Practical Skills in Biology – 2021/20 GCE AS Biology A

1. Nov/2021/Paper-H020/01/No.7

Which of the stains, **A** to **D**, would be chosen to bind to the phosphate group of DNA to make chromosomes more visible when using a light microscope?

A carbolfuchsin – a non-polar dye

B nigrosin – a negatively charged dye

C methylene blue – a positively charged dye

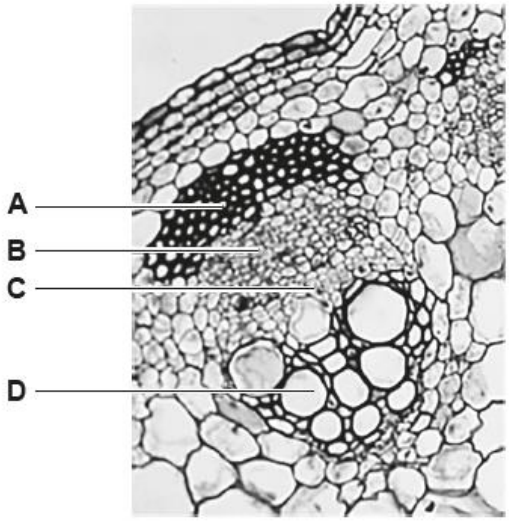
D Sudan 111 – a lipid-soluble dye

Your answer ☐ **[1]**

2. Nov/2021/Paper-H020/01/No.10

The image below shows a transverse section of a stem vascular bundle of a sunflower, *Helianthus annuus*.

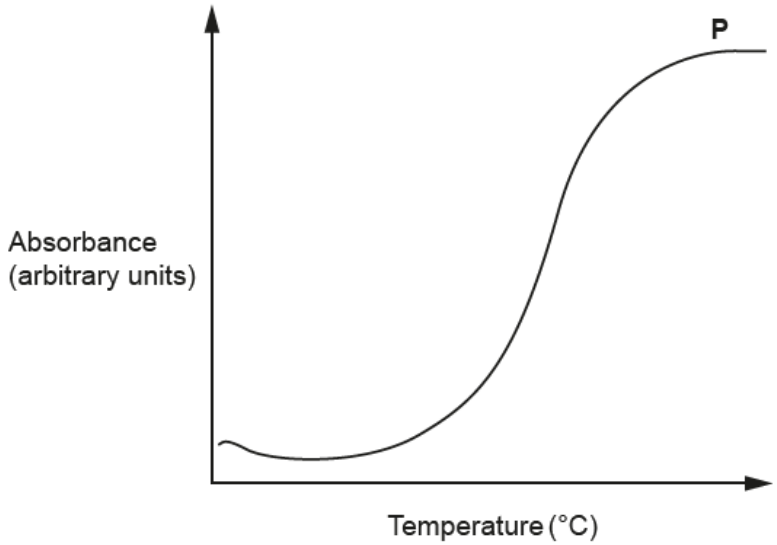
Which of the options, **A** to **D**, labels the xylem vessels?



Your answer ☐ **[1]**

3. Nov/2021/Paper-H020/01/No.19

The graph below shows readings from a colorimeter as pigment leaks out of beetroot membranes at different temperatures.



Which statement, **A** to **D**, explains why the absorbance stops increasing at point **P**?

A The phospholipid bilayer has melted.

B Vibration has created spaces between the phospholipids.

C Transmembrane proteins have denatured.

D Pigment is in equal concentration inside and outside the cells.

Your answer ☐ **[1]**

4. Nov/2021/Paper-H020/01/No.20

A student carried out four tests on samples from a beaker of starch and amylase.

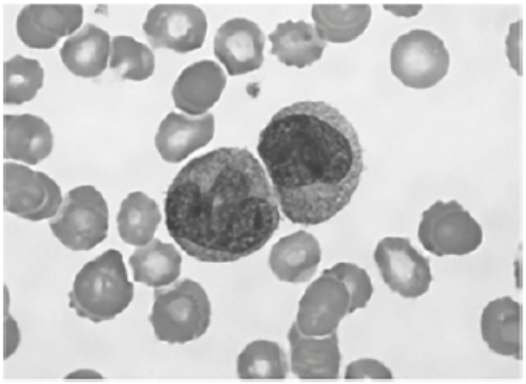
Which row, **A** to **D**, would show the correct results if the reaction was still happening?

	Iodine test	**Benedict's test**	**Biuret test**	**Emulsion test**
A	negative	positive	negative	positive
B	positive	negative	positive	positive
C	positive	positive	positive	negative
D	positive	positive	negative	negative

Your answer ☐ **[1]**

5. Nov/2021/Paper-H020/01/No.22

The image below shows two white blood cells in a blood sample, seen using a light microscope.



(a) Explain how to measure the diameter of the nucleus of one of the white blood cells, when observing the cells through a light microscope.

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..... **[4]**

(b) During a bacterial infection, activated white blood cells multiply by mitosis.

