Thank you for subscribing to SmarterScience Teacher Edition in 2025.

Key features of the Biology "2025 HSC Comprehensive Revision Series" for include:

- ~17 hours of cherry-picked HSC revision questions by topic
- Targeted at motivated students aiming for a Band 5 or 6 result
- Weighting toward more difficult examples
- Mark allocations given to each topic generally reflect its historical (new syllabus) HSC exam allocation.
- ***Attempt, carefully review and annotate*** this revision set in Term 3
- This question set provides the foundation of a concise and high-quality revision resource for the run into the HSC exam.
- This resource should be used to complement (not replace) the critical final stretch preparation for every student - timed full exam practice papers.

Our analysis on each topic, the common question types, past areas of difficulty and recent HSC trends all combine to create this revision set that ensures students cover a wide cross-section of the key areas.

IMPORTANT: If students have been exposed to questions in these worksheets during the year, we say great. Many top performing students attest to the benefits of doing quality questions 2-3 times before the HSC. This type of revision set is aimed at creating confidence and *speed through the exam*, with cherry picked questions that cover all important elements of revision while avoiding low percentage rabbit hole excursions.

HSC Final Study: M7 Infectious Disease

Causes of Infectious Disease (~8.5% historical contribution)

Key Areas addressed by this worksheet

- *M7 Causes of Infectious Disease* has been consistently tested in the band 5-6 range every year and is a key topic area for outperformance.
- *Classifying Pathogens* is an extremely important topic area that has attracted high mark longer answer questions in every new syllabus exam in the period 2019-23.
- Revision questions require students to identify pathogens using a limited description of their features, an area that has proven very challenging (see *2020 HSC 32b* and *2019 HSC 33d).*
- *Indirect Transmission, Direct Transmission* and *Vectors* is another focus area of this revision set. It has also been tested three times in the extended response section, most recently in 2022. We review *2019 HSC 31* among multiple examples.
- Revision questions require a good understanding of the works of *Louis Pasteur* and *Robert Koch.* Students must be able to efficiently describe their findings and integrate them into broad questions looking at causes and transmission of infectious diseases.
- *Microbial Tests* are covered with a weighting toward multiple-choice to reflect recent HSC questions on this topic.
- Effects on agricultural production from infectious diseases on plants was examined for the first time in *2024 HSC 26* which is an important revision question along with infectious diseases of animals which is also covered.

Study tip

Studying past 11 pm fuelled by chocolate, caffeine and sugar?
Crazy.
Getting a solid night's sleep, waking up early, and hitting the books fresh?
Crazy smart.

BIOLOGY 2025

HSC Revision Series

Module 7: Infectious Disease

Causes of Infectious Disease

Exam Equivalent Time: 90 minutes *(based on allocation of 1.5 minutes per mark)*

Questions

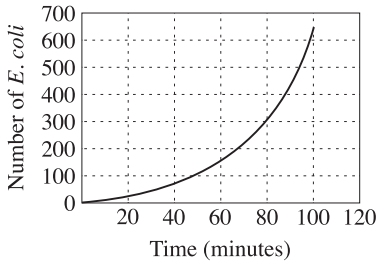
1. BIOLOGY, M7 2023 HSC 5 MC

An experiment was conducted to investigate the rate of binary fission in *E.coli*. The results of the experiment are shown.

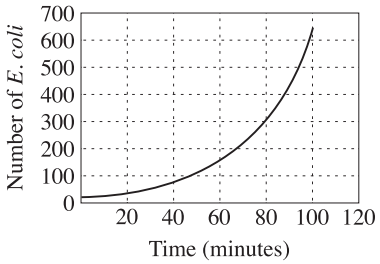
Time (minutes)	*Number of E.coli*
0	20
20	40
40	80
60	160
80	320
100	640

Which graph represents the data in the table?

A.



B.



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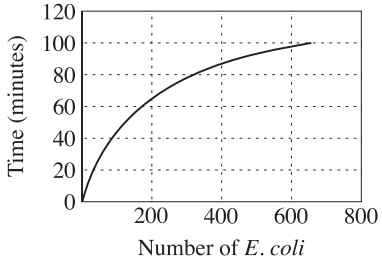
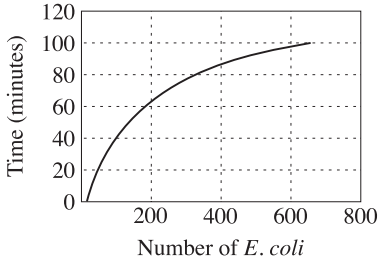


D.



2. BIOLOGY, M7 2024 HSC 1 MC

Which of the following are non-cellular pathogens?

A. Bacteria

B. Fungi

C. Prions

D. Protozoa

3. BIOLOGY, M7 2016 HSC 15 MC

The table shows four features that can be used to distinguish between types of pathogens.

