KEY STAGE 3 - LESSON 3

Micro-organisms: Harmful Microbes

In this lesson students will learn about some infectious diseases that cause problems in the world today.

Curriculum Links

Science

- Working scientifically
- Scientific attitudes
- Experimental skills and investigations

Biology

- Structure and function of living organisms
- Cells and organisation
- Nutrition and digestion

PSHE/RSHE

- Health and prevention

English

- Reading
- Writing

Key Words

Bacteria, Dermatophytes, Fungi, Infection, Pathogens, Toxin, Virus

Learning Outcomes

All students will:

- Understand that sometimes microbes can make us ill and cause infection.
- Understand that harmful microbes can pass from person to person.
- Understand that different infections cause different symptoms.
- Understand how global travel has influenced the spread of disease.

Most students will:

- Understand how individuals, groups, and organisations work together when responding to infectious diseases outbreaks.

Resources Required

Main activity: Infectious Disease Group Discussion

Per Class/Group

- Copy of SH1, SH2, SH3
- Copy of SW1
- Differentiated versions for students of different abilities SH4, SH5, SW2

Advance Preparation

1. Cut out the disease cards in SH1 - SH3, one set per group. Laminate or stick on to stiff card for future use. (Differentiated version: SH4 – SH5).
2. Copy SW1 for each group. (Differentiated version: SW2).
3. Copy TS1 - TS2 teacher answers.

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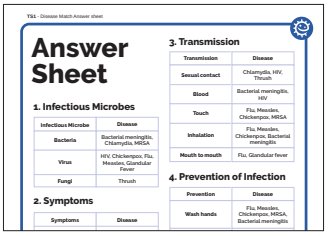
Supporting Materials


Answer Sheet

1. Infectious Microbes

Infectious Microbe	Disease
Bacteria	Bacterial meningitis, Chlamydia, MRSA
Virus	HIV, Chickenpox, Flu, Measles, Glandular Fever
Fungi	Thrush

2. Symptoms

Symptoms	Disease

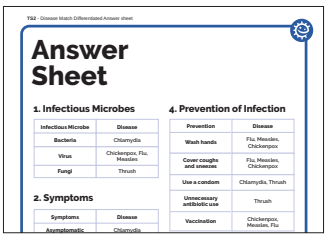
3. Transmission

Transmission	Disease
Sexual contact	Chlamydia, HIV, Thrush
Blood	Bacterial meningitis, HIV
Touch	Flu, Measles, Chickenpox, MRSA
Inhalation	Flu, Measles, Chickenpox, Bacterial meningitis
Mouth to mouth	Flu, Glandular fever

4. Prevention of Infection

Prevention	Disease
Wash hands	Flu, Measles, Chickenpox, MRSA, Bacterial meningitis

TS1 Disease Match Answer sheet


Answer Sheet

1. Infectious Microbes

Infectious Microbe	Disease
Bacteria	Chlamydia
Virus	Chickenpox, Flu, Measles
Fungi	Thrush

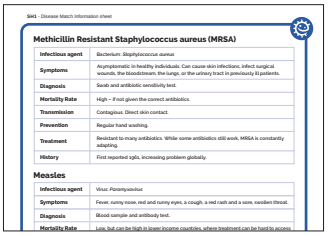
2. Symptoms

Symptoms	Disease
Asymptomatic	Chlamydia

4. Prevention of Infection

Prevention	Disease
Wash hands	Flu, Measles, Chickenpox
Cover coughs and sneezes	Flu, Measles, Chickenpox
Use a condom	Chlamydia, Thrush
Unnecessary antibiotic use	Thrush
Vaccination	Chickenpox, Measles, Flu

TS2 Disease Match Differentiated Answer sheet

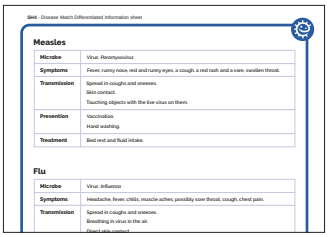

Methicillin Resistant Staphylococcus aureus (MRSA)

Infectious agent	Bacterium: *Staphylococcus aureus*
Symptoms	Asymptomatic in healthy individuals. Can cause skin infections, infect surgical wounds, the bloodstream, the lungs, or the urinary tract in previously ill patients.
Diagnosis	Swab and antibiotic sensitivity test.
Mortality Rate	High – if not given the correct antibiotics.
Transmission	Contagious. Direct skin contact.
Prevention	Regular hand washing.
Treatment	Resistant to many antibiotics. While some antibiotics still work. MRSA is constantly adapting.
History	First reported 1961, increasing problem globally.

