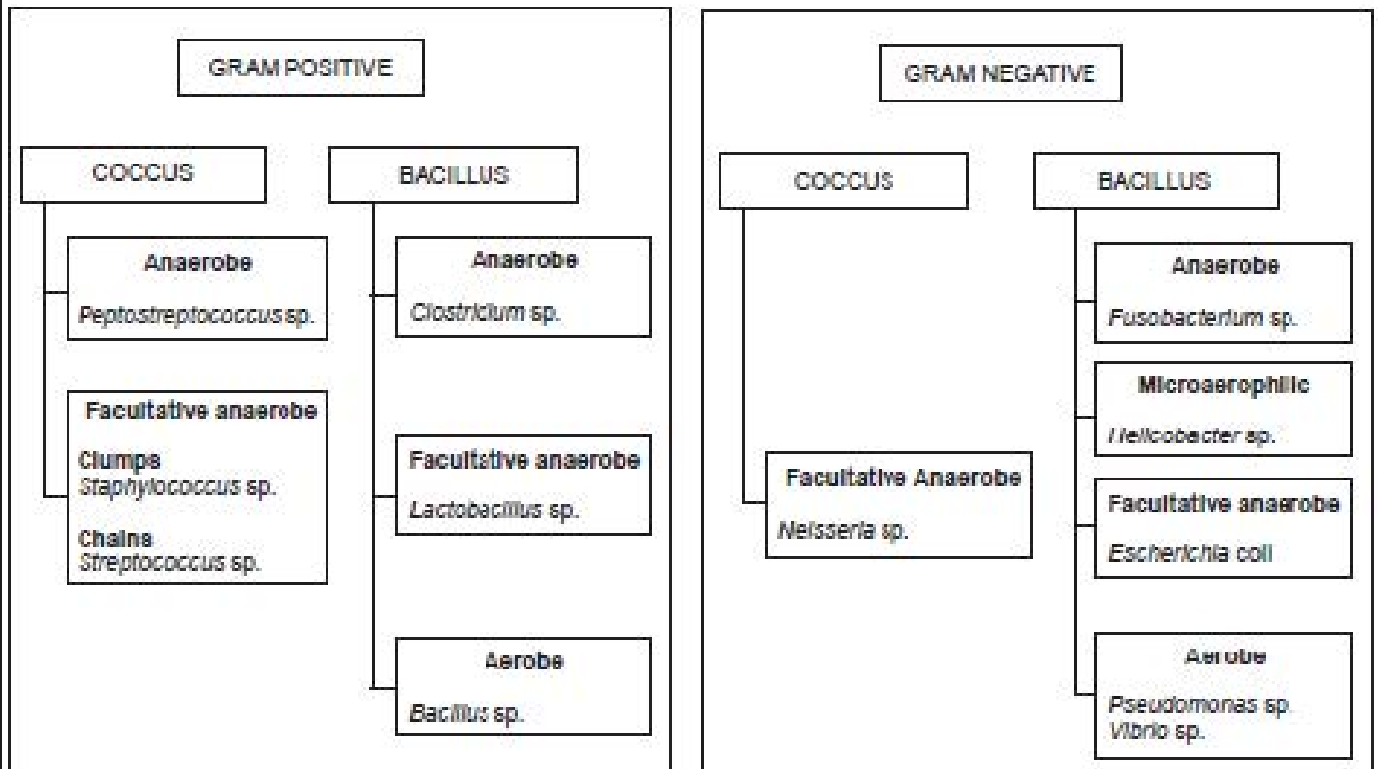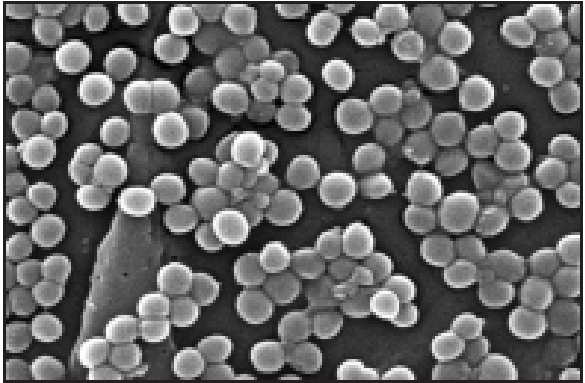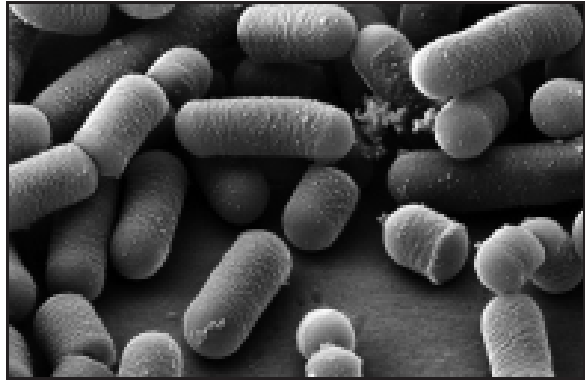# GCE Biology

