


SYRINGES

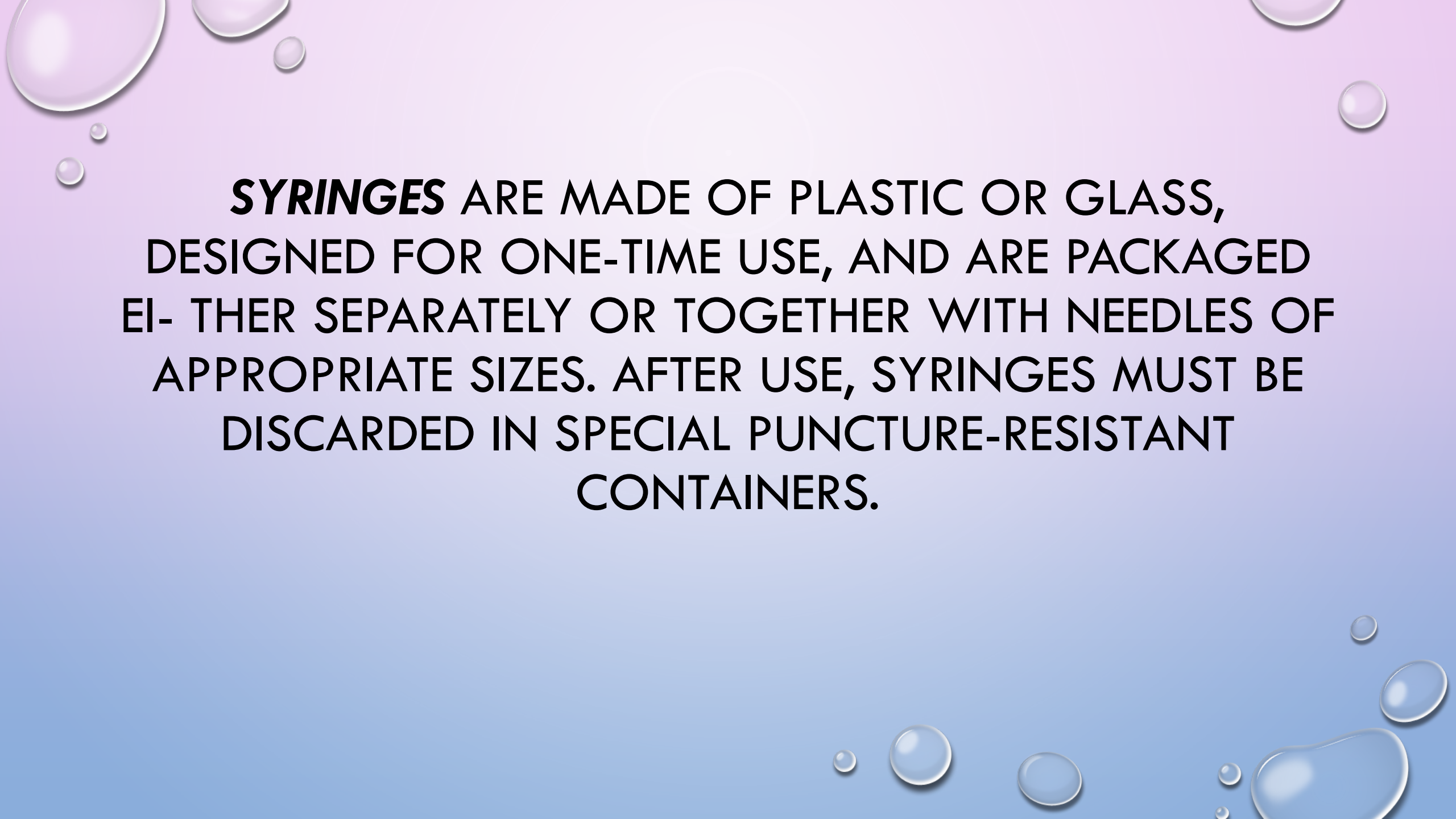


LEARNING OUTCOMES



AFTER COMPLETING THIS CHAPTER, YOU WILL BE ABLE TO

1. IDENTIFY THE PARTS OF A SYRINGE AND NEEDLE.
 2. IDENTIFY VARIOUS TYPES OF SYRINGES.
 3. READ AND MEASURE DOSAGES ON SYRINGES.
 4. SELECT THE APPROPRIATE SYRINGE TO ADMINISTER PRESCRIBED DOSES.
 5. READ THE CALIBRATIONS ON HYPODERMIC, TUBERCULIN, INSULIN, AND
 6. PREFILLED SYRINGES.
 7. MEASURE SINGLE INSULIN DOSAGES.
 8. MEASURE COMBINED INSULIN DOSAGES.
- 



SYRINGES ARE MADE OF PLASTIC OR GLASS, DESIGNED FOR ONE-TIME USE, AND ARE PACKAGED EITHER SEPARATELY OR TOGETHER WITH NEEDLES OF APPROPRIATE SIZES. AFTER USE, SYRINGES MUST BE DISCARDED IN SPECIAL PUNCTURE-RESISTANT CONTAINERS.