Measles

Infectious agent	Virus: *Paramyxovirus*
Symptoms	Fever, runny nose, red and runny eyes, a cough, a red rash and a sore, swollen throat.
Diagnosis	Blood sample and antibody test.
Mortality Rate	Low, but can be high in lower income countries, where treatment can be hard to access

SH1-3 Disease Match Information sheets

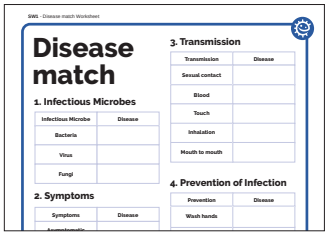

Measles

Microbe	Virus: *Paramyxovirus*
Symptoms	Fever, runny nose, red and runny eyes, a cough, a red rash and a sore, swollen throat.
Transmission	Spread in coughs and sneezes. Skin contact. Touching objects with the live virus on them.
Prevention	Vaccination. Hand washing.
Treatment	Bed rest and fluid intake.

Flu

Microbe	Virus: *Influenza*
Symptoms	Headache, fever, chills, muscle aches, possibly sore throat, cough, chest pain.
Transmission	Spread in coughs and sneezes. Breathing in virus in the air.

SH4-5 Disease Match Differentiated Information sheets


Disease match

1. Infectious Microbes

Infectious Microbe	Disease
Bacteria	
Virus	
Fungi	

2. Symptoms

Symptoms	Disease

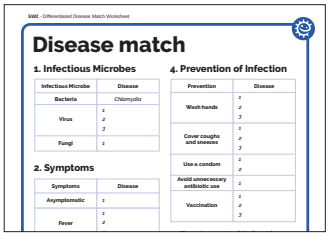
3. Transmission

Transmission	Disease
Sexual contact	
Blood	
Touch	
Inhalation	
Mouth to mouth	

4. Prevention of Infection

Prevention	Disease
Wash hands	

SW1 Disease match worksheet


Disease match

1. Infectious Microbes

Infectious Microbe	Disease
Bacteria	Chlamydia
Virus	1 2 3
Fungi	1

2. Symptoms

Symptoms	Disease
Asymptomatic	1
Fever	1 2

4. Prevention of Infection

Prevention	Disease
Wash hands	1 2 3
Cover coughs and sneezes	1 2 3
Use a condom	1 2
Avoid unnecessary antibiotic use	1
Vaccination	1 2 3

SW2 Differentiated Disease match Worksheet to match SH4 and TS2

Lesson Plan

Introduction

1. Begin the lesson by explaining to the class that sometimes microbes can be harmful to humans. Bacteria can produce toxins when they reproduce which are harmful to the body. Viruses enter the body and stick to the cell surface multiplying inside our cells and destroying them. Some fungi like to grow on our skin making it itchy and sore. Find out how many different words students know for microbes – germs, bugs, etc.

2. Ask the class to create a list of infections (infectious diseases) by brainstorming any diseases they have heard of. Do they know what microbes cause the diseases? Ask the students what disease they think poses a threat to students in the class today? Tell them that in the early 1900s the disease of greatest threat was measles; many children who caught measles then died of the disease. Thankfully today we now have a vaccine to prevent this.

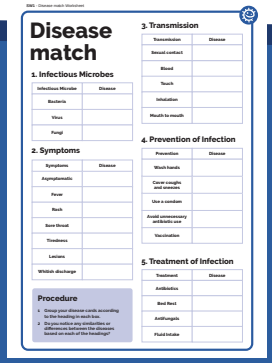
3. Tell the class that bacteria and other microbes that can cause infection and which can spread easily from person to person are called infectious. Discuss the difference between an infectious microbe and a non-infectious one. An example of a non-infectious microbe is the *Lactobacilli* bacteria we learned about in lesson 2. Discuss with students the various routes of transmission, i.e. touch, water, food, body fluid and air. Identify any infectious diseases mentioned in the brainstorming session and how they are transmitted.