S21-A400U10-1

Assessment Resource 6
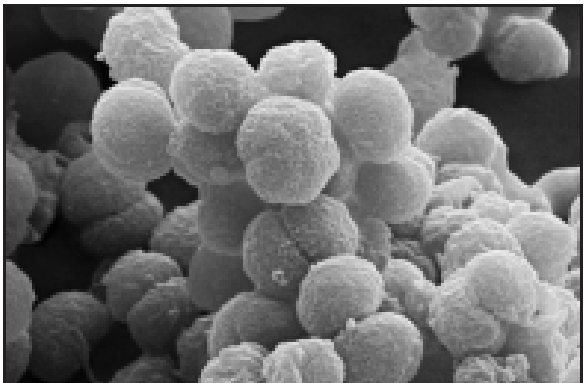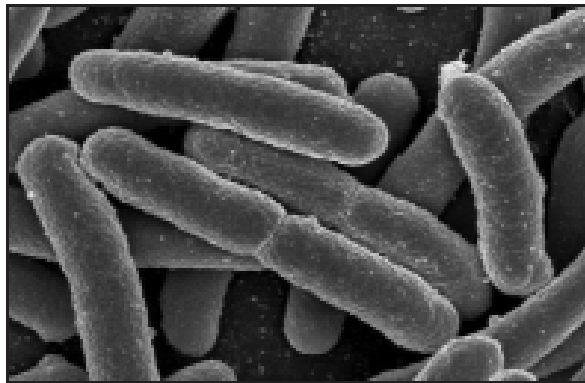
Energy for Life Resource F

1. Accurate and definitive bacterial identification is essential for disease diagnosis, treatment and the trace back of outbreaks associated with microbial infections. Bacterial identification is also used in a wide variety of other applications including microbial forensics, criminal investigations, bio-terrorism threats and environmental studies.

The simplified key shown below can be used to identify bacteria given some of their features.

GRAM POSITIVE

COCCUS

Anaerobe
Peptostreptococcus sp.

Facultative anaerobe

Clumps
Staphylococcus sp.

Chains
Streptococcus sp.

BACILLUS

Anaerobe
Clostridium sp.

Facultative anaerobe
Lactobacillus sp.

Aerobe
Bacillus sp.

GRAM NEGATIVE

COCCUS

Facultative Anaerobe
Neisseria sp.

BACILLUS

Anaerobe
Fusobacterium sp.

Microaerophilic
Helicobacter sp.

Facultative anaerobe
Escherichia coli

Aerobe
Pseudomonas sp
Vibrio sp.

The images below show four different bacteria together with information about their oxygen requirements and the results of Gram staining.

A	B
Facultative anaerobe Gram positive	Facultative anaerobe Gram positive

C	D
Facultative anaerobe Gram negative	Facultative anaerobe Gram negative

(a)   Using the key provided, identify the four bacteria in the images.   [4]

A ....

B ....

C ....

D ....

Each bacterial species has its own particular heat tolerance. During a process such as pasteurisation, the rate of cell destruction is logarithmic. Bacteria subjected to heat are killed at a rate that is proportional to the number of bacteria present. The process is dependent both on the temperature of exposure and the time required at this temperature to accomplish the desired rate of destruction.

The D value is the time in minutes at a given temperature required to destroy 90% of the bacterial population.

Graph 1

Log 10 of living bacteria

Time / min at 72°C
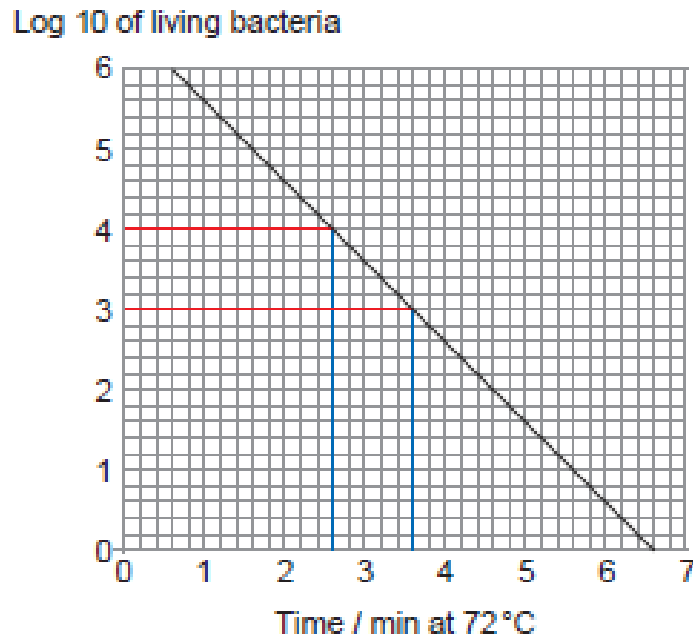
In the example shown above at 72°C, the D value = 1 minute. This means that for each minute of processing at 72°C the bacterial population will be reduced by 90%.