PARTS OF A SYRINGE

A SYRINGE CONSISTS OF A BARREL, PLUNGER, AND TIP.

BARREL: A HOLLOW CYLINDER THAT HOLDS THE MEDICATION. IT HAS CALIBRATIONS (MARKINGS) ON THE OUTER SURFACE.

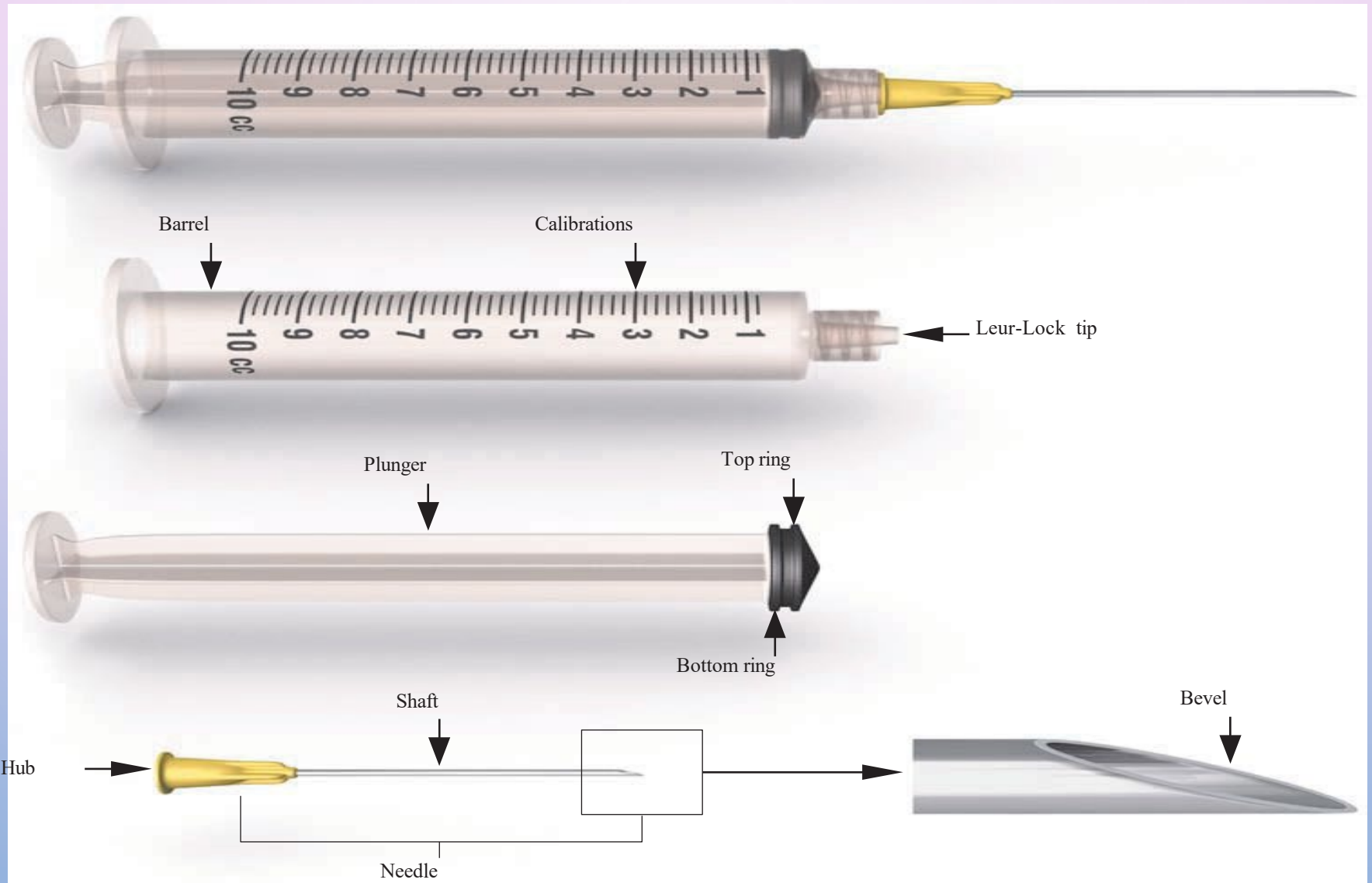
PLUNGER: FITS IN THE BARREL AND IS MOVED BACK AND FORTH. PULLING BACK ON THE PLUNGER DRAWS MEDICATION OR AIR INTO THE SYRINGE. PUSHING IN THE PLUNGER FORCES AIR OR MEDICATION OUT OF THE SYRINGE.