Main Activity: Infectious Disease Group Discussion

1 Discover the different types of infectious diseases caused by harmful microbes and their characteristics

2 By working in groups, fill in the various subheadings (symptoms, transmission, treatment)

3 Present your results to the class


Disease match

1. Infectious Microbes

Infectious Microbe	Disease
Bacteria	
Virus	
Fungi	

2. Symptoms

Symptoms	Disease
Asymptomatic	
Fever	
Rash	
Sore throat	
Tiredness	
Lesions	
Whitish discharge	

3. Transmission

Transmission	Disease
Sexual contact	
Blood	
Touch	
Inhalation	
Mouth to mouth	

4. Prevention of Infection

Prevention	Disease
Wash hands	
Cover coughs and sneezes	
Use a condom	
Avoid unnecessary antibiotic use	
Vaccination	

5. Treatment of Infection

Treatment	Disease
Antibiotics	
Bed Rest	
Antifungals	
Fluid Intake	

Procedure

1. Group your disease cards according to the heading in each box.
2. Do you notice any similarities or differences between the diseases based on each of the headings?

Infectious Disease Group Discussion

1. This activity should be carried out in groups of 3 – 5 people. Explain that during this activity students are going to learn about some infectious diseases that cause problems in the world today.
2. Provide each group with the disease cards found in SH1 – SH3. (Differentiated version: SH4 – SH5)
3. Tell the class that sometimes scientists need to group diseases under different headings to address different problems. Each group should examine the headings on SW1. (Differentiated version: SW2)
4. Ask each group to complete SW1 (Differentiated version: SW2) for the first heading – Infectious microbe. After a few minutes, ask a spokesperson in each group to read out their results. Write all the results on a white board for discussion.
5. After each heading in SW1/2 has been completed, discuss the class results.

a. Infectious organism: Remind students that there are three main types of microbes. It is important to identify the microbe causing the disease in order to treat the disease properly, e.g. antibiotics cannot be used to treat viruses (this will be covered in lesson 9 of the resource).

b. Symptoms: Students may notice that some diseases exhibit similar symptoms, e.g. fever or rash. You may wish to discuss how important it is for people to visit their doctor when they are ill to receive a correct and accurate diagnosis.

c. Transmission: Many diseases are transmitted very easily through touch or by inhalation. Other diseases are quite specific and require the transfer of blood or other bodily fluids.

d. Preventative measures: People can prevent the spread of, and protect themselves against, infection by employing a few simple steps. Regular hand washing and covering our

coughs and sneezes has been shown to reduce the incidence of many common infections. The correct use of a condom can reduce the transmission of many STIs. Vaccines are used to prevent certain infections, many of which were once more common than today.

e. Treatment: It is important to note here that not all illnesses require medical treatment; some require bed rest and an increased fluid intake; however, painkillers may be used to alleviate some of the symptoms. Highlight to the students that antibiotics are only used to treat bacterial infections.

Fascinating Fact

According to the WHO, the top 10 causes of death in 2019 accounted for 55% of the 55.4 million deaths worldwide. Four out of ten were caused by infectious diseases.

Learning Consolidation

Ask students to write a paragraph or three statements to summarise what they have learned during the lesson.

Discussion

Why do we see infectious diseases that used to be found in a single region, all over the world today?

Many infectious diseases start in a specific region or country. In the past the infection could easily be contained or isolated. Today, however, people travel faster, more frequently and further than ever before. A person travelling from Australia to England can make the journey in under a day, stopping off at Hong Kong en route. If this person has a new strain of the flu virus, they could spread it to anyone they came into contact with on the plane, people they come into contact with at Hong Kong airport and people they came into contact with when they landed in England. These people could also carry the flu to other people they come into contact with all over the world. Within a few days, this new strain of influenza virus could be found worldwide!!! You may want to discuss how quickly the virus causing the disease COVID-19 spread around the world.

