

## ANTIMICROBIALS

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### Objective/Rationale

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Selecting the appropriate antimicrobial agent is essential to treatment of infections. The student will evaluate antimicrobial agents and their appropriate use in the treatment of disease

TEKS 121.14 (c) 5E

TAKS ELA 1, 4  
Science 1, 2, 4

National Science Education Standards A9-12; C9-12; E9-12; F9-12; G9-12

National Health Care Skills Standards .01, .09

National Curriculum Standards for School Mathematics S1; S3

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### Key Points

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- I. Antimicrobials may occur as natural products, as a mixture of natural and synthetic compounds (semisynthetic), or may be derived entirely from synthetic chemicals.
- II. Antimicrobial agents inhibit the growth of microorganisms, (bacteriostatic), or kill microorganisms (bacteriocidal) and are further subclassified by their range of activity.
  - a. Narrow-spectrum antibiotics are effective against one type or group of microorganisms.
  - b. Broad-spectrum antibiotics are effective against a wide range of microorganisms.
  - c. Antimicrobials are also classified by family, organ system on which they exert their action, and by their mode of action.
- III. Mechanisms of antimicrobial action effect:
  - a. Microbial cell wall and membrane
  - b. Microbial protein synthesis
  - c. Nucleic acid synthesis
  - d. The synthesis of metabolites necessary for growth
- IV. The emergence of drug-resistant strains of microorganisms is a major health concern and has driven in the development of new antibiotics.
  - a. Misuse and overuse of antibiotics
  - b. Development of microbial resistance
- V. Antibiotic sensitivity testing in the clinical laboratory provides the physician vital information for the selection of the most appropriate antibiotic to be used for a specific infection.
  - a. Microbial sensitivity to therapeutic doses of specific antibiotics is indicated by clear zones around the antibiotic disc.
  - b. The Kirby-Bauer procedure is an antimicrobial susceptibility test
    - i. Susceptibility – implies the organism should respond favorable to therapeutic doses of the drug.
    - ii. Intermediate – implies some susceptibility to therapeutic doses
    - iii. Resistance - implies that the usual therapeutic doses would be ineffective

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### Activities

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- I. Complete the **Antibiotic Sensitivity Test Laboratory Investigation**.

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### Materials/Resources

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Sterile swabs

Sensitivity discs containing the following antibiotics:

- |                |                 |                 |
|----------------|-----------------|-----------------|
| a. Penicillin  | b. Erythromycin | c. Tetracycline |
| d. Cephalothin | e. Gentamicin   | f. Vancomycin   |

(other antibiotics discs may be substituted or added)

Sterile agar plates (150 mm)

Forceps

Culture tubes of the nonpathogenic organisms

Incubator (37 C)

Calipers

Zone Size Interpretive Chart

Gloves

Lab coat

Goggles

Biohazard Container

Surface disinfectant

Paper towels

[Http://members.tripod.com/med-moe/](http://members.tripod.com/med-moe/)

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### Assessment

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### **Laboratory Investigation Rubric**

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### Accommodations

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For reinforcement, the student will create a poster informing the public about the consequences of the misuse and abuse of antibiotics.

For enrichment, the student will research and report on the medical and economic implications of one of the following drug-resistant microorganisms on the state of Texas

1. Staph. Aureus
2. E. Coli
3. Enterococcus
4. Strep. Pyogenes
5. Mycobacterium

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### Reflections

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# Antibiotic Sensitivity Test Laboratory Investigation

## **Purpose:**

In this laboratory the antibiotic sensitivity will be tested using the Kirby-Bauer Method.

## **Background:**

## **Materials:**

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## **Procedure:**

1. Wash hands and put on gloves and goggles.
2. Assemble equipment and materials.
3. Prepare work area.
4. Use the swab to inoculate a large agar plate (150 mm). (Apply uniform smear: smear the plate in one direction top to bottom. Turn the plate 90 and repeat smear)
5. Antimicrobial disks are dropped onto the plate with forceps

6. Incubate overnight at 37 c
7. After incubation the diameter of each zone is measured with calipers.
8. Record results in mm.
9. Convert the zone diameter into one of three reportable categories using a zone size interpretive chart:
  - susceptible (S)
  - intermediate (I)
  - resistant (R)
10. Clean work area with surface disinfectant. Remove goggles and gloves and wash hands.

**Data:**

Create a data table to record results.

**Conclusion:**

1. Why is antibiotic sensitivity testing important?
2. What is the significance of the inhibition zone diameter?
3. Which antibiotic would be the most appropriate choice for treatment?
4. Predict possible limitations of in vitro antibiotic susceptibility tests?
5. What is a method used for tracking the emergence of antibiotic-resistant strains of bacterial pathogens?