TIP: THE END OF THE SYRINGE THAT HOLDS THE NEEDLE. THE NEEDLE SLIPS ONTO THE TIP OR CAN BE TWISTED AND LOCKED IN PLACE (LEUR-LOK).

THE INSIDE OF THE BARREL, PLUNGER, AND TIP (SHOWN IN ● MUST ALWAYS BE STERILE.

NEEDLES

NEEDLES ARE MADE OF STAINLESS STEEL AND COME IN VARIOUS LENGTHS AND DIAMETERS. THEY ARE PACKAGED WITH A PROTECTIVE COVER THAT KEEPS THEM FROM BEING CONTAMINATED. THE PARTS OF A NEEDLE ARE THE **HUB**, WHICH ATTACHES TO THE SYRINGE, THE **SHAFT**, THE LONG PART OF THE NEEDLE THAT IS EMBEDDED IN THE HUB, AND THE **BEVEL**, THE SLANTED PORTION OF THE TIP. THE **LENGTH** OF THE NEEDLE IS THE DISTANCE

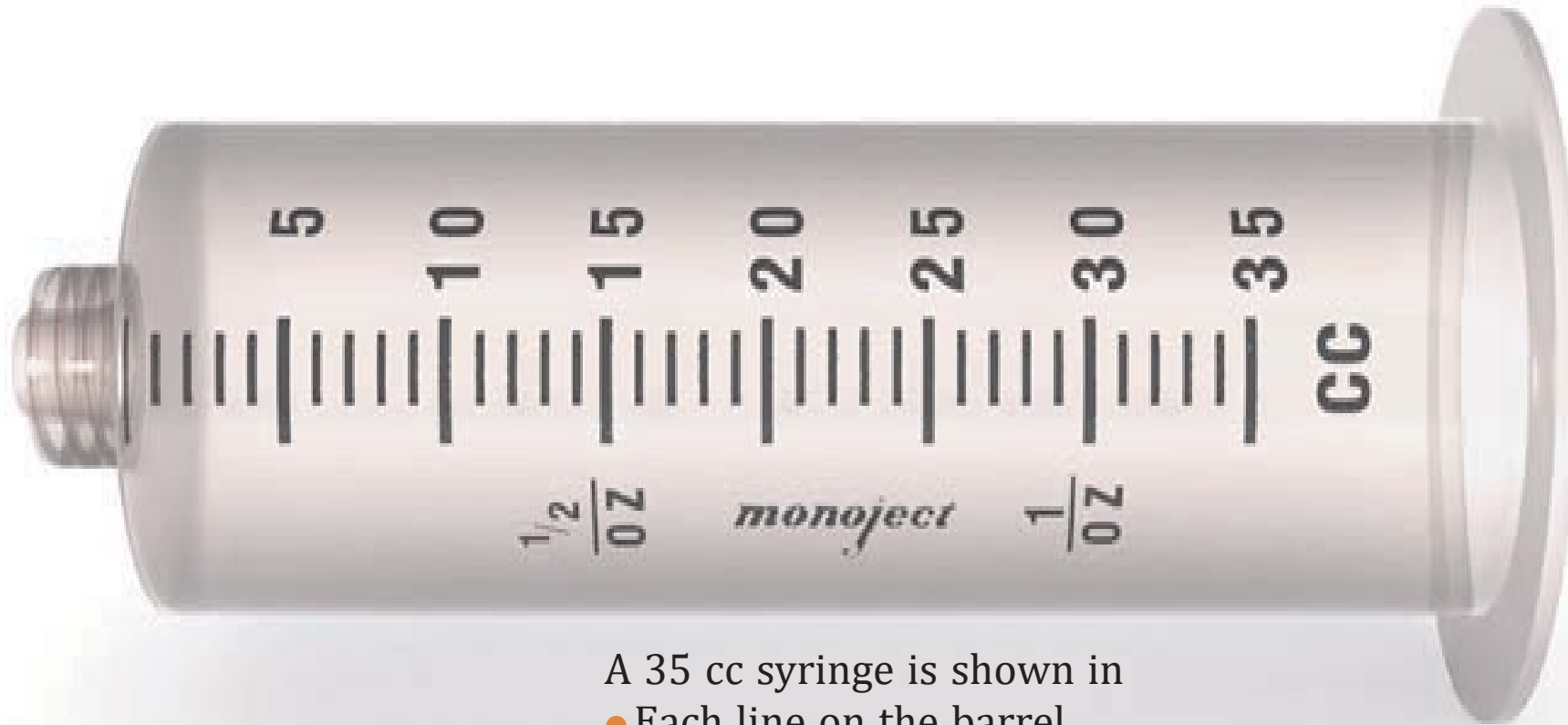


TYPES OF SYRINGES