What is an infectious disease?
An infectious disease is a disease that is caused by a microbe and can be spread to other people.

What is a disease?
An illness or sickness characterised by specific signs or symptoms.

Answer Sheet

1. Infectious Microbes

Infectious Microbe	Disease
Bacteria	Bacterial meningitis, Chlamydia, MRSA
Virus	HIV, Chickenpox, Flu, Measles, Glandular Fever
Fungi	Thrush

2. Symptoms

Symptoms	Disease
Asymptomatic	Chlamydia, MRSA
Fever	Flu, Measles, Chickenpox, Bacterial meningitis
Rash	Bacterial meningitis, Chickenpox, Measles,
Sore throat	Flu, Glandular fever
Tiredness	Glandular fever
Lesions	HIV
Whitish discharge	Chlamydia, Thrush

Points to Note

MRSA is an antibiotic resistant bacterium, it is specifically resistant to methicillin and some other commonly used antibiotics. Its resistance status is attributed to the overuse and misuse of this and other antibiotics. Treatment is still via antibiotic therapy, however, MRSA is also developing resistance to these as well.

3. Transmission

Transmission	Disease
Sexual contact	Chlamydia, HIV, Thrush
Blood	Bacterial meningitis, HIV
Touch	Flu, Measles, Chickenpox, MRSA
Inhalation	Flu, Measles, Chickenpox, Bacterial meningitis
Mouth to mouth	Flu, Glandular fever

4. Prevention of Infection

Prevention	Disease
Wash hands	Flu, Measles, Chickenpox, MRSA, Bacterial meningitis
Cover coughs and sneezes	Flu, Measles, Chickenpox, Bacterial meningitis
Use a condom	Chlamydia, HIV, Thrush
Avoid unnecessary antibiotic use	MRSA, Thrush
Vaccination	Chickenpox, Measles, Flu

5. Treatment of Infection

Treatment	Disease
Antibiotics	Chlamydia, Bacterial meningitis, MRSA
Bed Rest	Chickenpox, Glandular fever, Measles, Flu
Antifungals	Thrush
Fluid Intake	Chickenpox, Glandular fever, Measles, Flu

Answer Sheet

1. Infectious Microbes

Infectious Microbe	Disease
Bacteria	Chlamydia
Virus	Chickenpox, Flu, Measles
Fungi	Thrush

2. Symptoms

Symptoms	Disease
Asymptomatic	Chlamydia
Fever	Flu, Measles, Chickenpox
Rash	Chickenpox, Measles
Sore throat	Flu
Whitish discharge	Chlamydia, Thrush

3. Transmission

Transmission	Disease
Sexual contact	Chlamydia, Thrush
Touch	Flu, Measles, Chickenpox
Inhalation	Flu, Measles, Chickenpox
Mouth to mouth	Flu

4. Prevention of Infection

Prevention	Disease
Wash hands	Flu, Measles, Chickenpox
Cover coughs and sneezes	Flu, Measles, Chickenpox
Use a condom	Chlamydia, Thrush
Unnecessary antibiotic use	Thrush
Vaccination	Chickenpox, Measles, Flu

5. Treatment of Infection

Treatment	Disease
Antibiotics	Chlamydia
Bed Rest	Chickenpox, Measles, Flu
Antifungals	Thrush
Fluid Intake	Chickenpox, Measles, Flu

Methicillin Resistant Staphylococcus aureus (MRSA)

Infectious agent	Bacterium: *Staphylococcus aureus*
Symptoms	Asymptomatic in healthy individuals. Can cause skin infections, infect surgical wounds, the bloodstream, the lungs, or the urinary tract in previously ill patients.
Diagnosis	Swab and antibiotic sensitivity test.
Mortality Rate	High – if not given the correct antibiotics.
Transmission	Contagious. Direct skin contact.
Prevention	Regular hand washing.
Treatment	Resistant to many antibiotics. While some antibiotics still work, MRSA is constantly adapting.
History	First reported 1961, increasing problem globally.

