Monoclonal Antibodies

These practice questions can be used by students and teachers and is suitable for GCSE AQA Biology topic Questions 8641

Level: GCSE AQA Biology 8641

Subject: Biology

Exam board: GCSE AQA

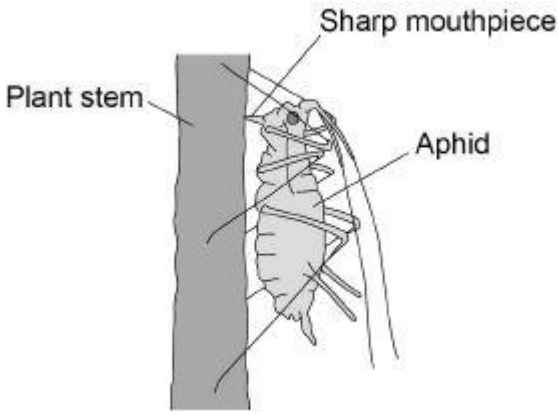
Topic: Monoclonal Antibodies

Q1.

Plants can be infected by fungi, viruses and insects.

Aphids are small insects that carry pathogens.

The diagram below shows an aphid feeding from a plant stem.



(a) An aphid feeds by inserting its sharp mouthpiece into the stem of a plant.

Give the reason why the mouthpiece of an aphid contains a high concentration of dissolved sugars after feeding.

(1)

(b) Plants infected with aphids may show symptoms of magnesium deficiency.

Magnesium deficiency symptoms include:

- yellow leaves
- stunted growth.

Explain how a deficiency of magnesium could cause these symptoms.

(5)

(c) A farmer thinks a potato crop is infected with potato virus Y (PVY).

The farmer obtains a monoclonal antibody test kit for PVY.

To make the monoclonal antibodies a scientist first isolates the PVY protein from the virus.

Describe how the scientist would use the protein to produce the PVY monoclonal antibody.

(4)

(Total 10 marks)

Q2.

A virus called RSV causes severe respiratory disease.

(a) Suggest **two** precautions that a person with RSV could take to reduce the spread of the virus to other people.

1.

2.

(2)

(b) One treatment for RSV uses monoclonal antibodies which can be injected into the patient.

Scientists can produce monoclonal antibodies using mice.

The first step is to inject the virus into a mouse.

Describe the remaining steps in the procedure to produce monoclonal antibodies.

(3)

(c) Describe how injecting a monoclonal antibody for RSV helps to treat a patient suffering with the disease.

(2)

A trial was carried out to assess the effectiveness of using monoclonal antibodies to treat patients with RSV.

Some patients were given a placebo.

(d) Why were some patients given a placebo?

(1)

A number of patients had to be admitted to hospital as they became so ill with RSV.

The results are shown in the table below.

Treatment received by patient	**% of patients within each group admitted to hospital with RSV**
Group **A**: Monoclonal antibody for RSV	4.8
Group **B**: Placebo	10.4

The trial involved 1 500 patients.

- Half of the patients (group **A**) were given the monoclonal antibodies.
- Half of the patients (group **B**) were given the placebo.

(e) Calculate the total number of patients admitted to hospital with RSV during the trial.

Total number of patients admitted to hospital = _____

(2)

(f) Evaluate how well the data in the table above supports the conclusion:

'monoclonal antibodies are more effective at treating RSV than a placebo'.

(2)

(Total 12 marks)

Q3.

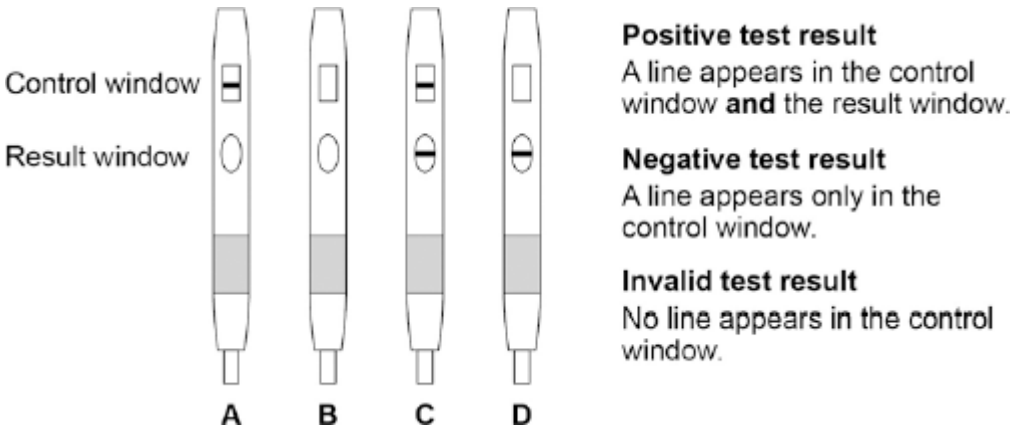
Monoclonal antibodies are used to measure the levels of hormones in the blood.

Pregnant women produce the hormone HCG.

HCG is excreted in urine.

Figure 1 shows four pregnancy test strips.