HYPODERMIC SYRINGES ARE CALIBRATED (MARKED) IN CUBIC CENTIMETERS (CC), MILLI- LITERS (ML), OR UNITS. PRACTITIONERS OFTEN REFER TO SYRINGES BY THE VOLUME OF CUBIC CENTIMETERS THEY CONTAIN, FOR EXAMPLE, A 3 CC SYRINGE

THE SMALLER CAPACITY SYRINGES (1, 2, 2 $\frac{1}{2}$, AND 3 ML) ARE USED MOST OFTEN FOR SUBCUTANEOUS OR INTRAMUSCULAR INJECTIONS OF MEDICATION. THE LARGER SIZES (5, 6, 10, AND 12 ML) ARE COMMONLY USED TO DRAW BLOOD OR PREPARE MEDICATIONS FOR INTRAVENOUS ADMINISTRATION. SYRINGES 20 ML AND LARGER ARE USED TO INJECT LARGE VOLUMES OF STERILE SOLUTIONS.

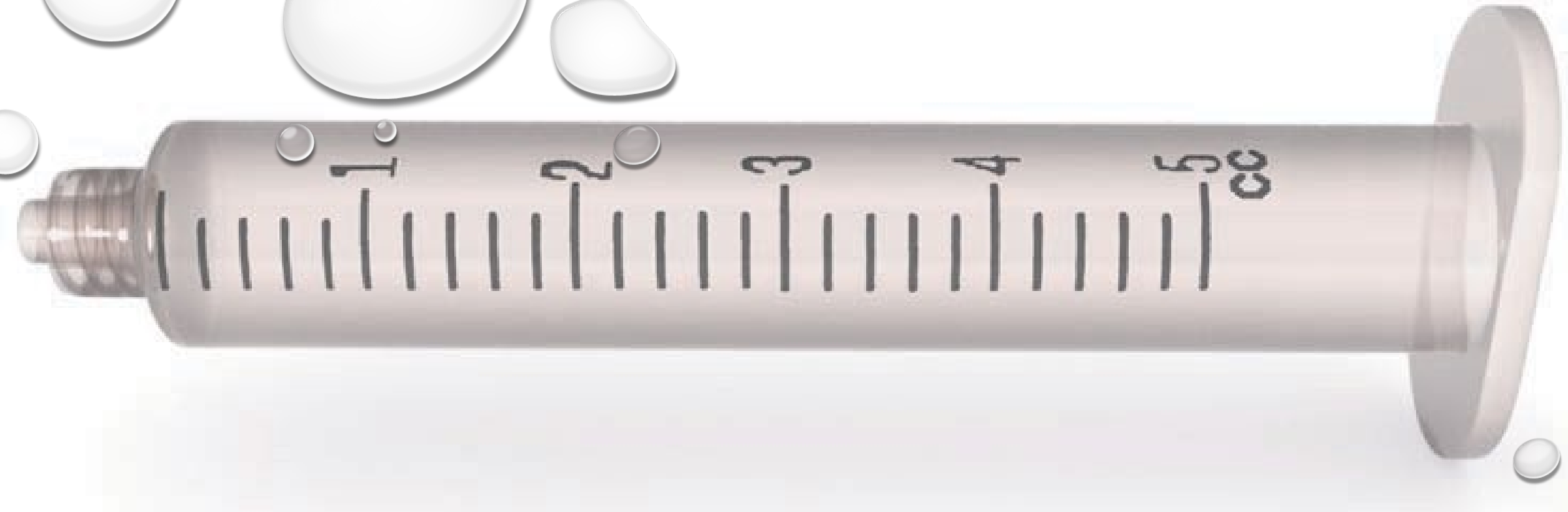




A 35 cc syringe is shown in
● Each line on the barrel represents 1 mL, and the longer lines represent 5 mL.