Measles

Infectious agent	Virus: *Paramyxovirus*
Symptoms	Fever, runny nose, red and runny eyes, a cough, a red rash and a sore, swollen throat.
Diagnosis	Blood sample and antibody test.
Mortality Rate	Low, but can be high in lower income countries, where treatment can be hard to access
Transmission	Contagious. Droplets from coughs and sneezes, skin contact or contact with objects that have the live virus on them.
Prevention	Prevention via vaccination.
Treatment	Bed rest and fluid intake.
History	Virus first reported 1911, has decreased dramatically in high and middle income countries in recent years although small epidemics do occur. Still a pandemic problem for low income countries.

Flu

Infectious agent	Virus: *Influenza*
Symptoms	Headache, fever, chills, muscle aches; possibly sore throat, cough, chest pain.
Diagnosis	Blood sample and antibody test.
Mortality Rate	Medium but higher in the very young and elderly.
Transmission	Highly contagious. Inhalation of viruses on airborne particles. Direct skin contact.
Prevention	Vaccination against current strains.
Treatment	Bed rest and fluid intake. Antivirals in the elderly.
History	Present for centuries, epidemics occur at regular intervals.

Thrush

Infectious agent	Fungi: *Candida albicans*
Symptoms	Itching, burning, soreness and white coating of the mouth or irritation of the vagina with a whitish discharge.
Diagnosis	Swab, microscopic examination and culturing.
Mortality Rate	None
Transmission	Person to person contact but is a normal part of the flora of the gut.
Prevention	Symptoms are caused by overgrowth of this fungus due to antibiotics killing off the normal protective bacteria. Therefore avoid unnecessary antibiotic use.
Treatment	Antifungals
History	Almost 75% of all women have had this infection at least once.

Chlamydia

Infectious agent	Bacterium: *Chlamydia trachomatis*
Symptoms	In many cases there are no symptoms but sometimes there is a discharge from the vagina or penis. Swollen testicles and inability to have children can also occur.
Diagnosis	Swab or urine sample for molecular testing.
Mortality Rate	Rare
Transmission	Contagious through sexual contact.
Prevention	Use a condom during sexual intercourse.
Treatment	Antibiotics
History	First discovered in 1907. Global problem which is on the increase.

Bacterial Meningitis

Infectious agent	Bacterium: *Neisseria meningitidis*
Symptoms	Headache, neck stiffness, high fever, irritability, delirium, rash.
Diagnosis	Spinal fluid sample and molecular testing.
Mortality Rate	Medium – higher risk in the young and elderly.
Transmission	Contagious, through saliva and inhalation of droplets.
Prevention	Vaccination against many strains, avoid contact with infected patients.
Treatment	Penicillin, oxygen and fluids.
History	First identified as a bacteria in 1887. Regular epidemics in low income countries

HIV/AIDS

Infectious agent	Virus: Human immunodeficiency virus (HIV).
Symptoms	Failing immune system, pneumonia, lesions.
Diagnosis	Blood sample and antibody test.
Mortality Rate	Medium – high in countries where access to HIV testing and anti-HIV drugs is limited.
Transmission	Highly contagious. Sexual contact, blood to blood contact, sharing of needles, mother to new born transmission.
Prevention	Always wear a condom during sexual intercourse.
Treatment	There is no cure although anti-HIV drugs can prolong life expectancy.
History	First identified in 1983. Currently a global epidemic.

Glandular fever (Kissing Disease)

Infectious agent	Virus: *Epstein Barr*
Symptoms	Sore throats, swollen lymph glands, extreme tiredness.
Diagnosis	Blood sample and antibody test.
Mortality Rate	Low
Transmission	Not very contagious. Direct contact such as kissing and sharing drinks.
Prevention	Avoid direct contact with infected patients.
Treatment	Bed rest and fluid intake, paracetamol can be used to relieve the pain.
History	First described in 1889, 95% population have had the infection, however, only 35% develop symptoms. Occasional isolated outbreaks.