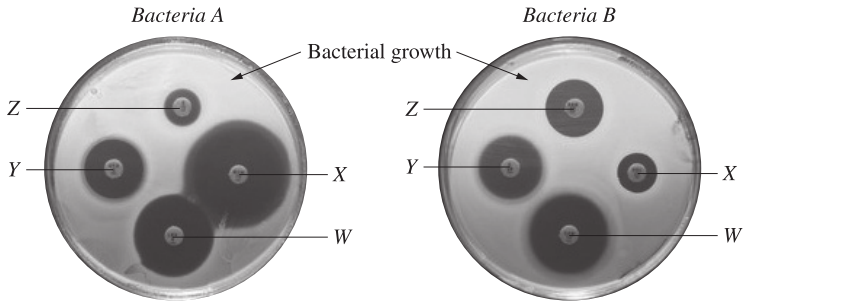
Which row of the table is correct?

	Feature	*Prion*	*Protozoan*
A.	Contains DNA	✓	*X*
B.	Cellular	*X*	✓
C.	Can reproduce	✓	*X*
D.	Composed of protein	*X*	✓

4. BIOLOGY, M7 2019 HSC 7 MC

Two types of bacteria were isolated from a patient's throat swab and grown in pure culture on separate agar plates. On each plate there were FOUR different antibiotic discs, W, X, Y and Z.

The photograph shows the plates seven days later.



Replacement image.
Original image awaiting copyright.
http://www.bacteriainphotos.com/disk%20diffusion%20testing.html

Which antibiotic should be used to treat the patient?

A. W

B. X

C. Y

D. Z

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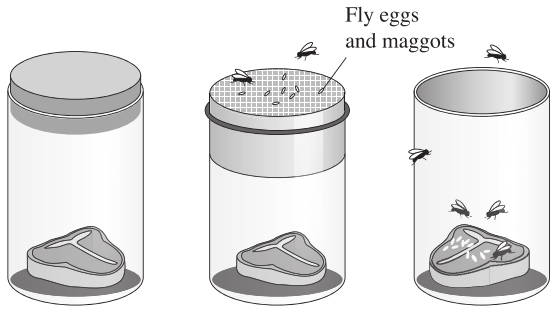
5. BIOLOGY, M7 2024 HSC 10 MC

Francesco Redi challenged the idea that maggots arose spontaneously from rotting meat. A modern version of his experiment was set up as shown.



Which of the following is correct for this experimental set up?

A. The sealed jar improves the validity of the experiment.

B. The independent variable is whether the meat spoils or not.

C. The use of three jars improves the reliability of the experiment.

D. The dependent variable is the use of different covers for the jars.

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6. BIOLOGY, M7 2024 HSC 12 MC

Robert Koch produced a set of criteria to establish whether a particular organism is the cause of a disease in an animal. The criteria are listed below but not in the correct order.

1. The microorganism must cause disease when introduced to a healthy experimental animal.
2. The microorganism must be extracted and isolated from the diseased animal and subsequently grown in culture.
3. The microorganism must be extracted from the diseased experimental animal and demonstrated to be the same microorganism that was isolated from the first diseased animal.
4. The microorganism must be found in the diseased animal, and not found in healthy animals.

Which of the following correctly shows the order of steps required to determine the cause of a particular disease in an animal?

A. 2, 3, 1, 4

B. 2, 4, 1, 3

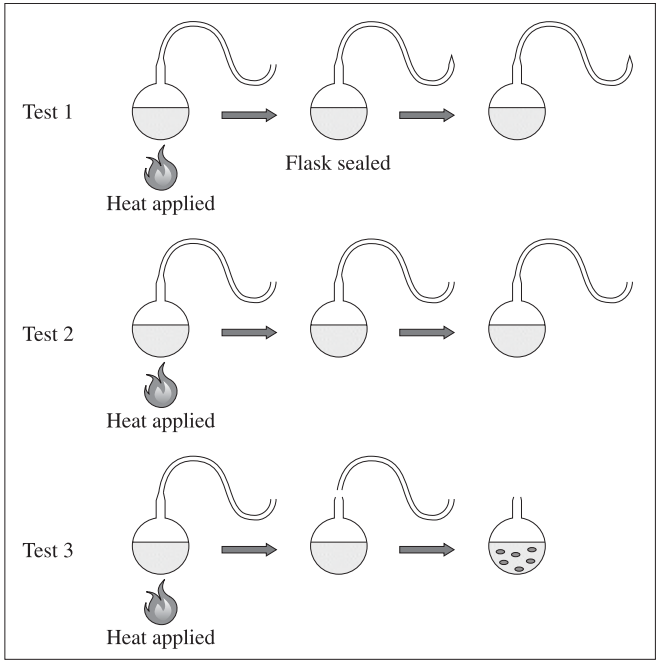
C. 4, 2, 1, 3

D. 4, 3, 2, 1

7. BIOLOGY, M7 2022 HSC 10-11 MC

Refer to the following information to answer Questions 10 – 11.

Pasteur used swan neck flasks to conduct experiments on microbial contamination of broth. One of Pasteur's investigations is shown.



Question 10

Which of the following was the independent variable in this investigation?

A. The air

B. The flask

C. The broth

D. The microbes

Question 11

What is the best explanation for Pasteur's results?

A. Cells arise from existing cells

B. Heating prevents broth spoiling

C. Gases in the air cause broth to spoil

D. Cells arise by spontaneous generation

8. BIOLOGY, M7 2018 HSC 8 MC

An organism suspected of causing a disease is described as being unicellular, having a cell wall and lacking a nucleus.