12 CC SYRINGE IS SHOWN IN EACH LINE ON THE BARREL REPRESENTS 0.2 ML, AND THE LONGER LINES REPRESENT 1 ML.

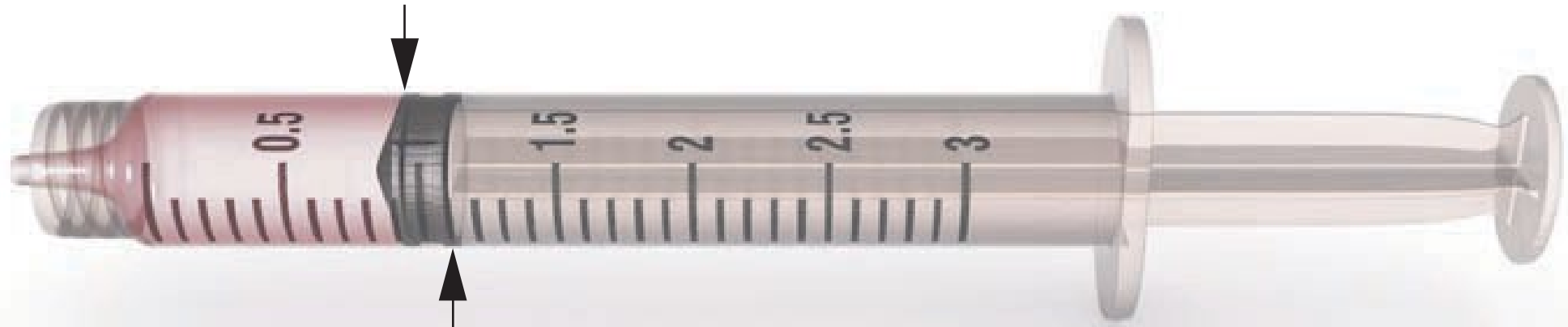


A 5 CC SYRINGE IS SHOWN IN • EACH LINE ON THE BARREL REPRESENTS 0.2ML'S, AND THE LARGER LINES REPRESENTS 1ML

3 CC/ML SYRINGE IS SHOWN. THERE ARE 10 SPACES BETWEEN THE LARGEST MARKINGS. THIS INDICATES THAT THE SYRINGE IS MEASURED IN TENTHS OF A MILLILITER. SO, EACH OF THE LINES IS 0.1 ML. THE LONGER LINES INDICATE HALF AND FULL MILLILITER MEASURES. THE LIQUID VOLUME IN A SYRINGE IS READ FROM THE *TOP RING*, **NOT** THE BOTTOM RING OR THE RAISED SECTION IN THE MIDDLE OF THE PLUNGER. THEREFORE, THIS SYRINGE CONTAINS