In order to study the behaviour of chromosomes during mitosis, higher resolution images are needed.

(i) Complete the table below about microscopes and their images.

	Laser scanning confocal microscope	**Scanning electron microscope**	**Transmission electron microscope**
Maximum resolution	200 nm	3–10 nm	0.5 nm
Image appearance	2D / 3D	.....	.....
Image colour	.....	.....	black and white

[2]

(ii) A transmission electron microscope image of a white blood cell was studied. It was concluded that the cell had stopped dividing at the G2 checkpoint.

Suggest **two** observations that would have led to this conclusion.

1 .....

2 .....

[2]

(c) DNA can be extracted from a culture of white blood cells and precipitated using the following procedure:

1. Mix a culture of white blood cells with a detergent.
2. Add salt.
3. Add an enzyme.
4. Place in a water bath at 40 °C.
5. Filter the culture.
6. Gently pour ice-cold ethanol onto the filtrate.

(i) Suggest why the cells do not need to be crushed before adding detergent.

..... **[1]**

(ii) Explain why the detergent is used in step 1.

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..... **[1]**

(iii) Suggest the type of enzyme that should be used in step 3 and explain why.

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..... **[2]**

6. Nov/2021/Paper-H020/01/No.23

Fig. 23.1 shows a spirometer trace of a student at rest breathing for one minute.

The trace shows a period of resting breathing, followed by a maximum inhalation and exhalation.

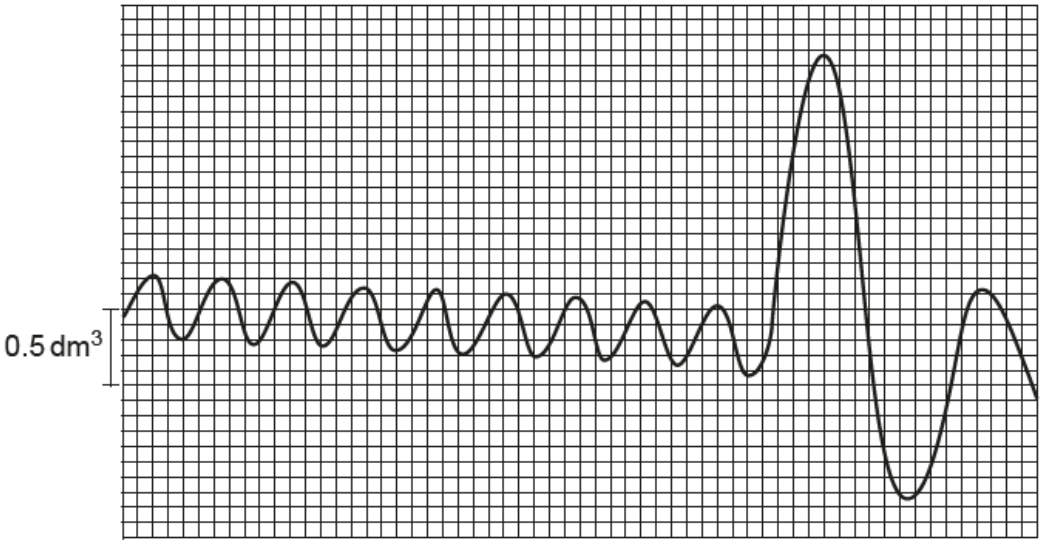

Fig. 23.1

(a) (i) Explain why there is a downward trend in the trace.

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..... **[2]**

(ii) Using **Fig. 23.1**, calculate the mean resting breathing rate.

Mean = ...breaths per minute **[2]**

(iii) Using the trace in **Fig. 23.1**, state the vital capacity.

Give your answer in cm^3.

Vital capacity = ... cm^3 **[2]**

(b) **Fig. 23.2** shows the change in mean resting tidal volume with age in 122 boys and girls from age 12 to 19.