How is this organism classified?

A. A bacterium

B. A fungus

C. A protozoan

D. A virus

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9. BIOLOGY, M7 2020 HSC 7 MC

Students designed and conducted an investigation to test for the presence of microbes in THREE different food samples.

They inoculated agar plates with the samples and placed them in an incubator set to 25°C.

Which row of the table represents a valid design for the investigation?

	Independent variable	*Dependent variable*	*Experimental control*
A.	Food sample	Number of microbes	An agar plate without a sample
B.	Number of microbes	Food sample	Temperature set to$25^{\circ}C$
C.	Food sample	Number of microbes	Temperature set to$25^{\circ}C$
D.	Number of microbes	Food sample	An agar plate without a sample

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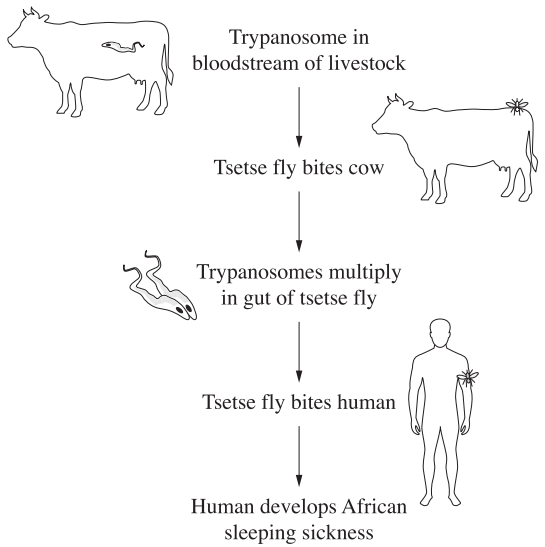
10. BIOLOGY, M7 2024 HSC 8 MC

Trypanosomes (*Trypanosoma brucei*) are protozoans that cause African sleeping sickness in humans. The diagram shows the way that the disease is transmitted to humans.



Which row of the table identifies the pathogen, vector and method of disease transmission to humans?

	Pathogen	*Vector*	*Method of disease transmission*
A.	Trypanosomes	Tsetse fly	Direct
B.	Tsetse fly	Cow	Direct
C.	Trypanosomes	Tsetse fly	Indirect
D.	Tsetse fly	Cow	Indirect

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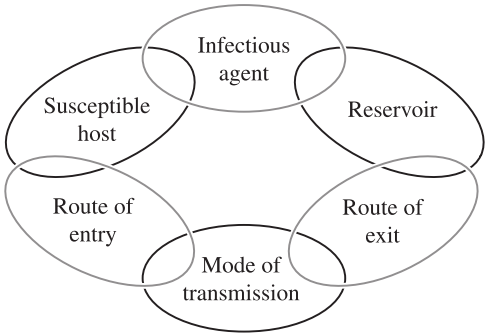
11. BIOLOGY, M7 EQ-Bank 10623 MC

The diagram shows a model of disease transmission.



An epidemiologist suspected that bats were acting as a reservoir for an infectious disease in humans.

Which condition would need to be met to confirm the epidemiologist's suspicion?

A. The infectious agent would need to have a mode of entry into humans.

B. The infectious agent would need a mode of transmission from bats to humans.

C. The bats would have to be able to transmit the infectious agent between each other.

D. The susceptible human host must be able to transmit the infectious agent to the reservoir of bats.

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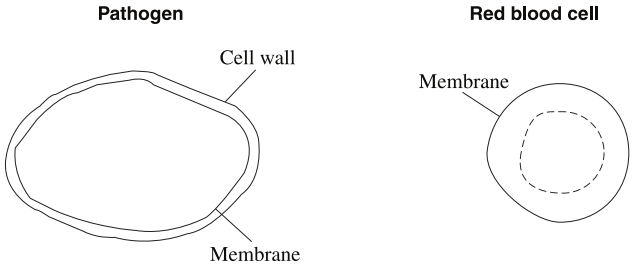
12. BIOLOGY, M7 2015 HSC 9 MC

A pathogen and a red blood cell are drawn to the same scale, with some features indicated.



What type of pathogen is this?