Chickenpox

Infectious agent	Virus: *Varicella-zoster*
Symptoms	Blistering rash on the body and head.
Diagnosis	Blood sample and antibody test.
Mortality Rate	Low
Transmission	Highly contagious. Direct skin contact or inhalation of droplets from sneezing and coughing.
Prevention	Prevention by vaccine.
Treatment	Bed rest and fluid intake, antivirals in some adult cases.
History	First identified in 1865. Decreased in countries where vaccination programmes have been implemented. No change elsewhere.

Measles

Microbe	Virus: *Paramyxovirus*
Symptoms	Fever, runny nose, red and runny eyes, a cough, a red rash and a sore, swollen throat.
Transmission	Spread in coughs and sneezes. Skin contact. Touching objects with the live virus on them.
Prevention	Vaccination. Hand washing.
Treatment	Bed rest and fluid intake.

Flu

Microbe	Virus: *Influenza*
Symptoms	Headache, fever, chills, muscle aches; possibly sore throat, cough, chest pain.
Transmission	Spread in coughs and sneezes. Breathing in virus in the air. Direct skin contact.
Prevention	Vaccination against current strains.
Treatment	Bed rest and fluid intake. Antivirals in the elderly.

Thrush

Microbe	Fungus: *Candida albicans*
Symptoms	Itching. Burning. Soreness. White coating in the mouth or irritation of the vagina with a whitish discharge.
Transmission	Person to person contact.
Prevention	The fungus that causes symptoms can grow better when our natural bacteria are killed off. Therefore, avoid unnecessary antibiotic use.
Treatment	Antifungals

Chlamydia

Microbe	Bacterium: *Chlamydia trachomatis*
Symptoms	In many cases there are no symptoms but sometimes there is a discharge from the vagina or penis. Swollen testicles. Inability to have children can also occur.
Transmission	Sexual contact.
Prevention	Use a condom during sexual intercourse.
Treatment	Antibiotics

Chickenpox

Microbe	Virus: *Varicella-zoster*
Symptoms	Blistering rash on the body and head.
Transmission	Direct skin contact. Spread in coughs and sneezes. Breathing in virus in the air.
Prevention	Prevention by vaccine. Handwashing.
Treatment	Bed rest and fluid intake, antivirals in some adult cases.

Disease match

1. Infectious Microbes

Infectious Microbe	Disease
Bacteria	
Virus	
Fungi	

2. Symptoms

Symptoms	Disease
Asymptomatic	
Fever	
Rash	
Sore throat	
Tiredness	
Lesions	
Whitish discharge	

Procedure

1. Group your disease cards according to the heading in each box.
2. Do you notice any similarities or differences between the diseases based on each of the headings?

3. Transmission

Transmission	Disease
Sexual contact	
Blood	
Touch	
Inhalation	
Mouth to mouth	

4. Prevention of Infection

Prevention	Disease
Wash hands	
Cover coughs and sneezes	
Use a condom	
Avoid unnecessary antibiotic use	
Vaccination	

5. Treatment of Infection

Treatment	Disease
Antibiotics	
Bed Rest	
Antifungals	
Fluid Intake	

Disease match

1. Infectious Microbes

Infectious Microbe	Disease
Bacteria	*Chlamydia*
Virus	*1* *2* *3*
Fungi	*1*

2. Symptoms

Symptoms	Disease
Asymptomatic	*1*
Fever	*1* *2* *3*
Rash	*1* *2*
Sore throat	*1*
Whitish discharge	*1* *2*

3. Transmission

Transmission	Disease
Sexual contact	*1* *2*
Touch	*1* *2* *3*
Inhalation	*1* *2* *3*
Mouth to mouth	*1*

4. Prevention of Infection

Prevention	Disease
Wash hands	*1* *2* *3*
Cover coughs and sneezes	*1* *2* *3*
Use a condom	*1* *2*
Avoid unnecessary antibiotic use	*1*
Vaccination	*1* *2* *3*

5. Treatment of Infection

Treatment	Disease
Antibiotics	*1*
Bed Rest	*1* *2* *3*
Antifungals	*1*
Fluid Intake	*1* *2* *3*

Procedure

1. Use the information sheets to find out which disease should go in each empty box below. This has been started for you.
2. Do you notice any similarities or differences between the diseases