Name: …… School: ……..

TONBRIDGE SCHOOL

Scholarship Examination 2017

Science I

Monday 24th April 2017

2:15 pm

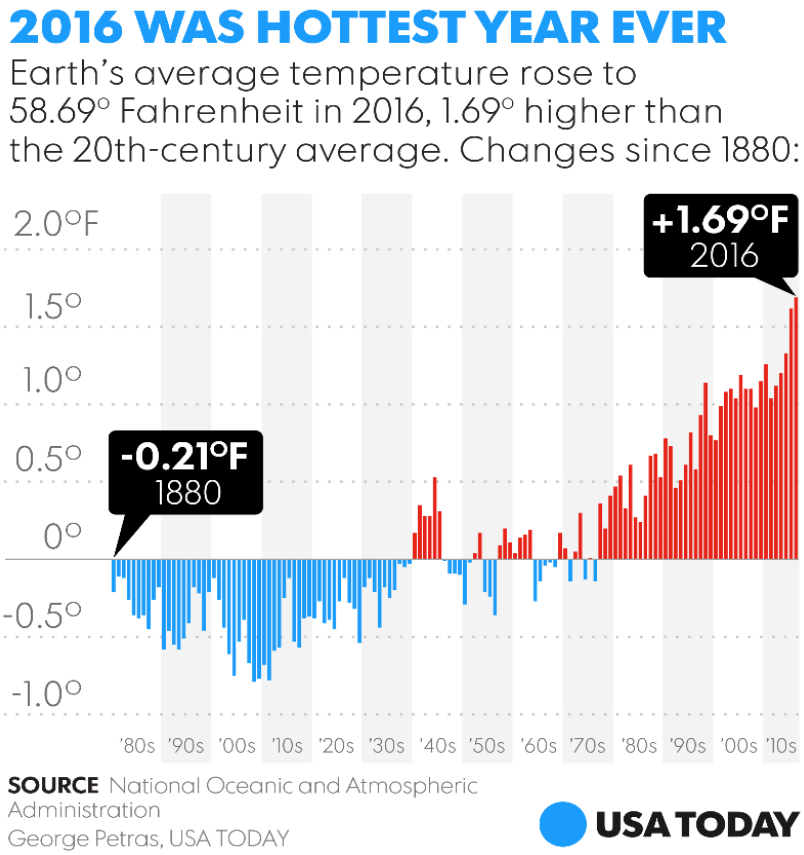
Time allowed: 45 minutes

Answer all the Questions

You may use a calculator

The entire paper is worth 40 marks and the number of marks for each question is shown in brackets.

1. 2016 was officially the hottest year since climate records began. The figure below was published in an American newspaper.



a) What was the global average temperature, in Fahrenheit, during the 20th Century? [1]

……

b) What was the global average temperature, in Fahrenheit, in 1880? [1]

……

c) What was the percentage increase in global temperature, in Fahrenheit, between 1880 and 2016? [2]

