1. What in your opinion are the major factors contributing to antibiotic resistance, answer under the following sub-headings (400 words):
   1. Overuse
   2. Misuse (ie. viral, fungal)
   3. Veterinary Use
   4. Food Production and Food preservation
   5. Illegal purchasing in certain countries
   6. Environmental exposure and contaminated water also leads to antimicrobial resistance and consumption of low levels of AB’s
2. Outline the major issues resulting from this resistance (200 words).
3. Provide your scientific opinion on the advantages and disadvantages of bacteriocins and bacteriophages and the fight against AMR. (400 words)

**Tips for answer given by lecturer (incorporate points into answer):**

relating to potency, bio-availability, scale up and mass production, selectivity, solubility and ease of delivery, AMR, stability

really issues of drug design and production and all aspects of pharmacodynamics and pharmacokinetics need to thought through for this answer

can the phages mutate to infect human cells? extra marks for questions such as this to show independent thought and critical analysis, will they work for intracellular bacterial infections such as TB?

1. In your opinion, what are the major challenges facing the development of new therapeutic antimicrobial agents? (400 words)

**Tips for answer given by lecturer (incorporate points into answer):**

the development of resistance mechanisms particularly the efflux pump is going to happen, discuss how the pump is non selective and so will affect any drug structure, horizontal gene transfer of resistance will always happen also proliferating resistance.

issues with length of time for clinical trials with only a few years of actual use when in the market

issues with the biocompatibility of certain drugs which are being considered as antimicrobial agents.

environmental exposure to numerous chemicals has proliferated the presence of the pump and chemical resistance also

time and cost of new drug development with only limited time useful on the market - it is predicted it will take only 2 years for resistance to emerge.

1. List the factors to be considered for oral drug delivery under the following headings (400 words):
2. Absorption
3. Distribution
4. Metabolism
5. Elimination

**Tips for answer given by lecturer (incorporate points into answer):**

headings of pharmacokinetics

ADME

how drug design is used to increase biocompatibility

route of administration, first pass effect - prodrugs, solubility, half life, elimination etc

extra marks for outlining an example

1. Discuss the possible benefits and limitations of changing from oral antibiotics drug delivery to IV drug delivery (400 words)

**Tips for answer given by lecturer (incorporate points into answer):**

issues relating to first pass metabolism, toxicity to target organs the liver and kidney, issues with sterility of IV preparations, antimicrobial prodrug activation from the first pass effect, general issues with IV delivery such as invasive needles and infections. cost of IV drug production and ensuring sterility, advantages of IV may relate to lower dose required and avoiding altering the guy microbiota, reducing dysbiosis issues and also reducing AMR emergence from exposing gut microbiota will gain extra marks for this question.

renal and liver toxicity of IV

manufacturing issues such as cost and sterility

be critical and logical in the answer looking at both aspects of advantages and disadvantages. limitations are also important

1. In your opinion, what are the two most important achievements in drug development and design to date (400 words)

**Tips for answer given by lecturer (incorporate points into answer):**

answer can include any aspect of medicinal chemistry such as the discovery of antibiotics, use of bioreactors. there is no set right answer but students must give rationale for their choice with clear advantages that development has brought. outline why you believe your choice is a key area of medicinal chemistry.

also suggest how it might expand drug development or discovery going forward. extra marks for issues relating to the discovery of choice will be given. suggesting alternatives will also show good understanding of the area.