0.9 ML.

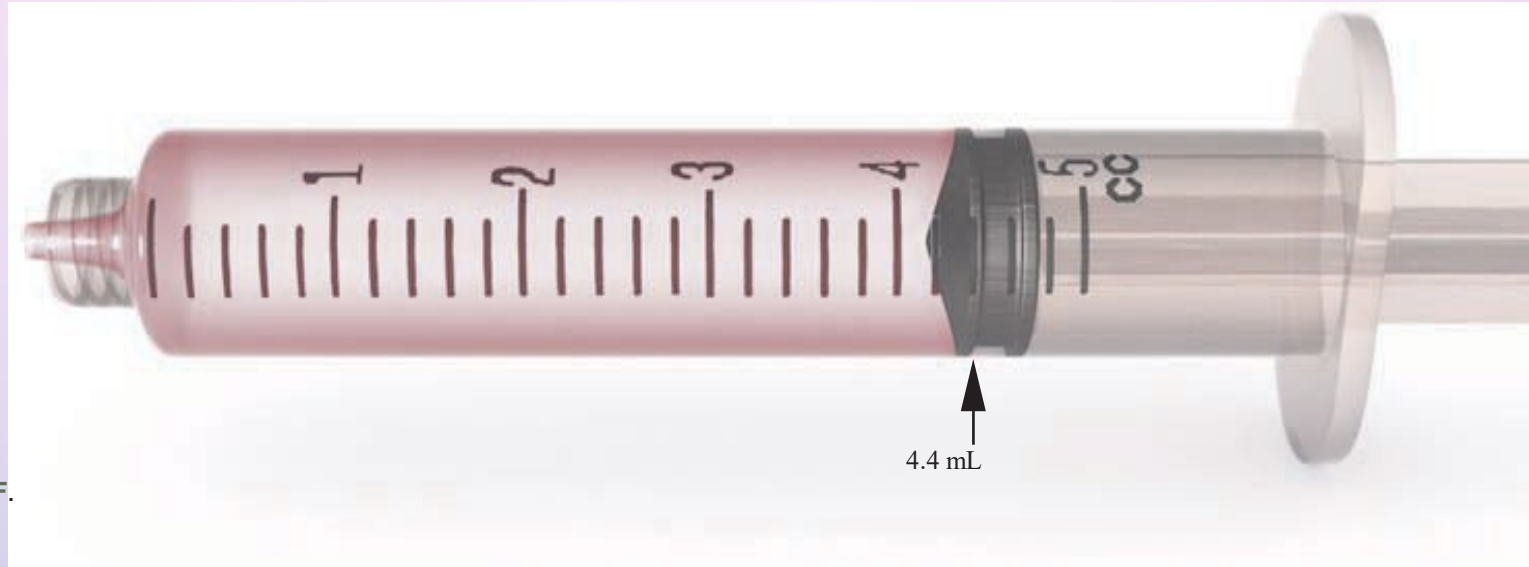




Bottom ring

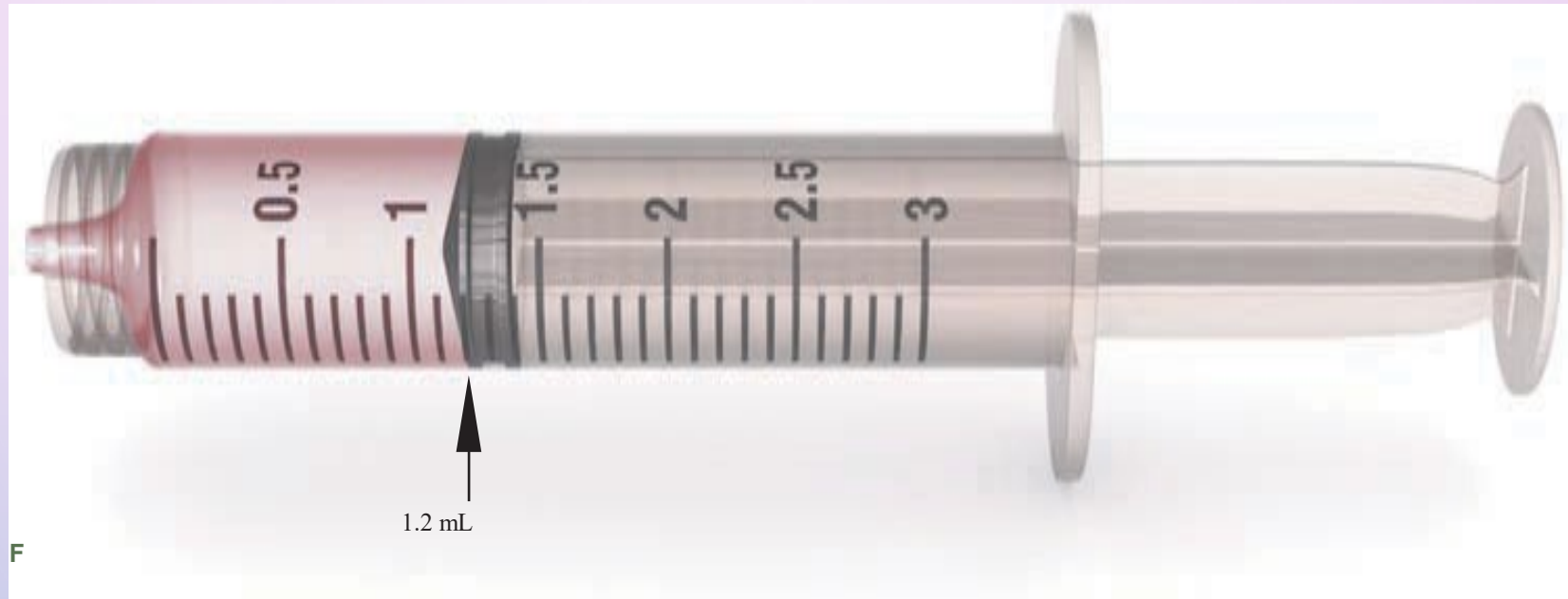


TOP RING OF THE PLUNGER IS AT THE SECOND LINE AFTER THE 5 ML LINE. BECAUSE EACH LINE MEASURES 0.2 ML, THE SECOND LINE MEASURES 0.4 ML. THEREFORE, THE AMOUNT IN THE SYRINGE IS 5.4 ML.