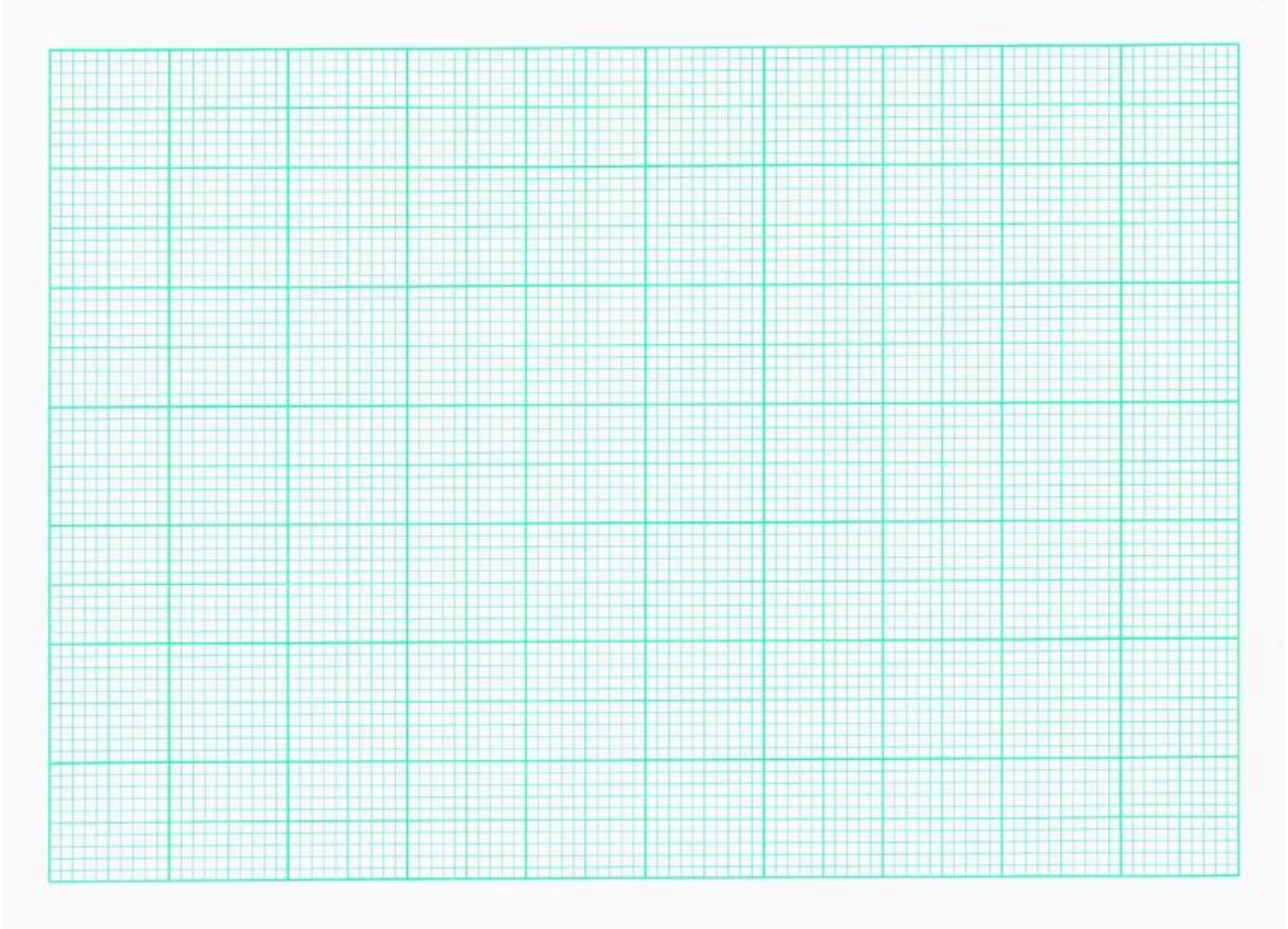
Answer: ……... %

The units in the figure are in Fahrenheit, but in Britain we use a different unit of temperature. The table below shows temperatures in Fahrenheit and their equivalent when measured using the scale normally used in Britain.

Temperature in ^{o} F	Temperature in British units
32	0
41	5
50	10
59	15
68	20
77	25
86	30
95	35
104	40

d) Plot a **line graph** to show the relationship between temperatures in Fahrenheit and in British units.

- Follow the usual rules for presenting graphs
- Plot temperature in Fahrenheit on the X axis.
- Label the Y axis with the correct name of "British units" [6]



e) A warm summer's day might be about 27^{o} in "British units". Use your graph to convert this value to Fahrenheit. [1]

……

f) What was the global average temperature in 2016, using British units? [2]

……

g) What is the *Systéme Internationale (SI)* and why is it useful? [2]

……

……

……

h) What is the actual SI unit for temperature? [1]

……

[Total 16 marks]

2. This question is about a lab experiment investigating climate change.

Global climate change is caused by increasing concentrations of certain gases in the atmosphere, such as carbon dioxide and methane. Some people hope that extra carbon dioxide in the atmosphere will stimulate extra photosynthesis by plants, and that this will tend to return the carbon dioxide levels to normal.

Paul, Hugh and Mark did an experiment.

- Six plastic bottles were set up like the one on the right. Each contained soil, water and a plant.
- Three of the bottles were filled with air and three had air with extra carbon dioxide added.
- The lids of the bottles were tightly closed.
- The bottles were all exposed to light for a week.
- The plan was to determine whether plants in the bottles with extra carbon dioxide grew faster.

