# COLORIMETRY (VISIBLE SPECTROSCOPY) – TOPIC TEST 1

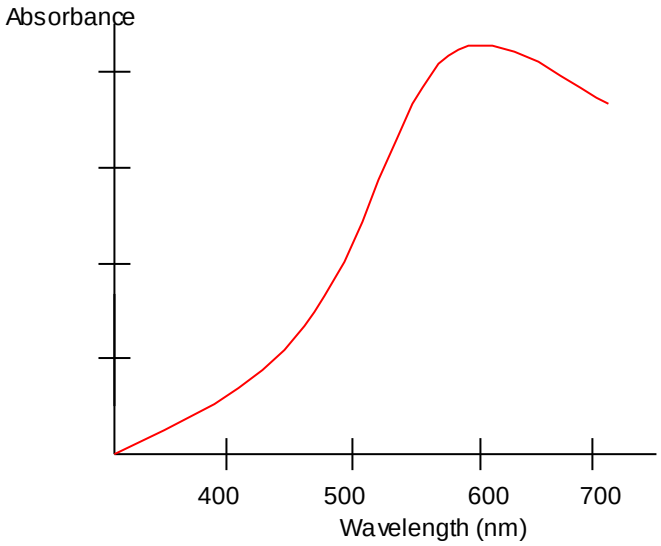
**QUESTION 1**
The main instrument used in colorimetry is called a:

**A** Photometer
**B** Spectrometer
**C** Spectrophotometer
**D** Wave spectrophotometer

**QUESTION 2**
Colorimetry is based on the amount of light of a particular wavelength:

**A** Being reflected by the sample.
**B** Being absorbed by the sample.
**C** Being refracted by the sample.
**D** Being scattered by the sample.

**QUESTION 3**
In order to decide which wavelength gives maximum absorbance for a certain substance, absorbance V's wavelength graphs are constructed, like the example below:




The best wavelength to use for maximum absorbance would be:

**A** 700nm
**B** 600nm
**C** 500nm
**D** 400nm

**QUESTION 4**
Copper (II) ion ($Cu^{2+}$) solutions have a distinct blue colour and the more concentrated the solution, the higher the colour intensity. Filters are often used in colorimetric determinations so that the least suitable wavelengths are absorbed and the most suitable allowed passing through. The use of a blue filter in Copper (II) analysis would be unsuitable because:

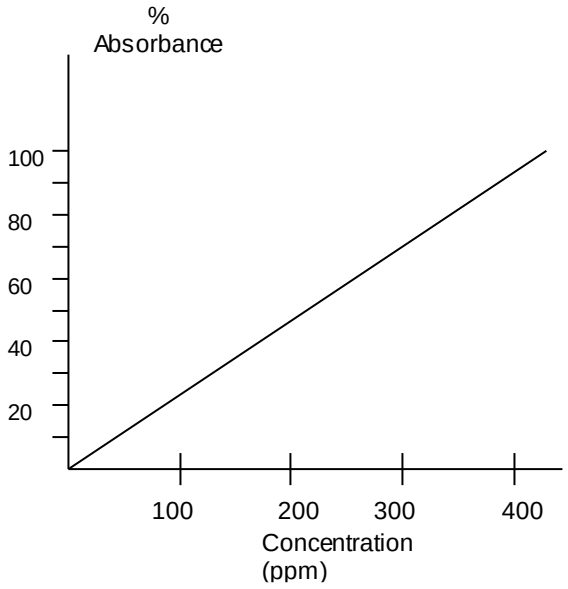
**A** Blue light would be absorbed by the filter and that's what the solution would also be absorbing.

**B** The filter would alter the colour intensity of the sample.

**C** Blue light would pass through the filter and the sample as well, no absorbance could be recorded.

**D** The filter would stop any light from getting through to the sample.

**QUESTION 5**
The following is a calibration curve for colorimetric analysis of a particular substance:



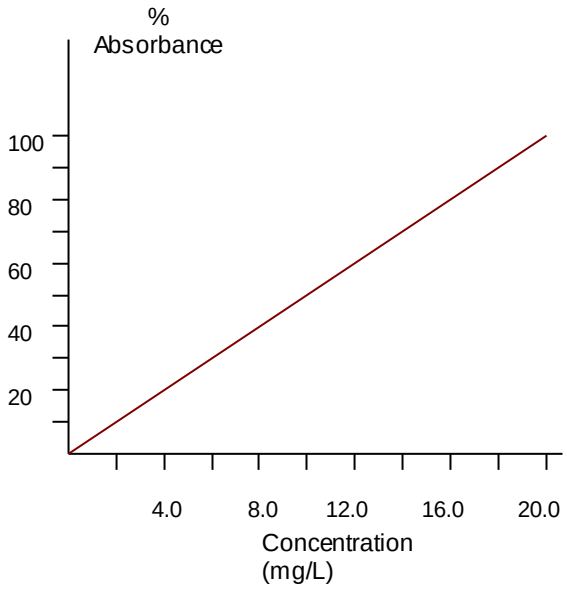

If the absorbance reading for the test sample were 85%, the concentration would be:

**A** 200ppm
**B** 300ppm
**C** 350ppm
**D** Off the scale

**QUESTION 6**
One limitation of the use of colorimetric techniques is:

**A** The method is not very accurate.
**B** The method is not very reliable.
**C** The samples to be tested have to produce a coloured solution.
**D** None of the above.

**QUESTION 1**
A patient's blood sample was analysed for iron levels using colorimetric analysis. The blood sample was diluted by a factor of 10 and reacted to form a coloured complex before being analysed. Below is a calibration curve for various concentrations of iron:




When the patient's blood sample was analysed, the absorbance was recorded to be 90%.

**a** Calculate the concentration of iron in the sample analysed.

**b** Calculate the concentration of iron in the original, undiluted blood sample.

**c** If the patient has 5.5 L of blood, calculate the total mass of iron in the patient's blood.

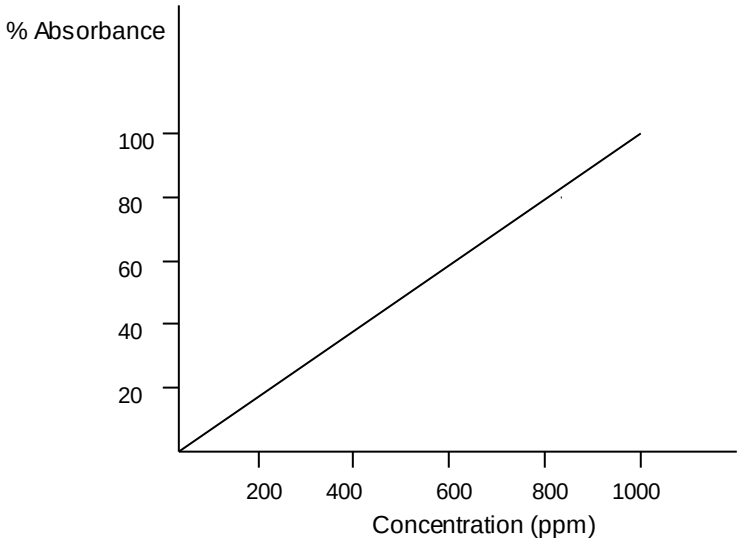
**d** The recommended mass of iron for this particular patient, according to size and weight, is around2.5g of total iron in blood. Determine whether the patient satisfies this minimum requirement.

**QUESTION 2**

Identify the major components of a spectrophotometer and outline the function of each.

***Solution***

**QUESTION 3**
A calibration curve for copper sulphate ($CuSO_4$) is shown below:




The sample to be tested gave an absorbance reading of 50%. Also, the sample had been diluted by placing 10.0mL of the original solution into a volumetric flask and making it up to 150.0mL.

**a** Calculate the concentration of copper sulphate of the test cell from the absorbance reading.

**b** Calculate the concentration of copper sulphate in the original undiluted sample.

**c** Calculate the concentration of copper sulphate in mg/L.

# SOLUTIONS

**QUESTION 1** Answer is C

**QUESTION 2** Answer is B

**QUESTION 3** Answer is B

**QUESTION 4** Answer is C

**QUESTION 5** Answer is C

**QUESTION 6** Answer is C

**QUESTION 7**

**a** From calibration graph: 90% abs= 18mg/L.

**b** Since sample was diluted by a factor of 10: [Fe]= 18 x 10=180mg/L.

**c** m(Fe)= 18 x 5.5= 990mg OR 0.99g.

**d** The patient falls short of the minimum iron level in blood. The patient suffers from anaemia.

**QUESTION 8**

List should include:

- Light source (lamp): to provide a range of wavelengths.
- Slit: to narrow the beam of light.
- Filter: to absorb unusable wavelengths and transmit desirable ones.
- Light detector: to detect the amount of light after going through the sample.
- Recorder: to indicate amount of light absorbed and/or transmitted.

**QUESTION 9**

**a** 50% absorbance= 500ppm

**b** Sample was diluted by a factor of 15
∴concentration original sample= 500 x 15= 7,500ppm

**c** 7,500 ppm= 7.5 mg/L