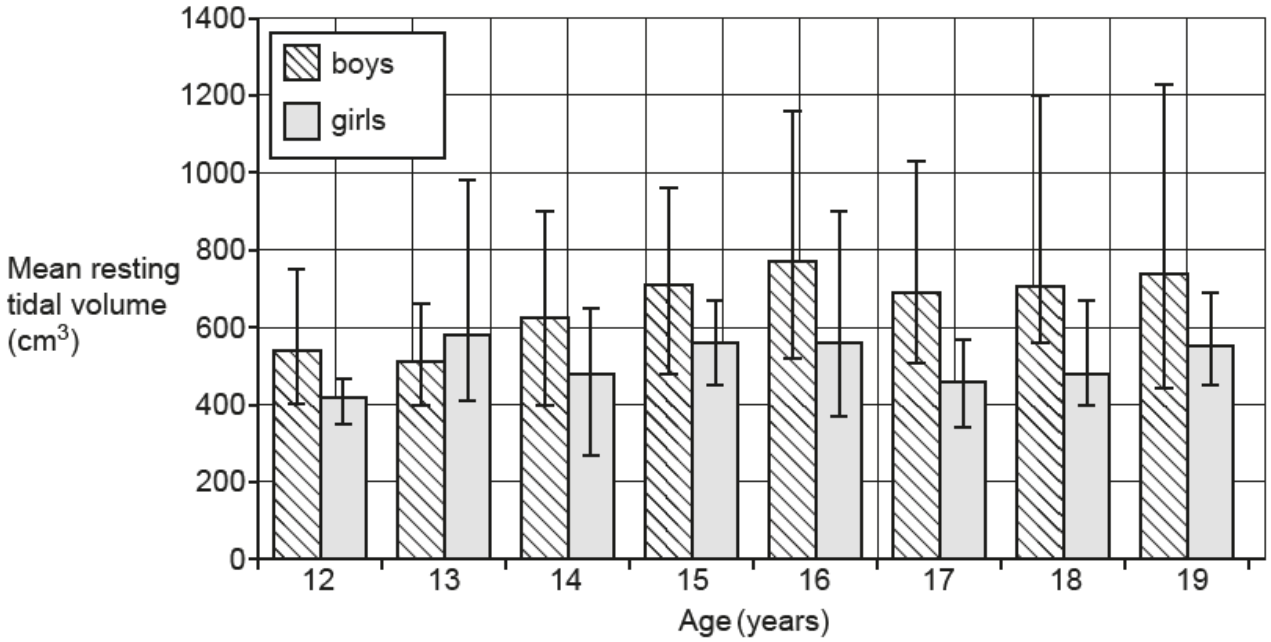

Fig. 23.2

The ranges shown in **Fig. 23.2** are the maximum and minimum values for each group.

(i) Describe **three** patterns in the data in **Fig. 23.2**.

1 .....

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2 .....

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3 .....

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[3]

(ii) State **one** group from **Fig. 23.2** that is likely to contain an anomaly. Explain your choice.

Group .....

Explanation .....

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[2]

(iii) Explain why using standard deviation error bars in **Fig. 23.2** would increase the confidence in any conclusion made.

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..... **[2]**

(iv) The table shows the raw data of resting tidal volume for 13-year-old boys in **Fig. 23.2**.

The mean resting tidal volume for this group is 510 cm^3.

Person	Resting tidal volume (cm^3)
1	410
2	660
3	650
4	440
5	400
6	450
7	540
8	530

Calculate the standard deviation of the resting tidal volume for 13-year-old boys.

Use the formula: $s = \sqrt{\frac{\Sigma(x-\overline{x})^2}{n-1}}$

Give your answer to **3** significant figures.

Standard deviation = ... **[3]**

(v) Other than increasing the sample size, suggest **two** ways that the selection of participants in the study could have improved the validity of the data.

1 .....

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2 .....

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[2]

7. Nov/2020/Paper-H020/01/No.22(b, c)

Collagen is a protein found in arterial walls. A collagen molecule has three polypeptide chains, each with 1050 amino acids, wrapped into a triple helix. A repeating sequence of the amino acids glycine and proline occur in each polypeptide chain. These amino acids have non-polar side chains.

(b) Outline the method of chromatography that will separate the main amino acids in collagen.

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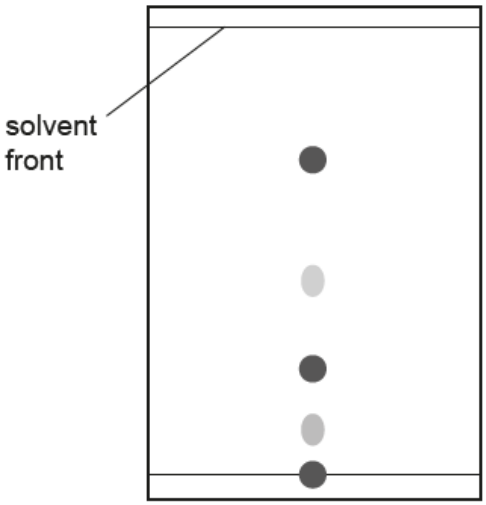
..... **[3]**

(c) A student carried out the method of chromatography on a sample labelled 'collagen'. The results can be seen on the chromatogram below.

On a chromatogram, the darker the spot, the higher the concentration of that amino acid.



(i) Calculate Rf values for the two highest concentration amino acids.

Rf value 1 = ...

Rf value 2 = ...

[2]

(ii) The table shows the Rf values of a range of amino acids.

amino acid	Rf value
glutamine	0.13
glycine	0.27
isoleucine	0.72
leucine	0.73
methionine	0.55
phenylalanine	0.68
proline	0.43
tryptophan	0.66
tyrosine	0.45
valine	0.61

The student thought that they may have made an error and **not** used a sample of collagen.

Use the information in the table to conclude whether the chromatogram shows that the protein analysed is collagen.

Explain your answer.

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..... **[2]**