	Statement	Guidance
D.1.U1	In animal studies, the therapeutic index is the lethal dose of a drug for 50% of the population (LD50) divided by the minimum effective dose for 50% of the population (ED50)	
D.1.U2	In humans, the therapeutic index is the toxic dose of a drug for 50% of the population (TD50) divided by the minimum effective dose for 50% of the population (ED50).	
D.1.U3	The therapeutic window is the range of dosages between the minimum amounts of the drug that produce the desired effect and a medically unacceptable adverse effect.	Discussion of experimental foundations for therapeutic index and therapeutic window through both animal and human studies.
D.1.U4	Dosage, tolerance, addiction and side effects are considerations of drug administration.	Discussion of drug administration methods.
D.1.U5	Bioavailability is the fraction of the administered dosage that reaches the target part of the human body.	Comparison of how functional groups, polarity and medicinal administration can affect bioavailability.
D.1.U6	The main steps in the development of synthetic drugs include identifying the need and structure, synthesis, yield and extraction.	
D.1.U7	Drug–receptor interactions are based on the structure of the drug and the site of activity.	
D.2.U8	Mild analgesics function by intercepting the pain stimulus at the source, often by interfering with the production of substances that cause pain, swelling or fever.	Discussion of the synergistic effects of aspirin with alcohol.
D.2.U9	Aspirin is prepared from salicylic acid.	Description of the use of salicylic acid and its derivatives as mild analgesic. Explanation of the synthesis of aspirin from salicylic acid, including yield, purity by recrystallization and characterization using IR and melting point.
D.2.U10	Aspirin can be used as an anticoagulant, in prevention of the recurrence of heart attacks and strokes and as a prophylactic.	Discussion of how the aspirin can be chemically modified into a salt to increase its aqueous solubility and how this facilitates its bioavailability.
D.2.U11	Penicillins are antibiotics produced by fungi.	Discussion of the importance of patient compliance and the effects of the overprescription of penicillin.
D.2.U12	A beta-lactam ring is a part of the core structure of penicillins	Explanation of the importance of the beta-lactam ring on the action of penicillin.
D.2.U13	Some antibiotics work by preventing cross-linking of the bacterial cell walls.	
D.2.U13	Modifying the side-chain results in penicillins that are more resistant to the penicillinase enzyme.	Discussion of the effects of chemically modifying the side-chain of penicillins.
D.3.U14	The ability of a drug to cross the blood–brain barrier depends on its chemical structure and solubility in water and lipids	Discussion of the advantages and disadvantages of using morphine and its derivatives as strong analgesics. Discussion of side effects and addiction to opiate compounds
D.3.U15	Opiates are natural narcotic analgesics that are derived from the opium poppy.	Comparison of the structures of morphine, codeine and diamorphine (heroin)
D.3.U16	Morphine and codeine are used as strong analgesics. Strong analgesics work by temporarily bonding to receptor sites in the brain, preventing the transmission of pain impulses without depressing the central nervous system	Explanation of the synthesis of codeine and diamorphine from morphine. Description and explanation of the use of strong analgesics.
D.3.U17	Medical use and addictive properties of opiate compounds are related to the presence of opioid receptors in the brain.	Explanation of the increased potency of diamorphine compared to morphine based on their chemical structure and solubility.
D.4.U18	Non-specific reactions, such as the use of antacids, are those that work to reduce the excess stomach acid.	Explanation of how excess acidity in the stomach can be reduced by the use of different bases. Explanation of how compounds such as

		ranitidine (Zantac) can be used to inhibit stomach acid production. Explanation of how compounds like omeprazole (Prilosec) and esomeprazole (Nexium) can be used to suppress acid secretion in the stomach.
D.4.U19	Active metabolites are the active forms of a drug after it has been processed by the body	Construction and balancing of equations for neutralization reactions and the stoichiometric application of these equations. Solving buffer problems using the Henderson–Hasselbalch equation
D.5.U20	Viruses lack a cell structure and so are more difficult to target with drugs than bacteria.	Description of how viruses differ from bacteria.
D.5.U21	Antiviral drugs may work by altering the cell's genetic material so that the virus cannot use it to multiply. Alternatively, they may prevent the viruses from multiplying by blocking enzyme activity within the host cell.	Explanation of the different ways in which antiviral medications work. Explanation of how oseltamivir (Tamiflu) and zanamivir (Relenza) work as a preventative agent against flu viruses. Comparison of the structures of oseltamivir and zanamivir. Discussion of the difficulties associated with solving the AIDS problem.
D.6.U22	High-level waste (HLW) is waste that gives off large amounts of ionizing radiation for a long time	Describe the environmental impact of medical nuclear waste disposal. Explanation of the dangers of antibiotic waste, from improper drug disposal and animal waste, and the development of antibiotic resistance.
D.6.U23	Low-level waste (LLW) is waste that gives off small amounts of ionizing radiation for a short time.	Discussion of environmental issues related to left-over solvents.
D.6.U24	Antibiotic resistance occurs when micro-organisms become resistant to antibacterials	Discussion of the basics of green chemistry (sustainable chemistry) processes. Explanation of how green chemistry was used to develop the precursor for Tamiflu (oseltamivir).
D.7.U25	Taxol is a drug that is commonly used to treat several different forms of cancer	
D.7.U26	Taxol naturally occurs in yew trees but is now commonly synthetically produced.	Explanation of how taxol (paclitaxel) is obtained and used as a chemotherapeutic agent.
D.7.U27	A chiral auxiliary is an optically active substance that is temporarily incorporated into an organic synthesis so that it can be carried out asymmetrically with the selective formation of a single enantiomer.	Description of the use of chiral auxiliaries to form the desired enantiomer. Explanation of the use of a polarimeter to identify enantiomers.
D.8.U28	Alpha, beta, gamma, proton, neutron and positron emissions are all used for medical treatment.	Explanation of why technetium-99m is the most common radioisotope used in nuclear medicine based on its half-life, emission type and chemistry Explanation of why lutetium-177 and yttrium-90 are common isotopes used for radiotherapy based on the type of radiation emitted. Balancing nuclear equations involving alpha and beta particles. Calculation of the percentage and amount of radioactive material decayed and remaining after a certain period of time using the nuclear half-life equation.
D.8.U29	Magnetic resonance imaging (MRI) is an application of NMR technology.	
D.8.U30	Radiotherapy can be internal and/or external.	Discussion of common side effects from radiotherapy
D.8.U31	Targeted Alpha Therapy (TAT) and Boron Neutron Capture Therapy (BNCT) are two methods which are used in cancer treatment.	Explanation of TAT and how it might be used to treat diseases that have spread throughout the body.

D.9.U32	Organic structures can be analysed and identified through the use of infrared spectroscopy, mass spectroscopy and proton NMR	Interpretation of a variety of analytical spectra to determine an organic structure including infrared spectroscopy, mass spectroscopy and proton NMR. Description of the process of steroid detection in sport utilizing chromatography and mass spectroscopy.
D.9.U33	The presence of alcohol in a sample of breath can be detected through the use of either a redox reaction or a fuel cell type of breathalyser	Description of the process of extraction and purification of an organic product. Consider the use of fractional distillation, Raoult's law, the properties on which extractions are based and explaining the relationship between organic structure and solubility. Explanation of how alcohol can be detected with the use of a breathalyser.