Paul wanted to measure the growth of the plants by weighing the sealed bottles at the beginning and then again at the end. Hugh didn't think this would work.

a) Explain why Hugh was correct [3]

……

……

……

Hugh wanted to measure the growth of the plant by checking the length of the leaves at the beginning and then again at the end. Mark reckoned that should be possible but might not detect any growth even if it happened.

b) Suggest a reason Mark could be right [2]

……

……

……

Mark was concerned that the higher carbon dioxide concentration in three of the bottles would affect the temperature of the experiment, which would make it an unfair test.

c) How might carbon dioxide affect the temperature in the bottles? [3]

……

……

……

d) Why would different temperatures in different bottles make the experiment unfair? [3]

……

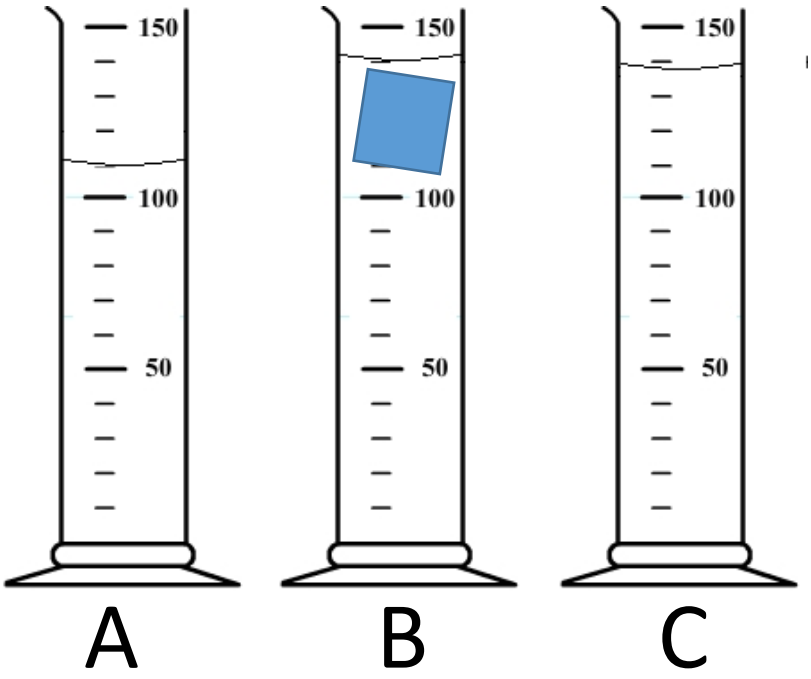
……

……

[Total 11 marks]

3. Climate change is resulting in melting of sea ice (ice floating on the ocean) in the arctic. This is sometimes incorrectly linked to rising sea levels, an idea which can be tested with a simple laboratory experiment.

   A measuring cylinder marked in cm^3 was partially filled with water (A) and an ice cube was added (B). The ice was allowed to melt (C).



a) What was the displacement of the ice cube? [2]

……..

b) Another ice cube, with displacement 12 cm^3, floats in water. Estimate the maximum mass of this ice cube, if water has a density of 1 g / cm^3. Explain your answer. [3]

……

……

……

……

c) Referring to the results of the experiment in your answer, explain why melting sea ice is not likely to contribute to rising sea level. [3]

……

……

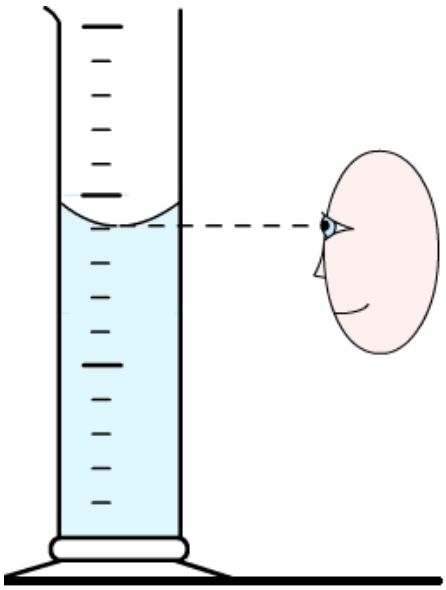
……

d) Sea levels are rising, but melting sea ice is not responsible. Suggest where else the extra water could be coming from. [2]

……

……

e) Consider the diagram below and state three steps which have been taken to ensure the measurement is accurate. [3]



i)

ii)

iii)

[Total 13 marks]

End of paper – now check your answers!