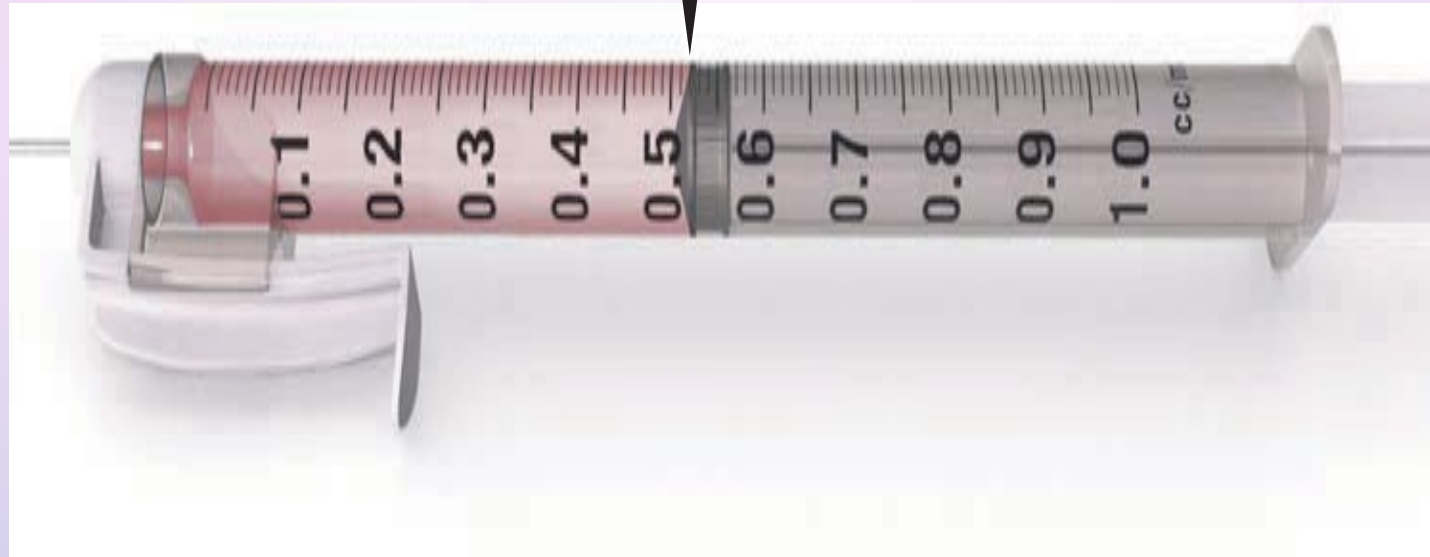


F.

HOW MUCH LIQUID IS IN THE 5 CC SYRINGE SHOWN IN?
THE TOP RING OF THE PLUNGER IS AT THE SECOND LINE AFTER 4 ML. BECAUSE EACH
LINE MEASURES 0.2 ML, THE SECOND LINE MEASURES 0.4 ML. THEREFORE, THE AMOUNT
OF LIQUID IN THE SYRINGE IS 4.4 ML.

