Below is an instruction that describes a task. Write a response that appropriately completes the request.

{{Instruction}}: What is drug?

{{Response}}: Drug is a chemical substance that interacts within the body and may produce pharmacological effect(s). It is natural or man-made (synthetic). The drug is used for the diagnosis, prevention, or cure of the disease. It is also used for recreational purpose which is illegal. That is why, the drug which is used for the diagnosis, prevention or cure of the disease is better termed as "Medicine".

{{Instruction}}: What is pharmacology?

{{Response}}: Pharmacology is the branch of science that deals with the study of drugs and their actions on living organisms. It includes the discovery, development, manufacture, formulation, dispensing, administration, monitoring, evaluation, and disposal of medicines.

{{Instruction}}: What is pharmacy?

{{Response}}: Pharmacy is an area of health science that deals with preparation and dispensing of drugs. A person who practices this profession is known as pharmacist.

{{Instruction}}: What is Pharmacodynamics?

{{Response}}: Pharmacodynamics may be defined as 'what the drug does to the body'. It includes pharmacological effects and mechanism of action.

{{Instruction}}: What is Pharmacokinetics?

{{Response}}: Pharmacokinetics means 'what the body does to the drug'. It includes absorption, distribution, biotransformation and excretion of drug.

{{Instruction}}: What is British Approved Name?

{{Response}}: British Approved Name (BAN) is a British Pharmacopoeia term that refers to the official name of an active pharmaceutical ingredient or drug substance approved for use in the UK. It is used as a standardized reference point when reporting on the composition and quality of medicines, including their strength, purity, and stability.

{{Instruction}}: What is United States Approved Name?

{{Response}}: United States Approved Name (USAN) is a systematic name for the active ingredients of drugs approved by FDA, USPHS or PHS. It is used to identify and classify pharmaceutical substances in the United States. For example, acetaminophen is a United States Approved name for paracetamol.{{Response}}: Pharmacy is an area of health science that deals with preparation and dispensing of drugs. A person who practices this profession is known as pharmacist.

{{Instruction}}: What is Prodrug?

{{Response}}: Prodrug is a chemical substance that is inactive but when enters into the body it is converted into active one to produce pharmacological effect(s).

{{Instruction}}: What is Medicinal bottle?

{{Response}}: Medicinal bottles (also known as a medicine bottle or pharmaceutical container) are specially designed containers used to store and dispense medications or pharmaceutical products. They come in various shapes and sizes depending on the type of medicine and its intended use, and they play a crucial role in ensuring the safety, stability, and efficacy of medicines.

{{Instruction}}: What is Alu-Alu blister?

{{Response}}: Alu-Alu (aluminum-aluminum) blisters are a type of pharmaceutical packaging that involves the use of multiple layers of aluminum and plastic to create a secure and protective enclosure for tablets, capsules or suppositories. The blister is typically made from material that is safe for storing medications, and it comes in various shapes and sizes depending on the type of medication and its intended use. It plays a crucial role in ensuring the safety, stability, and efficacy of medications.

{{Response}}: Packaging 7, 14, or 28 tablets or capsules in a foil strip is preferred instead of more common quantities like 10. 7 tablets or capsules might be more suitable for treatment regimens that last for one week. Patients who need to take a medication for a week may find it easier to manage their doses when they have a weekly supply in one strip. For medications with shorter treatment durations, packaging fewer tablets or capsules can help reduce the amount of unused medication that could go to waste.

{{Response}}: Dosage form means the mixing of a definite amount of active pharmaceutical ingredients (API) with different excipients to make it suitable for administration by the patient. Dosage form is supplied to the Pharmacy store or Hospital Pharmacy for availability to the patient. In case of capsule, both API and excipients are enclosed within the shell.

{{Response}}: Pharmaceutical formulation means a multistep process of mixing excipients with API that depend on the size of drug particle, pH, solubility and polymorphism. Thereby, the drug becomes an effective one.