A. A virus

B. A prion

C. A fungus

D. A bacterium

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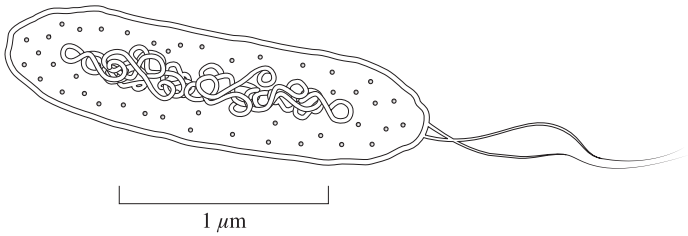
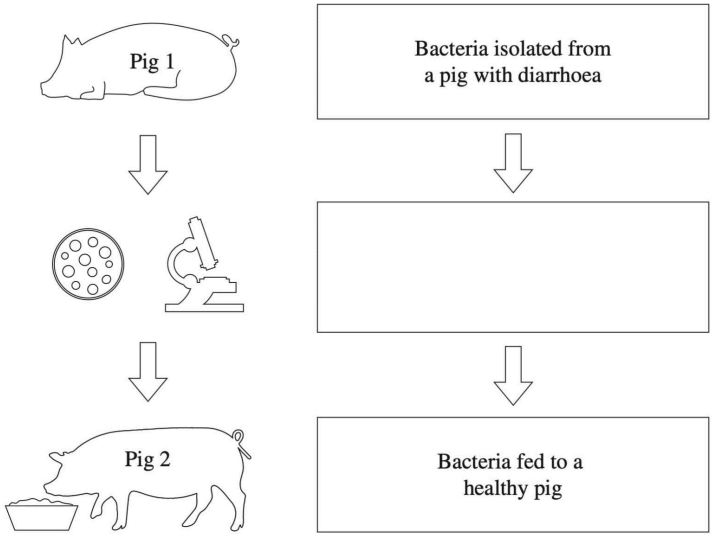
13. BIOLOGY, M7 2021 HSC 21

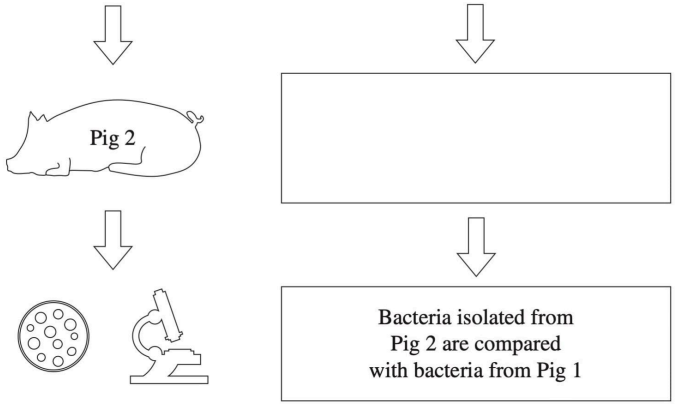
a. Label TWO features on the diagram below that would help to classify this pathogen as a bacterium.
(2 marks)



b. A scientist followed Koch's postulates to confirm that this bacterium was causing diarrhoea in pigs on a local farm.

Complete the boxes in the flowchart provided to show the steps taken by the scientist. *(2 marks)*





c. Two pig farmers on neighbouring farms noticed that their pigs were suffering from diarrhoea and gradually losing weight. The farmers each adopted a different strategy to deal with this disease, as shown in the table.

Farm	*Strategy*	*Result*
1	Treatment with antibiotics	All pigs recovered after two weeks
2	Elimination of rats and mice from pig sheds to improve hygiene	Decrease in number of sick animals over three months

Outline ONE benefit and ONE limitation of the strategies used on each farm. *(3 marks)*

14. BIOLOGY, M7 2018 HSC 22b

Describe the contribution of Robert Koch to our understanding of disease. ***(3 marks)***

15. BIOLOGY, M7 2023 HSC 28

a. Describe a feature that distinguishes a viral from a bacterial pathogen. ***(2 marks)***

b. A waterborne disease outbreak occurred after a flood.

Outline an experimental procedure that could be used to determine if the pathogen is viral or bacterial. ***(2 marks)***

16. BIOLOGY, M7 2024 HSC 26

Describe a plant disease and its effect on agricultural production. ***(4 marks)***

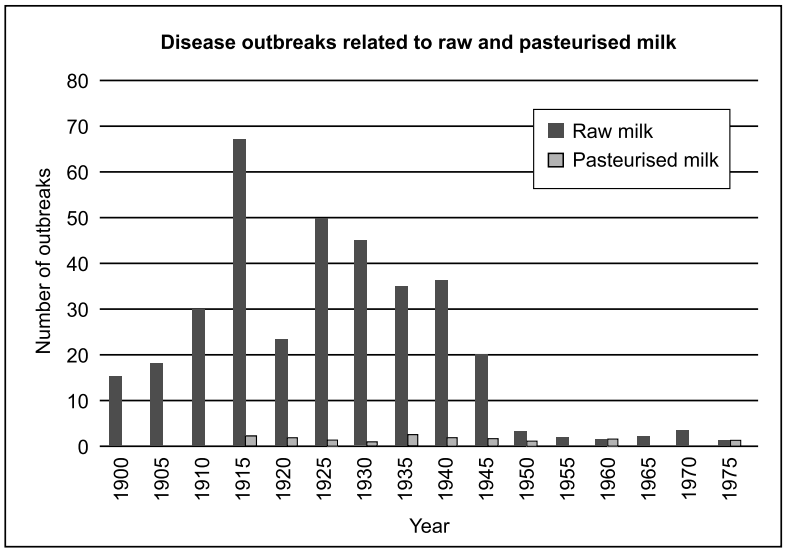
17. BIOLOGY, M7 2019 HSC 31

a. Outline ONE adaptation of a specific pathogen that facilitates its entry into a host. ***(2 marks)***

b. Explain how the mode of transmission of pathogens influences the spread of diseases. ***(3 marks)***

18. BIOLOGY, M7 2024 HSC 27

Milk pasteurisation (heating to approximately 70°C) was gradually introduced in America from the early 1900s. The graph shows the number of disease outbreaks in relation to raw (unpasteurised) and pasteurised milk in America from 1900-1975.