Figure 1



(a) Which test strip shows a negative test result?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(b) Monoclonal antibodies are used for pregnancy testing.

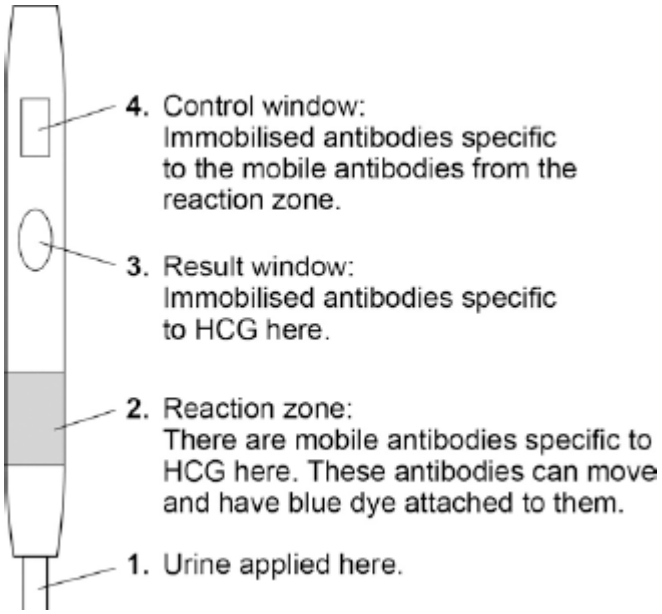
Give **one other** use of monoclonal antibodies.

_____

(1)

(c) **Figure 2** shows the parts of a pregnancy test strip.

Figure 2



The pregnancy test strip will show a positive test result when a woman is pregnant.

Explain how the pregnancy test strip works to show a positive result.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(Total 8 marks)

Mark schemes

Q1.

(a) (mouthpiece) has pierced / entered the phloem
or
(the aphid) has been feeding from the phloem

1

(b) yellow leaves due to lack of chlorophyll

ignore 'chloroplasts'
ignore magnesium is needed to make chlorophyll

1

(therefore) less / no light absorbed (by chlorophyll)

1

(therefore) lower rate of / no photosynthesis

*do **not** allow 'energy is produced by photosynthesis'*

1

(therefore) plant makes less / no sugar / glucose

1

(therefore) plant converts less / no sugar / glucose into protein (for growth, so growth is stunted)

allow less glucose / sugar converted into cellulose (cell wall)
allow less energy for protein synthesis

1

(c) inject the protein / it into a mouse

1

combine lymphocytes with tumour / cancer cells to make hybridoma (cells)

ignore white blood cells
allow T or B lymphocytes
ignore tumour unqualified

1

find a hybridoma which makes a monoclonal antibody specific to PVY

1

(the scientist) clones (the hybridoma) to produce many cells (to make the antibody)

*do **not** allow cloning of original stem cells*
allow many rounds of cloning / mitosis

1

[10]

Q2.

(a) any **two** from:

- regular hand washing
  or
  use hand sanitiser / alcohol gel
- cover nose / mouth when coughing / sneezing
  allow wear a face mask
- put used tissues (straight) in the bin
- don't kiss uninfected people
  allow isolate patient from others
  or
  don't share cutlery / cups / drinks with uninfected people
- clean / disinfect / sterilise surfaces regularly
  ignore responses referring to infected people

2

(b) any **three** from:

- stimulate (mouse) lymphocytes to produce antibody
  for marking points 1 and 2 lymphocyte must be used at least once
- combine (mouse) lymphocyte with tumour cell
  or
  (create a) hybridoma
- clone (hybridoma) cell
- (hybridoma) divides rapidly **and** produces the antibody

3

(c) any **two** from:

- (monoclonal) antibody binds to virus **or** antibody binds to antigen on surface of virus
- (monoclonal) antibody is complementary (in shape) / specific to antigen (on surface of virus)
- white blood cells / phagocytes kill / engulf the virus(es)

2

(d) as a control
or
to see / compare the effects of the treatment (vs. no treatment)

1

(e) (4.8 + 10.4) ÷ 2 ÷ 100 × 1500
or
(4.8 ÷ 100 × 750) + (10.4 ÷ 100 × 750)

1

114

*an answer of 114 scores **2** marks*
*allow 228 for **1** mark*

1

(f) **(supports the conclusion because)**
over double the number / % of patients (in the trial) were hospitalised with the placebo (compared to MAB)

1

(does not support the conclusion because)
no information on patients not hospitalised / still unwell at home
or
other factors may have affected those admitted to hospital
allow correct named factor e.g. age / gender / other illness
or
don't know if it was a double blind trial

1

[12]

Q3.

(a) **A**

1

(b) any **one** from:
- identify / locate specific molecules / other hormones
- locate blood clots
- diagnose / treat some cancers

1

(c) (as) urine passes through reaction zone

1

HCG hormone binds to the mobile HCG antibody (in the reaction zone)

1

(passes up the stick) HCG hormone binds to the immobilised HCG antibodies in the results zone

1

(the other) antibodies which do not attach to HCG

1

bind to antibodies in control zone

1

blue dye appears in both control and results zones (to show positive result)

1

[8]