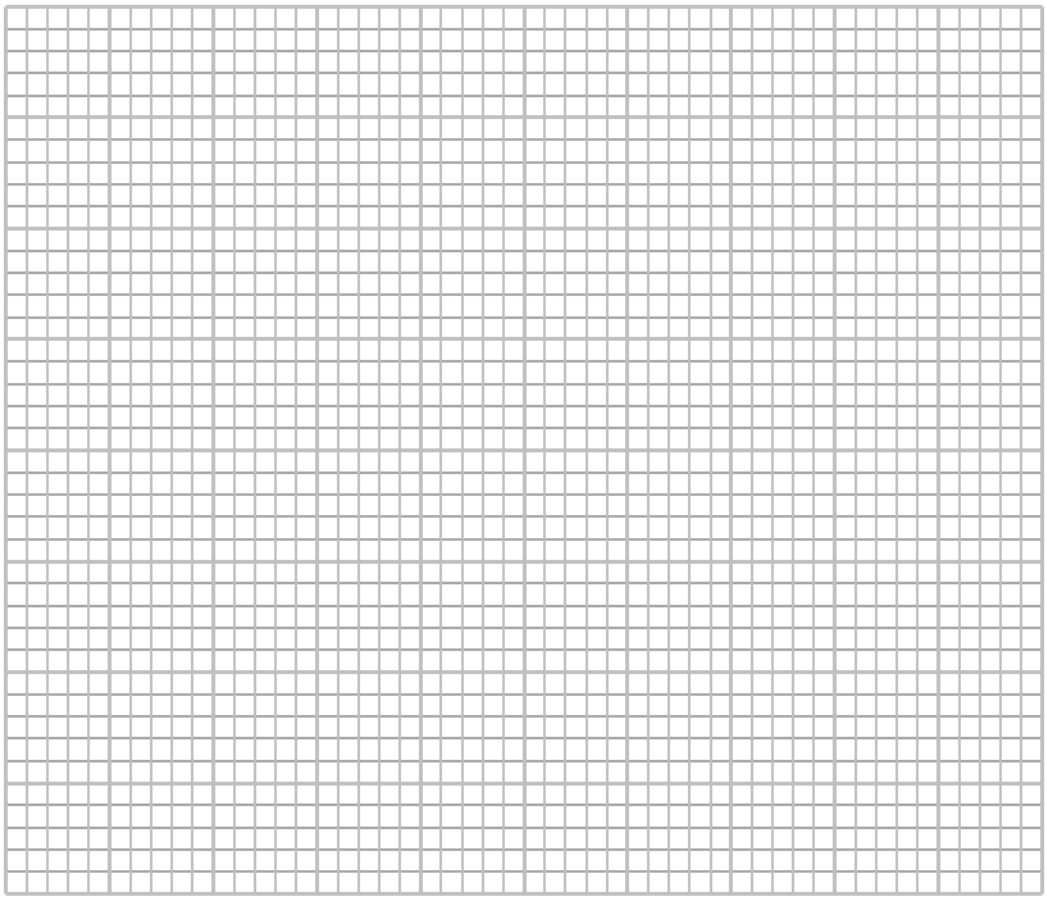
[4]

(i) Explain why 26 control patients were included in this study.

[2]

Of 50 patients treated with vitamin D, one required admission to the ICU, while of 26 untreated patients, 13 required admission. Of the patients treated with vitamin D, none died. Of the 13 untreated patients requiring admission to the ICU, two died and the remaining 11 were eventually discharged from hospital.

(j) Using the grid below, display these results in a **single** suitable bar chart, which makes the comparisons between the treatments and medical outcomes clear and meaningful. **[4]**



(k) The results suggest that vitamin D was an effective treatment for those admitted to hospital with severe symptoms of COVID-19. To what extent do you agree with this conclusion? Suggest what was done to make this study a 'fair test' and discuss the possible limitations of its findings.

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_____

_____ **[3]**

[End of paper]