Explain the trends observed in the graph. In your response, refer to the role of Pasteur's work in pasteurisation. *(5 marks)*

19. BIOLOGY, M7 2016 HSC 25

Rabies is a disease caused by a virus that affects mammals.

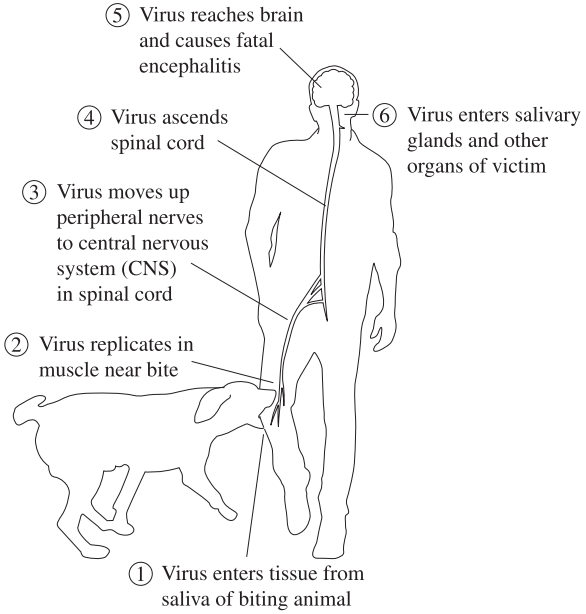
In 1880 Louis Pasteur investigated dogs that were suffering from rabies in order to find the cause. He believed rabies was caused by a microorganism but could not culture it in broth nor observe it under the light microscope. However, he could cause the disease in healthy dogs by injecting them with saliva from infected dogs. He was able to repeat the disease cycle in this way.

a. Why was Pasteur NOT able to observe the rabies virus? *(2 marks)*

b. Explain why Pasteur needed to identify and culture the microorganism in order to meet the scientific standards for establishing the cause of rabies. *(4 marks)*

20. BIOLOGY, M7 2020 HSC 32a

Rabies is a disease that can affect all mammals and is caused by the rabies virus. It is transmitted by the bite of an infected animal. Without treatment it almost always results in death.



Use the information provided to identify TWO features of the rabies infection that facilitate transmission of the pathogen to a new host. ***(2 marks)***

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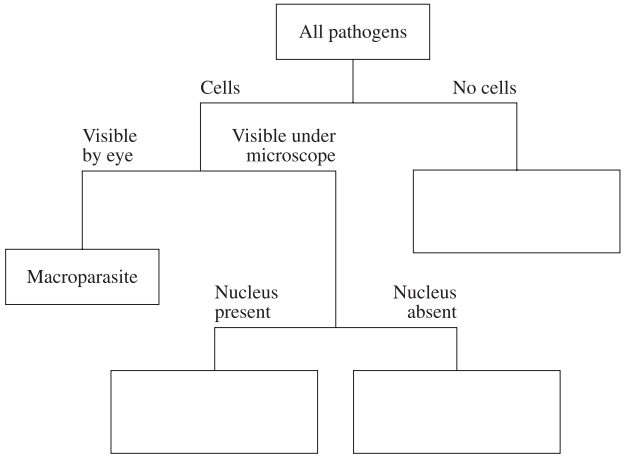
21. BIOLOGY, M7 2022 HSC 21b

The following key can be used to classify some pathogens.

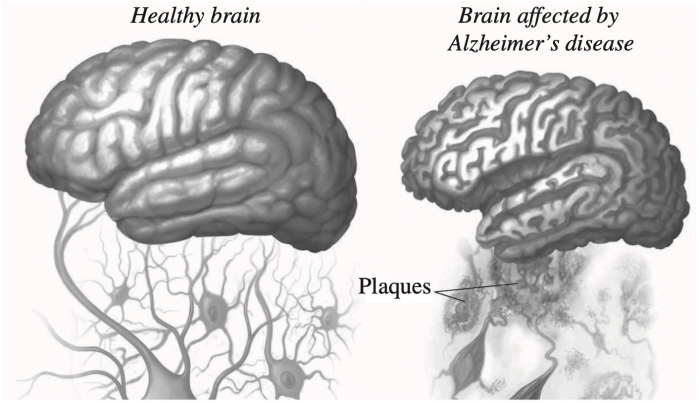
Complete each empty box with an appropriate pathogen. ***(3 marks)***



22. BIOLOGY, M7 2019 HSC 33d

Alzheimer's disease causes destruction of brain tissue, dementia and eventually death.

The diagram shows the effect of Alzheimer's disease on the brain.



Amyloid beta protein is produced in the human brain throughout life. In people with Alzheimer's disease, it accumulates in excessive amounts.

The gene with the greatest known effect on the risk of developing late-onset Alzheimer's disease is called APOE. It is found on chromosome 19.

The APOE gene has multiple alleles, including e2, e3 and e4 .