{{Response}}: Blister packaging consists of individual compartment, or blister, that holds a single dose of a medication. Each compartment is sealed with a protective covering that is typically made of plastic or aluminum foil. It ensures proper dosing, protect the medication from moisture and light, and provide a convenient way to keep track of doses.

{{Response}}: Strip packaging refers to a method of packaging tablet, capsule, or other small items, in a long, narrow strip of sealed packaging material. The strip is typically made of a flexible material, such as plastic or aluminum foil, that is heat-sealed to create separate, airtight compartments for each dose. The strip is then perforated or scored between each compartment, making it easy to tear off a single dose without affecting the rest of the packaging.

{{Response}}: Patient Information Leaflet (PIL) is a document provided with medication to inform patients about the proper usage, potential risks, benefits, and other essential information. A typical patient information leaflet might include the following information- Name and description of drug, dosage form, route of administration, clinical uses, contraindications, precautions, drug interaction, adverse effects, drug storage, handling, expiry date, and patient education. Nowadays its importance is reduced. A buyer can get information about that data using mobile phone.

{{Response}}: A score line (also known as score mark or break line) on the surface of a tablet refers to a visible, shallow groove that is intentionally created during the manufacturing process of the tablet. This groove is used to split or break the tablet into smaller doses. Score line is commonly found on tablet that is formulated at higher strengths, allowing the patient to adjust the dose. The quality of the drug as well as easy administration are ensured. Sustained-release paracetamol tablet or enteric coated tablet has no score line to break the tablet.

{{Response}}: The shelf life of a pharmaceutical product refers to the period during which the product is expected to remain stable, safe, and effective when stored under appropriate conditions. The expiry date appears on the product's packaging. The expiry date indicates the last day the product is expected to be safe and effective as long as it's stored properly.

{{Response}}: Biotransformation is the process of molecular alteration of drug within the body that will help the compound taken out of the body and change the activities.

{{Response}}: Absorption is the process by which drug enters into the systemic circulation after administration except intravenous administration.

{{Response}}: Drug distribution is the process by which drug is available in different tissue of the body including blood. It depends on various factors like absorption, metabolism, excretion, and protein binding.

{{Response}}: Drug excretion is the process by which drug is taken out of the body. It includes urine, feces, sweat, breath, etc.

{{Response}}: BP means British Pharmacopoeia. It is a comprehensive collection of quality standards for medicinal substances and pharmaceutical products. It provides specifications for the identity, strength, quality, and purity of medicines used in the UK. It was first introduced in 1864.

{{Response}}: USP means United States Pharmacopoeia. It is a comprehensive collection of quality standards for medicines and healthcare products in the USA. It provides specifications for the identity, strength, quality, purity, and consistency of various pharmaceutical substances and products. It was first introduced in 1820.

{{Response}}: Pharmacopoeias are the British Pharmacopoeia (BP), United States Pharmacopoeia (USP), Indian Pharmacopoeia (IP), International Pharmacopoeia, European Pharmacopoeia, Japanese Pharmacopoeia, etc.

{{Response}}: Bangladesh has no Pharmacopoeia. Instead, it has Bangladesh National Formulary (BDNF) like British National Formulary (BNF). It was first published in 2001. The last edition (5th) was published in 2019.

{{Response}}: Oral bioavailability means the amount of drug that enters into the systemic circulation after oral administration. It is always expressed as percentage. Twenty percent oral bioavailability is written as 0.2.

{{Response}}: The surface of each tablet is grooved with word or numerical. The name of drug in short, manufacturing company's name, dosage strength, and code number are present. In some cases, logo is used.

{{Response}}: Glidant is a substance that is added to a powder (API and excipients) to improve its flowability by reducing the interparticle friction, surface charge, and cohesion. It works at a certain range of concentrations. Above that concentration, the glidant will inhibit the flowability. In manufacturing a tablet, glidant is added just prior to compression. Examples are magnesium stearate, starch, talc, etc.

{{Response}}: Talc is the hydrated form of magnesium silicate. It is commonly used in tablet formulation as a lubricant and diluent, which helps to improve the flow properties of the powder mixture and ensure that the tablet is easily swallowed. It is also used as a glidant in capsule formulation to improve the flow of the powder into the capsule.