Graph 2

Log 10 of living bacteria

Time / min at 62°C
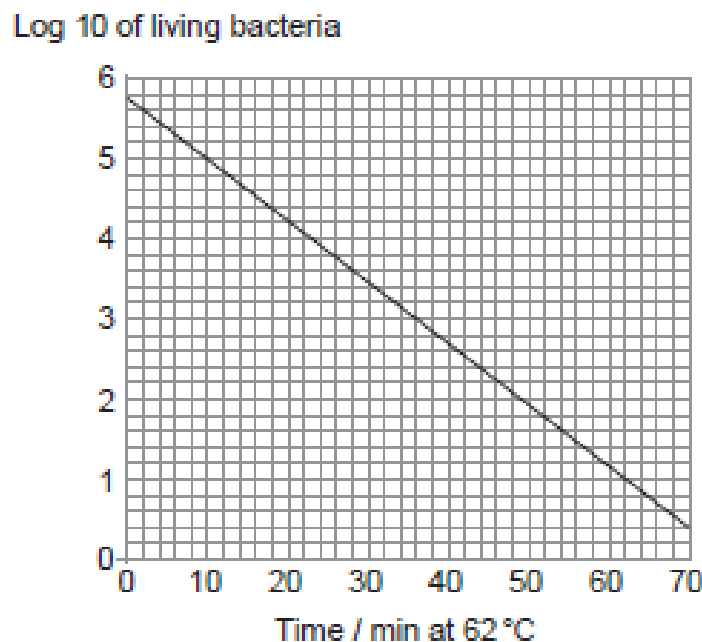
(b) Follow the method shown on graph **1** to calculate the D value for 62 °C (graph **2**).   [3]

D Value = ...

(c) Describe a method that you could use to determine the number of living bacteria in the original sample prior to heat treatment. No reference to aseptic technique is required. [4]

....

....

....

....

....

....

....

....

(d) Describe the effect of heat in the process of pasteurisation on the proteins in the bacteria.   [3]

....

....

....

....

....

....

2. In the past, Red Kites *(Milvus milvus)* almost became extinct in the UK and by 1905 there were estimated to be only three breeding pairs in the UK, all of which were in West Wales.

It has taken a century for the UK Red Kite population to recover from the few remaining birds. In 1986 the recovery was helped by the re-introduction of some Red Kites from Wales to England and Scotland. Although they are still rare, between 2008 and 2011 they were found breeding in over 700 areas that were sampled across the UK.

The population recovery has involved keeping nest sites secret and round-the-clock protection by volunteers.

(a) In 1995 there were 284 Red Kites in the UK with numbers increasing to 1025 per cent of the original population between 1995 and 2017. Calculate the approximate **number of breeding pairs** of Red Kites present in 2017. [3]

.... breeding pairs

(b) In areas where Red Kites were absent and then re-introduced the numbers increased much more rapidly than in areas where they were already established. Explain the reasons for this. [3]

....

....

....

....

....

(c) Explain why the location of nest sites needed to be kept secret with round-the-clock protection. [1]

....

Many Red Kite chicks are tagged so that their survival and lifespan can be monitored. Survival rates in Northern Scotland are poorer than elsewhere, mainly because of illegal poisoning and shooting on grouse-shooting estates.

(d) Suggest two ways in which society could improve the survival rates of Red Kites. [2]

....

....

....

....

Red Kites have often bred successfully in woodland SSSI's.

(e) State what is meant by an SSSI and why Red Kites may breed more successfully in these sites. [2]

....

....

....

....

3. Since the beginning of the Industrial Revolution (250 years ago), carbon dioxide concentration in the atmosphere has risen from about 280 parts per million to 408 parts per million in 2018. This means that for every million molecules in the atmosphere, 408 of them are now carbon dioxide, the highest concentration in two million years. Ice samples provide a record of the Earth's atmospheric temperature and CO_2 levels. The data below shows how global temperatures and atmospheric CO_2 levels have changed from the year 1000.

Use your knowledge of the carbon cycle to explain how humans have affected global carbon dioxide levels and temperature levels. Use the information and data provided to support your answer.

Describe the effects of increasing carbon dioxide levels and global temperatures on aquatic environments.

[9 QER]

....

....

....

....

....

....

....

....

....

....

END OF PAPER