The table shows the risk of developing Alzheimer's disease for various APOE genotypes compared to average risk in the population.

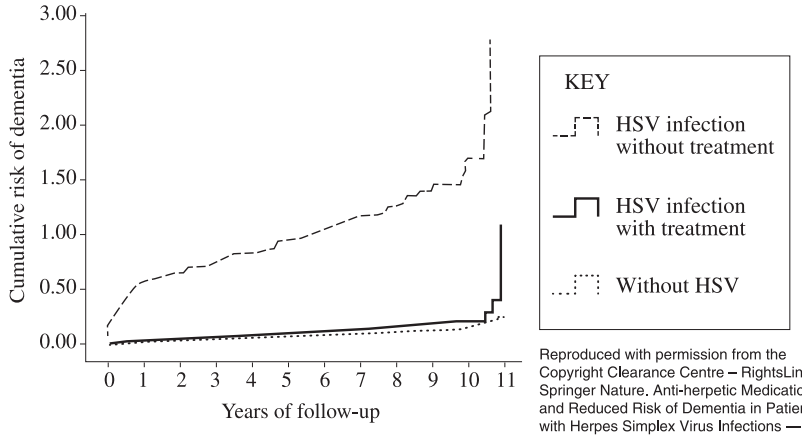
APOE genotype	e2/e2	e2/e3	e2/e4	e3/e3	e3/e4	e4/e4
Risk of developing Alzheimer's disease (compared to average)	40% less likely	40% less likely	2.6 times more likely	Average	3.2 times more likely	14.9 times more likely

Risk of susceptibility, based on alleles. © Alzheimer.org

A large epidemiological study was conducted. It used historical data to investigate the association between Herpes simplex virus (HSV) infection and dementia. Dementia is caused by a variety of brain illnesses. Alzheimer's disease is the most common cause of dementia.

The study used the records of 8362 patients with HSV infection and 25086 randomly selected sex- and age-matched control patients without HSV infection. Some of the patients with HSV had been treated with antiviral medication.

The graph below shows some results of the study.



Diseases are classified as infectious or non-infectious.

Evaluate whether Alzheimer's disease should be classified as an infectious disease or a non-infectious disease. In your answer, include reference to the information and data provided above. ***(8 marks)***

Worked Solutions

1. BIOLOGY, M7 2023 HSC 5 MC

By Elimination:

→ The independent variable (time) must be on the x-axis (Eliminate *C* and *D*).

→ The number of E. Coli starts at 20, not 0 (Eliminate *A*).

$\Rightarrow B$

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2. BIOLOGY, M7 2024 HSC 1 MC

→ Bacteria, fungi, and protozoa are all cellular organisms.

→ Prions are misfolded proteins that can cause disease by inducing normal proteins to misfold, making them non-cellular pathogens.

$\Rightarrow C$

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3. BIOLOGY, M7 2016 HSC 15 MC

By elimination:

→ Both contain DNA, can reproduce and are composed of protein therefore eliminate A, C and D

Mean mark 59%.

→ Prion are non-cellular and protozoan are cellular, therefore B.

$\Rightarrow B$

---

4. BIOLOGY, M7 2019 HSC 7 MC

→ The area of each circle shows the amount of bacterial growth each antibiotic has inhibited.

→ The larger the circle, the more effective that antibiotic is at inhibiting bacterial growth.

→ Antibiotic W has the most consistently large disc, and should be used to treat the patient.

$\Rightarrow A$

---

5. BIOLOGY, M7 2024 HSC 10 MC

Mean mark 58%.

→ The sealed jar improves the validity of Redi's experiment because it serves as a proper control that completely prevents flies from reaching the meat.

→ This allows Redi to conclusively demonstrate that maggots come from flies laying eggs rather than spontaneous generation.

$\Rightarrow A$

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6. BIOLOGY, M7 2024 HSC 12 MC

→ Koch's postulates follow a logical sequence of first identifying the microorganism in sick but not healthy animals (4).

→ Second step is isolating and culturing it (2), using it to infect a healthy animal to prove it causes disease (1), and finally re-isolating the same organism from the newly infected animal (3) to conclusively prove causation.

$\Rightarrow C$

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7. BIOLOGY, M7 2022 HSC 10-11 MC

Q10.

→ The flask was changed in each test therefore it is the independent variable.

$\Rightarrow B$

Q11.

♦ Mean mark (Q11) 40%.

→ Pasteur's experiment was conducted to show that microbes arise from existing cells in the air, disproving spontaneous generation.

$\Rightarrow A$

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8. BIOLOGY, M7 2018 HSC 8 MC

By Elimination

♦♦ Mean mark 35%.

→ By definition, a virus is not unicellular as it is not living or a cell (Eliminate D).

→ Both protozoa and fungi contain a nucleus (Eliminate B and C).

$\Rightarrow A$

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9. BIOLOGY, M7 2020 HSC 7 MC

♦ Mean mark 49%.

→ The different food samples are deliberately selected (independent).

→ The number of microbes is a consequence of the specific food samples (dependent).

→ An agar plate with a food sample would be a base of comparison (experimental control) while temperature would be a controlled variable.