{{Response}}: Starch has a number of roles in pharmaceutical formulation, including acting as a binder to hold the active ingredients together, providing bulk and texture to the final product, improving flowability by reducing interparticle friction, surface charge, and cohesion. It also acts as a diluent or filler, which helps to improve the flow properties of the powder mixture and ensure that the tablet is easily swallowed.

{{Response}}: Stearic acid is used as a lubricant in tablet formulation. It helps to reduce friction between the powder particles during compression, which improves the flowability and ejection properties of the tablets. Stearic acid also acts as an emulsifier, helping to stabilize the dispersion of active ingredients within the matrix.

{{Response}}: Magnesium stearate is a white, waxy solid that has the chemical formula $Mg(C17H35O2)2$. It is commonly used as an anti-adherent agent in tablet formulations to prevent sticking of powder particles during compression and improve flowability.

{{Response}}: Hydroxyethylcellulose (HEC) is a water-soluble, nonionic polymer that can be used to increase the viscosity of liquids and as an emulsifying agent. It is commonly used in pharmaceutical formulations as a thickening or gelling agent, binder, stabilizer, suspending agent, and tablet disintegrant.

{{Response}}: The word excipient is derived from the Latin excipere, meaning 'to except', which is simply explained as 'other than'. Pharmaceutical excipients are basically everything other than the active pharmaceutical ingredient.

{{Response}}: Effervescent tablets are a type of medication that dissolve in water to produce carbon dioxide gas, which creates bubbles that make the solution fizzy and foamy. They are commonly used for pain relief or as antacids to relieve heartburn and indigestion.

OK

{{Response}}: Primary information about the quality of a tablet can be obtained by breaking the tablet into two parts if the tablet has a score line. If the surface of each breaking part is smooth, then it can be concluded that the tablet quality is good. If the surface of each breaking part is not smooth, then it can be concluded that the quality of the table is not good.

{{Response}}: Tablets are presented within the blister or strip. Even then tablet may be coated with a film. The advantages are to a) give the tablet attractive color, b) released its contents within the stomach in controlled manner.

{{Response}}: The advantage of adding more amount of disintegrant in a tablet will help it to dissolve within the gut quickly. If less amount of disintegrant is used, then the swallowed tablet will be released slowly or will not release at al.

{{Response}}: During the commercial production of API or the use of medicine before consumption of by the patient, some unwanted compound(s) are found within the medication. These are small in amount but these may produce harmful effects like, embryo toxic, genetic mutation or may produce cancer.

{{Response}}: A suppository is typically bullet-shaped solid dosage form that is designed to be inserted into a body cavity, typically the rectum or the vagina. It is also administered into ear, nose or urethra. Rectal suppositories are inserted into the rectum when oral administration of a medication is not possible or effective. Rectal suppositories are used to relieve constipation, reduce fever, deliver pain relief medications, or administer certain medications to individuals who cannot swallow or tolerate oral medications.

Suppositories are made from a mixture of cocoa butter and the active medication. The medication is released slowly as the suppository dissolves or melts at body temperature.

The advantages of using suppositories include- reduced gastrointestinal irritation, use in nausea or vomiting, and local action particularly in hemorrhoid.

{{Response}}: Suppository base are of three types- cocoa butter, glycerin-gelatin and polyethylene glycol. Cocoa butter is a commonly used base or excipient in suppositories. It has several advantages like it has a melting point close to body temperature, ease of insertion, well-tolerated, relatively long shelf life and stable at room temperature, compatible with a wide range of medications and non-toxic.

{{Response}}: Any injectable medicine can be administered to the vein directly by either bolus dose or by infusion.

{{Response}}: Paracetamol (also known as acetaminophen) is an analgesic and antipyretic. It has no anti-inflammatory effect. It is well-tolerated and relatively safe.

{{Response}}: Paracetamol is available as 6 dosage forms- tablet, syrup, suspension, pediatric drop, suppository and injectable form.

