**Units**

1. Convert the following units using standard form where appropriate:
   1. Convert 10mm into μm 6. Convert 100mm into m
   2. Convert 1m into mm 7. Convert 100mm into μm
   3. Convert 17μm into mm 8. Convert 100mm into nm
   4. Convert 1m into μm 9. Convert 57μm into nm
   5. Convert 100nm into μm 10. Convert 5m into nm

**Magnification**

1. State the equation linking magnification, image size and actual size.
2. Calculate the magnification for the following:
   1. Image size = 1000μm; actual size = 10μm
   2. Image size = 5000μm; actual size = 10μm
   3. Image size = 2500μm; actual size = 50μm
   4. Image size = 1000μm; actual size = 50μm
   5. Image size = 9mm; actual size = 10μm
   6. Image size = 15mm; actual size = 10μm
   7. Image size = 5mm; actual size = 15μm
   8. Image size = 6mm; actual size = 15nm
3. Calculate the actual size, in μm, for the following:
   1. Image size = 1500μm; magnification = x100
   2. Image size = 2700μm; magnification = x900
   3. Image size = 10mm; magnification = x100
   4. Image size = 5mm; magnification = x400
   5. Image size = 8mm; magnification = x500
   6. Image size = 5mm; magnification = x250
   7. Image size = 1.7cm; magnification = x75
   8. Image size = 2.1cm; magnification = x300
4. Calculate the following:

***Use appropriate units and standard form where applicable.***

* 1. Actual size = 8μm; image size = 8mm. Calculate the magnification.
  2. Magnification = x400; image size = 6mm. Calculate the actual size.
  3. Image size = 8mm; magnification = x100. Calculate the actual size.
  4. Actual size = 8nm; magnification = x1000. Calculate the image size.
  5. Image size = 1.9cm; magnification = x450. Calculate the actual size.

**Microbiology**

1. State what is meant by the term ‘**zone of inhibition**’.
2. State the equation for calculating the **cross sectional area** of a zone of inhibition.
3. Calculate the following cross sectional areas, assume π = 3.14.

***Show all of your workings to an appropriate number of decimal places, include units.***

* 1. Radius = 1.0mm 6. Diameter = 1.0mm
  2. Radius = 1.2mm 7. Diameter = 2.3mm
  3. Radius = 2.3mm 8. Diameter = 1.7mm
  4. Radius = 1.7mm 9. Diameter = 3.6mm
  5. Radius = 1.3mm 10. Diameter = 1.6mm

1. Calculate the cross sectional area of each of the following zones of inhibition around the antibiotic discs, assume π = 3.14.

***Show all of your workings to an appropriate number of decimal places.***

G

F

E

D

A

B

C

**Examination style questions**

**1** Look at the following image of a eukaryotic cell.



Organelle A

Magnification x20,000

**(a)** Name **organelle A**.

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**(b)** What is the function of organelle A?

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**(c)** Calculate the **actual length** of organelle A, in **μm**.

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**(d)** Calculate the actual size of a cell, in **μm**, if the image measures 5.8cm with a magnification of x1,000.

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**(e)** Define the term ‘**resolution**’.

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**2** A scientist was investigating the antibacterial properties of plant sap. Below is a diagram showing the results of their investigation.

A

B

C

D

E

**(a)** Which plant sap is the most effective antibacterial agent? Explain your answer.

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**(b)** Calculate the zones of inhibition for B, C and D. Show your working.

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**3** A group of students investigated the effect of 5 different antibiotics on one type of bacterium.

**(a)** State 3 variables which must be kept the same to ensure the results are valid.

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**(b)** Describe a method for this investigation. Do not include details of aseptic techniques in your response.

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**(c)** Describe how to calculate a zone of inhibition.

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**(d)** Explain why the plates should not be incubated at 50oC.

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**4** Give a reason for each of the following aseptic techniques used when preparing a bacterial plate.

**(a)** The lid of the petri dish is only partly opened.

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**(b)** The petri dish is sealed with tape.

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**(c)** The loop used to spread the bacteria onto the plate is heated in a Bunsen flame **and** then cooled.

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**(d)** The side bench is swabbed with alcohol.

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**Answers**

**Microscopes**

**a** **(1)** 10,000 or 1 x104

**(2)** 1,000 or 1 x103

**(3)** 0.017 or 1.7 x10-2

**(4)\*** 1,000,000 or 1 x106

**(5)** 0.1

**(6)** 0.1

**(7)** 100,000 or 1 x105

**(8)\*** 100,000,000 or 1 x107

**(9)** 57,000 or 5.7 x104

**(10)\*** 5,000,000,000 or 5 x109

**b** Magnification = Image size ÷ Actual size (any correctly rearranged)

**c** **(1)** x100 **(5)\*** x900

**(2)** x500 **(6)\*** x1500

**(3)** x50  **(7)\*** x333

**(4)** x20 **(8)\*** x400

**d** **(1)** 15 **(5)\*** 16

**(2)** 3 **(6)\*** 20

**(3)\*** 100  **(7)\*** 226.7

**(4)\*** 12.5 **(8)\*** 70

**e** **(1)** x1000 **(4)** 8 x10-3nm

**(2)** 15μm **(5)\*** 42.2μm

**(3)\*** 80μm

**Microbiology**

**a** Area (around a disc) where bacteria do not grow.

**b** πr2

**Questions marked with an asterisk \* may be more challenging due to changes in units, or the complexity of the equation.**

**c** **(1)** 3.2mm2 **(6)\*** 0.8mm2

**(2)** 4.5mm2 **(7)\*** 4.2mm2

**(3)** 16.6mm2  **(8)\*** 2.3mm2

**(4)** 9.1mm2 **(9)\*** 10.2mm2

**(5)** 5.3mm2 **(10)\*** 2.0mm2

**d** **(A)** 415mm2 **(E)** 491mm2

**(B)** 154mm2 **(F)** 0mm2

**(C)** 254mm2 **(G)** 0.8mm2

**(D)** 1170mm2

**Examination style questions**

**1** **(a)** Mitochondrion (accept plural).

**(b)** Site of aerobic respiration.

**(c)** 0.5μm

**(d)\*** 58μm

**(e)** How close together two objects can be, and still be seen as separate objects.

**2** **(a)** C; largest zone of inhibition

**(b)** B = 0.8mm2; C = 314mm2;

D = 2.3mm2

**3** **(a)** Petri dish; size of disc; amount

of antibiotic on disc; concentration of antibiotic on disc; bacteria type; time incubated; temperature

**(b)** Spread bacteria on sterile agar plate; soak a disc in each of the antibiotics; place discs on agar; incubate; measure zones of inhibition

**(c)** Measure diameter; convert to radius; πr2

**(d)** Bacteria would die

**4** **(a)** Prevent unwanted bacteria

(fungal) growth/ prevent contamination

**(b)** So petri dish not opened

**(c)** Sterilised to kill unwanted bacteria; if still hot then wanted bacteria would be killed

**(d)** Sterilise bench/ kill unwanted bacteria