$\Rightarrow A$

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10. BIOLOGY, M7 2024 HSC 8 MC

♦ Mean mark 48%.

→ African sleeping sickness is caused by trypanosome parasites (pathogen).

→ The pathogens are transmitted indirectly to humans through the bite of tsetse flies (vector).

$\Rightarrow C$

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11. BIOLOGY, M7 EQ-Bank 10623 MC

→ For the assumption to be true, the pathogen would need to have developed an adaptation allowing it to transfer from bats to humans.

$\Rightarrow B$

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12. BIOLOGY, M7 2015 HSC 9 MC

→ Pathogen structure and size are indicative of a fungus.

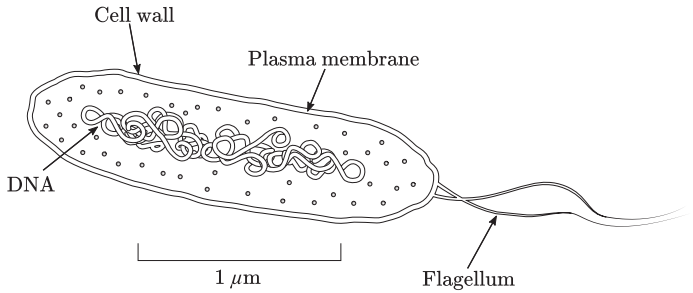
$\Rightarrow C$

♦♦♦ Mean mark 27%.

13. BIOLOGY, M7 2021 HSC 21

***Keyword (Part part c.) - "Outline"**: Sketch in general terms; indicate the main features of.*

a. Include two of the following labels:



b. Box 2: Bacteria grown in pure culture and identified.

Box 4: Healthy pig became ill with diarrhoea.

c. Benefits and Limitations of the strategies used on each farm.

The use of antibiotics on farm 1 has resulted in a rapid elimination of diarrhoea cases, however may induce antibiotic resistance in the future, rendering the strategy less effective.

The removal of rats and mice from pig sheds to increase hygiene on farm 2 is slow to eliminate diarrhoea cases, however provides reassurance to prevent future outbreaks.

Other correct answers:

- Proper hygiene practices can reduce incidence of other diseases, not just diarrhoea.

14. BIOLOGY, M7 2018 HSC 22b

***Keyword - "Describe"**: Provide characteristics and features.*

→ Robert Koch demonstrated a relationship between microbes and infectious disease.

→ Koch revealed that specific infectious diseases were caused by specific microbes.

→ He developed Koch's postulates which allow for the identification of specific diseases.

Mean mark 58%.

15. BIOLOGY, M7 2023 HSC 28

***Keyword (Part part a.) - "Describe"**: Provide characteristics and features.*
***Keyword (Part part b.) - "Outline"**: Sketch in general terms; indicate the main features of.*

a. Viral vs Bacterial Pathogen

→ Bacteria are single celled organisms and can reproduce on their own, outside of a host.

→ A virus is simply a protein coating around genetic material that can only reproduce via a host, using ribosomes to make copies of itself.

Other answers could include:

→ Bacteria contain plasmids while viruses do not.

→ Bacteria contain a cell membrane and flagella while viruses are just a protein coat.

→ The length of a bacterium is 1–10 μm, much larger than the length of a virus which is typically between 0.05–0.1 μm.

b. Experimental procedure:

→ Collect diarrhoea samples from infected individuals and make stool cultures.

→ If the disease is bacterial, the bacteria will be able to grow and multiply but if it is viral no growth will occur.

Other answers could include

→ Using PCR to multiply DNA within the sample then using antigen testing to determine if the DNA is viral or bacterial in nature.

Mean mark (b) 56%.

16. BIOLOGY, M7 2024 HSC 26

***Keyword - "Describe"**: Provide characteristics and features.*

Two possible examples (among many) are described below.

Plant disease: Wheat rust

→ Wheat rust is a fungal disease that produces reddish-brown pustules on wheat stems and leaves, weakening the plant and reducing grain development.

→ This disease can devastate entire wheat crops, significantly reducing grain yields and causing major economic losses for Australian grain producers.

Plant disease: Stone fruit scab

→ Caused by fungi, produces dark spots on plums, peaches and nectarines that develop into scabs, potentially cracking and destroying the fruit.

→ This disease significantly impacts crop quality and yield, resulting in economic losses for farmers.

17. BIOLOGY, M7 2019 HSC 31

***Keyword (Part part a.) - "Outline"**: Sketch in general terms; indicate the main features of.*
***Keyword (Part part b.) - "Explain"**: Relate cause and effect, make the relationships between things evident, provide why and/or how.*

a. → *Helicobacter pylori* is a bacteria that causes stomach ulcers.

→ It has flagellum which allows it to move in the stomach and penetrate the stomach wall.

♦♦ Mean mark (a) 36%.

Other answers could include:

→ *Salmonella* and its ability to adapt to host blood temperature.

b. → Diseases will be able to spread faster and easier with certain modes of transmission.

→ Airborne disease such as influenza are able to spread faster as the virus can be passed through droplets of air by infected individuals sneezing/coughing.