{{Response}}: Paracetamol tablets are available as immediate-release, sustained-release, combined immediate- and sustained-release. It is also available as soluble and effervescent tablet. The strengths of paracetamol tablets are 500 mg, 650 mg and 500/65 mg. The immediate-release paracetamol tablet releases its content within the gut within 2-3 hours. The sustained-release paracetamol tablet releases its content within the gut within 7-8 hours. Sustained-release paracetamol tablet has either single or two layers. Immediate-release paracetamol tablet may be crushed before swallow. Sustained-release paracetamol tablet should not be crushed before swallow. Sustained-release tablet is also known as modified-release or extended-release tablet.

{{Response}}: The metabolites of paracetamol are paracetamol glucuronides, glutathione conjugates, sulfate, cysteine and mercapturic acid conjugate.

{{Response}}: Paracetamol syrup is available within the bottle (60 and 100 mL size, 24 mg/mL) in liquid form instead of solid powder form. The activity of paracetamol is not degraded in liquid form. The bottle is made of either glass or plastic and is supplied with either a plastic syringe, spoon, or cup as measuring aid for measurement of accurate volume of drug.

{{Response}}: Paracetamol suspension is available as 60 and 100 mL bottles (24 mg/mL). Paracetamol suspension is available within the bottle in liquid form instead of solid powder form. The activity of paracetamol is not degraded in liquid form. Paracetamol suspension is supplied with either a plastic syringe, spoon, or cup as measuring aid for measurement of accurate volume of drug.

{{Response}}: Paracetamol suppository contains either 250 mg or 500 mg of paracetamol. The weight of a paracetamol suppository is 2 grams for adult size and 1 gram for child size. Five paracetamol suppositories are packaged in aluminum foil. These are kept in low temperature (within refrigerator, -4 degree centigrade).

{{Response}}: Paracetamol pediatric drop is available as 15 and 30 mL bottles (80 mg/mL). The bottle is supplied with a dropper for measurement of accurate volume of drug.

{{Response}}: Paracetamol vial is available as 100 mL container. Each milliliter contains 10 mg of paracetamol. Paracetamol infusion bottle contains 100 mL of solution. It contains 1000 mg (1 gram) of paracetamol. That means, 1.0% w/v. Each mL contains 10 mg of paracetamol.

{{Response}}: A patient of high fever can be treated with,

1) Tablet Paracetamol (500 mg) when there is fever

2) Plenty of fluid intake

3) Cold sponging of forehead and body

4) No antimicrobial agent is prescribed until there is bacterial cause.

{{Response}}: The absorption of paracetamol after oral administration occurs primarily along the small intestine by passive diffusion.

{{Response}}: The rate-limiting step is the rate of gastric emptying into the intestines. Several clinical factors can affect absorption per se or the rate of gastric emptying, such as diet, concomitant medication, surgery, pregnancy, and others.

{{Response}}: The reason behind supplying two spoons combined together with paracetamol syrup or suspension instead of one is to measure either 5 mL or 2.5 mL of medicine. When a single spoon is provided with paracetamol syrup and suspension, it has a circular line inside it. This indicates that if you take medicine up to this inner circle, then 2.5 mL of drug will be measured. However, the outer part of the spoon is used for measuring 5 mL of medicine.

{{Response}}: Some of the pharmaceutical packaging is printed as paracetamol forte. The word Forte comes from fortified. In case of paracetamol forte, codeine is added to paracetamol.

{{Response}}: Paracetamol is manufacture with a number of drugs. In Bangladesh, it is only with caffeine. However, in other countries, it is combined with codeine, aspirin, diclofenac, ibuprofen, tramadol, antihistamines and vitamins.

{{Response}}: Paracetamol is not a drug. It is a prodrug. After administration, it is converted into its active form NAPQI (N-acetyl-p-benzoquinone imine) within the body that produces pharmacological effects.

{{Response}}: NAPQI is rapidly converted to inactive compound after combining with glutathione. When a therapeutic dose of paracetamol is administered, the amount of NAPQI is rapidly combined with the glutathione to make it inactive and finally excreted from the body. In case of paracetamol overdose, there will be shortage of glutathione that leads to accumulation of NAPQI within the body that eventually damages the liver.

{{Response}}: The excipients of immediate-release paracetamol tablets are starch, magnesium stearate, and purified talc. Among them, the amount of starch is higher. Starch is obtained from the corn, potato, rice, bean and wheat. Starch from corn is commonly used. When the starch within the tablet comes in contact with water, it swells up 5 to 10%. Then the tablet breaks up.

{{Response}}: The excipients of sustained-release paracetamol tablets are starch, magnesium stearate, hydroxyethyl cellulose, microcrystal cellulose, sodium lauryl sulfate and povidone.

{{Response}}: Paracetamol is absorbed from the gut by passive diffusion after oral administration.

{{Response}}: Soluble paracetamol tablets are designed to dissolve quickly in water, making them easier to ingest for people who cannot swallow the tablet.

{{Response}}: Paracetamol effervescent tablet is designed to dissolve in water before consumption. This type of tablet is often used to provide quick relief from pain and fever. Paracetamol effervescent tablet contains citric acid and

sodium bicarbonate. When the tablet comes in contact with water, sodium bicarbonate reacts with the citric acid to produce carbon dioxide gas, which aids in the tablet's dissolution.

{{Response}}: Paracetamol soluble tablet is a specific formulation that can be dissolved in a glass of water before consumption. These tablets are designed to be dissolved in water to make it easier for individuals who have difficulty swallowing traditional solid tablets or capsules. This allows for quicker absorption of the medication in the body, as it doesn't have to go through the process of breaking down a solid tablet in the digestive system.

{{Response}}: The acceptable amounts of impurities in different drugs are mentioned in either British Pharmacopoeia or United States Pharmacopoeia. In case of paracetamol, it will be less than 0.1%. During the commercial production of paracetamol, the byproducts 4-nitrophenol (para-nitrophenol) and 4'chloroacetanilide are produced. These two impurities further converted to benzoquinone and hydroquinone.

{{Response}}: Sucrose is used during the production of paracetamol syrup. It makes the syrup sweetening. In addition, it increases the density of the syrup as well as acts as a preservative.

{{Response}}: Paracetamol syrup and elixir are both in liquid forms. But syrup is more acceptable to the patient than elixir. It has some advantages like a) the amount of ethanol is low, b) suitable for the children, c) having more density, and d) easy to measure.

{{Response}}: If the paracetamol syrup is not available in the Drug store (pharmacy), paracetamol suspension can be used, if available. However, the use of paracetamol suspension has the advantage of no propylene glycol or diethylene glycol.

{{Response}}: The dose of any liquid preparation can be selected based on a) body weight, b) age, c) surface area, d) height and e) gender. In case of paracetamol syrup, body weight, age, and height may be used to calculate the dose.

{{Response}}: In case of non-availability of paracetamol syrup or suspension, paracetamol tablet may be used to make it powder using two teaspoons. The power, is then, mixed with child's preferred cold drink or water for swallow purpose.

{{Response}}: The excipients of paracetamol syrup may vary from manufacturing company to company depend on the cost. These are diluting agent, sweetening agent, buffering agent, coloring agent and preservative. Usually it contains sucrose, propylene glycol (10%), glycerin, ethanol, nipagin, nipazol, and sodium phosphate. The diluents are sucrose, glycerin, and water.

{{Response}}: Some of the manufacturing companies use diethylene glycol instead of propylene glycol in the production of paracetamol syrup, wine, or toothpaste because of cheaper than propylene glycol. Paracetamol is not water soluble (maximum 4 mg of paracetamol is dissolved per milliliter of water). That is why, propylene glycol is necessary to dissolve it. Swallowing paracetamol syrup with diethylene glycol causes death of a number of children.

{{Response}}: More than one sweetening agent is used to prepare a paracetamol syrup or suspension. It is due to adjust the level of sweetening. The agents used are sucralose and sodium saccharin.