→ Diseases that can only spread via direct contact will have lower infection rates as there is a less effective mode of transmission.

Other answers could include the effectiveness of modes such as

→ Vectors and their presence in an area influencing infection rate.

→ Foodborne/waterborne diseases.

→ Zoonotic diseases.

18. BIOLOGY, M7 2024 HSC 27

***Keyword - "Explain"**: Relate cause and effect, make the relationships between things evident, provide why and/or how.*

→ Louis Pasteur's research was pivotal in debunking the theory of spontaneous generation and establishing our understanding of microorganisms.

→ His work revealed that microbes present in milk could be responsible for disease outbreaks.

→ He demonstrated that exposing substances to high temperatures effectively kills microorganisms, which is why heating milk to 70°C eliminates many harmful bacteria.

→ This scientific foundation – the presence of microbes in milk and their vulnerability to heat – explains the effectiveness of milk pasteurisation in preventing disease outbreaks.

→ The historical data presented in the graph supports this, showing significantly fewer disease outbreaks linked to pasteurised milk compared to raw milk.

→ A notable decline in raw milk-related outbreaks occurred after 1945, though this may also be attributed to decreased raw milk consumption during that period.

→ While pasteurised milk has generally proven safer, some disease outbreaks have still occurred with pasteurised products. These cases typically result from issues in the pasteurisation process itself or problems during subsequent storage and transportation of the milk.

19. BIOLOGY, M7 2016 HSC 25

***Keyword (Part part b.) - "Explain"**: Relate cause and effect, make the relationships between things evident, provide why and/or how.*

a. → The rabies virus is very small in size.

→ It is unable to be seen by the naked eye under light microscopes.

Mean mark (a) 52%.

b. → Dog saliva contains many microorganisms.

→ Any of these could have been responsible for causing rabies.

→ It was necessary for Pasteur to isolate and culture the specific microorganism he believed to be causing the disease.

→ A healthy host without symptoms needed to be injected with one of the isolated microorganisms and develop the disease.

→ By trial and error of this process, Pasteur could deduce which microorganism had caused the rabies.

Mean mark (b) 54%.

20. BIOLOGY, M7 2020 HSC 32a

***Keyword - "Identify"**: Recognise and name.*

Successful answers should include two of the following:

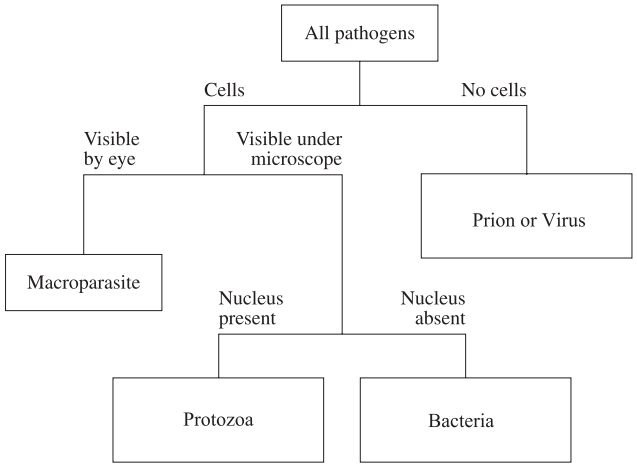
→ The rabies virus can travel through the nervous system which allows it to reach the salivary glands.

→ The virus can then be directly transmitted to another host with a bite from the infected host.

→ The virus can replicate in muscle after an infected bite.

Mean mark 51%.

21. BIOLOGY, M7 2022 HSC 21b



♦ Mean mark 47%.

22. BIOLOGY, M7 2019 HSC 33d

***Keyword - "Evaluate"**: Make a judgement based on criteria.*

♦♦ Mean mark 46%.

Infectious vs non-infection disease classification

→ Infectious diseases are a result of pathogens, biological agents of disease, which transmit disease between hosts. A pathogen is a cause of a certain disease if it meets the criteria in Koch's postulates.

→ The study above shows the association between HSV and Alzheimer's.

→ The study is conducted over a long period and includes a large and controlled sample size, so the assumption can be made that the findings are valid.

→ HSV is an infectious disease as it is caused by a pathogen, the virus *Herpes simplex*.

→ The findings show that treating HSV with antiviral medication also reduces the risk of developing Alzheimer's.

→ This may mean that Alzheimer's is also a virus and therefore an infectious disease.

→ Non-infectious diseases are not contagious and do not spread from person to person. They are a result of environmental factors or genetic conditions.

→ Alzheimer's is the result of a build-up of the amyloid beta protein, which is produced in the brain.

→ The synthesis of this protein is regulated by the APOE gene. This gene also has various alleles, each of which in different combinations can increase or decrease a individual's risk of developing Alzheimer's.

→ This indicates that Alzheimer's is a non-infectious disease, as it is not transmitted by a pathogen. Rather, it results from a natural build up of a specific protein, which may be accelerated or reduced based on genotype.

Conclusion

→ From the information provided it is not possible to accurately classify Alzheimer's as either an infectious or non-infectious disease.

→ There is evidence to support that the risk of developing Alzheimer's can be linked to both antiviral and virus traits as well as genotype.