{{Response}}: To reduce the production cost of paracetamol syrup, the following measures are taken by the pharmaceutical companies- a) reduce the number of excipients, b) use low-cost excipients and use of more than one excipient having same property.

{{Response}}: More than one preservative is used for paracetamol syrup. These are nipazol, nipagin and ethanol. It will reduce the cost and adverse effects.

{{Response}}: Paracetamol syrup can undergo chemical changes when exposed to light (photodegradation). It can be diagnosed initially by change in color, odor or taste. The efficacy the syrup is lost. It can be confirmed by chemical analysis.

{{Response}}: Shaking a paracetamol syrup or suspension before swallowing is often necessary for several reasons- a) uniform distribution, b) homogenous mixture, c) dosage accuracy, and d) improve palatability.

{{Response}}: The excipients of paracetamol suspension are invert sugar, sorbitol, glycerin, cross-povidone, polyethylene glycol 4000, xanthan gum, sodium benzoate, sucralose, saccharin, citric acid, amaranth, and peppermint oil.

{{Response}}: When the bottle of paracetamol suspension is shaken, the contents is uniformly distributed. If the bottle is then kept on the table, the suspending particles are not dropped immediately. Paracetamol suspension contains xanthan gum which prevents the rapid fall of particles within the bottle.

{{Response}}: The excipients of paracetamol pediatric drop are polyethylene glycol 6000 and glycerin.

{{Response}}: The excipients of paracetamol suppository contain cocoa butter, gelatin, glycerin, polyethylene glycol, vanillin, vegetable oil, antioxidant, and antimicrobial agent.

{{Response}}: Any injectable medicine can be administered to the vein directly by either bolus dose or by infusion. Paracetamol is administered into the body by intravenous infusion. Paracetamol infusion may be given to a child more than 33 kg body weight. Mild to moderate type of pain after operation can be relieved by administering paracetamol in intravenous infusion form. The excipients of paracetamol infusion are dimethyl acetamide, sodium meta-bi-sulfite, mannitol, sodium dihydrogen phosphate. Hydrochloric acid or sodium hydroxide are added to adjust the pH to 5.5. Paracetamol is degraded within the solution. To avoid degradation, mannitol and sodium dihydrogen phosphate are used within the infusion solution.

{{Response}}: Propacetamol is a prodrug that is converted to paracetamol within the body. Unlike paracetamol, propacetamol is water soluble.

{{Response}}: Undiluted paracetamol is administered within the body within 15 minutes whereas diluted paracetamol is administered within 60 minutes. During infusion of paracetamol, close monitoring is necessary to check whether there is formation of air embolism. At the side of administration, there may be pain or burning sensation. In addition, erythema, blister formation, itching, and increased heart rate.

{{Response}}: The following things must be checked before administering paracetamol infusion: a) Is the solution clear? Cloudy solution means there is formation of fungus. b) Is the expiry date has crossed? c) Check is there any interaction of paracetamol with other drug(s).

{{Response}}: Mir Misbahuddin is the retired Professor of Pharmacology. He worked at the Bangabandhu Sheikh Mujib Medical University for more than 27 years. He wrote 6 books on pharmacology and arsenicosis. At present, he is the editor-in-chief of Bangladesh Journal of Pharmacology.

Drugs can be administered through various routes, including oral, topical, injectable, inhalational, or intravenous, depending on the drug's properties and the condition being treated.

Drugs can act on the body in different ways, such as:

1. Stimulating or depressing a specific physiological process or function
2. Modifying the body's metabolism or biochemistry
3. Affecting the body's immune system
4. Altering the body's nervous system function
5. Inhibiting or promoting the growth of microorganisms, such as bacteria or fungi
6. Acting on specific molecules or receptors in the body
7. Modifying the body's pH levels
8. Affecting the body's blood flow or circulation
9. Inhibiting or promoting the breakdown of drugs by enzymes in the body
10. Altering the body's excretory processes, such as urine production or feces formation.