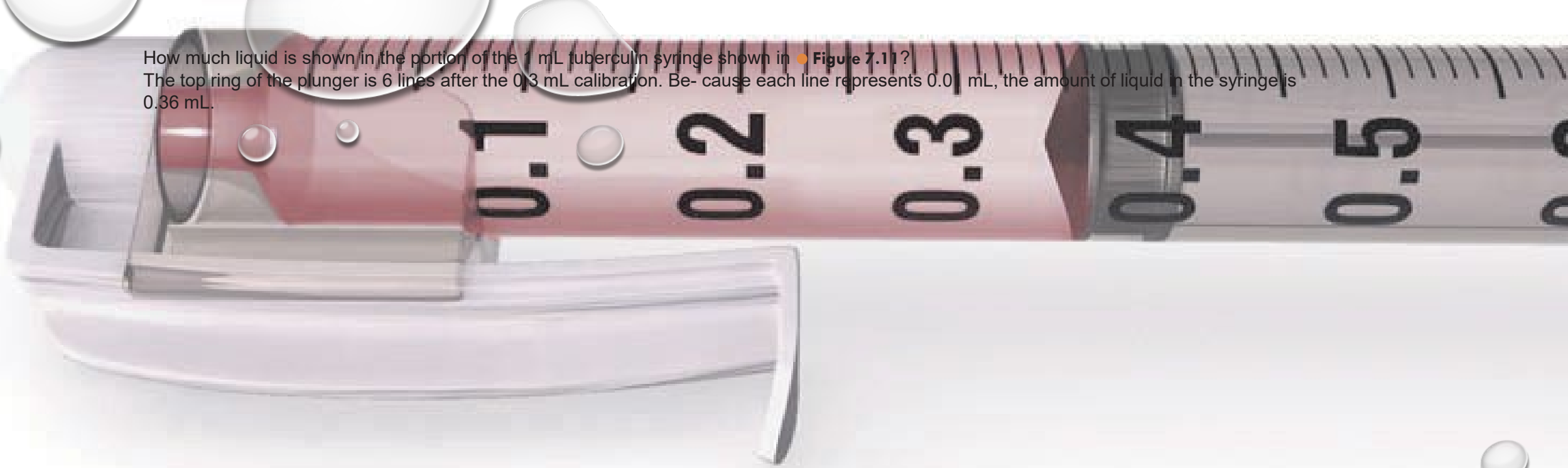


THE TOP RING OF THE PLUNGER IS AT THE SECOND LINE AFTER 1 ML. BECAUSE EACH LINE MEASURES 0.1 ML, THE TWO LINES MEASURE 0.2 ML. THEREFORE, THE AMOUNT IN THE SYRINGE IS 1.2 ML.



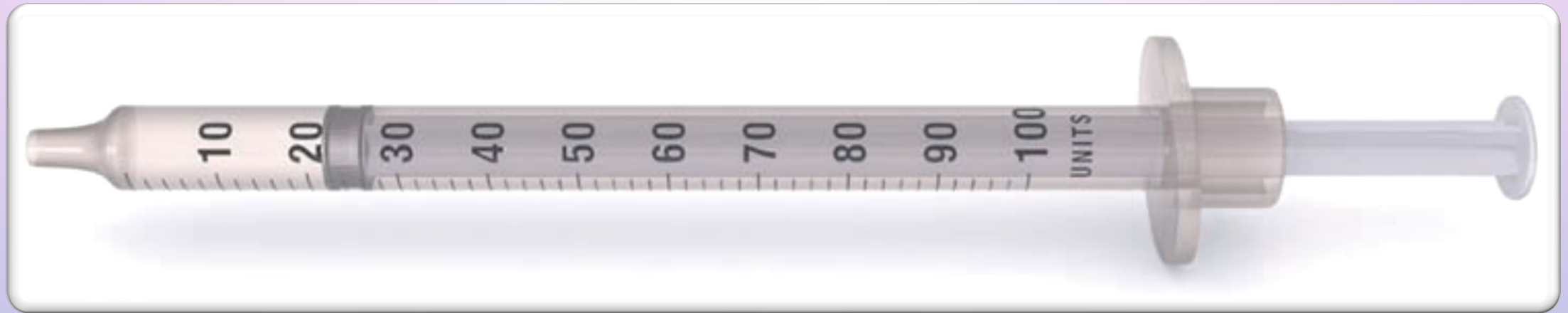
THE 1 ML SYRINGE, ALSO CALLED A **TUBERCULIN SYRINGE**, SHOWN IS CALIBRATED IN HUNDREDTHS OF A MILLILITER. BECAUSE THERE ARE 100 LINES ON THE SYRINGE, EACH LINE REPRESENTS 0.01 ML. THIS SYRINGE IS USED FOR INTRADERMAL INJECTION OF VERY SMALL AMOUNTS OF SUBSTANCES IN TESTS FOR TUBERCULOSIS AND ALLERGIES, AS WELL AS FOR INTRAMUSCULAR INJECTION OF SMALL QUANTITIES OF MEDICATION. THE TUBERCULIN SYRINGE IS THE PREFERRED SYRINGE FOR USE IN MEASURING MEDICATIONS LESS THAN 1 ML. THE TOP RING OF THE PLUNGER IS AT THE SECOND LINE AFTER 0.5 ML. THEREFORE, THE AMOUNT IN THE SYRINGE IS 0.52 ML.

How much liquid is shown in the portion of the 1 mL tuberculin syringe shown in **Figure 7.11**? The top ring of the plunger is 6 lines after the 0.3 mL calibration. Because each line represents 0.01 mL, the amount of liquid in the syringe is 0.36 mL.



THE TOP RING OF THE PLUNGER IS 6 LINES AFTER THE 0.3 ML CALIBRATION. BE- CAUSE EACH LINE REPRESENTS 0.01 ML, THE AMOUNT OF LIQUID IN THE SYRINGE IS 0.36 ML.

INSULIN SYRINGES ARE USED FOR THE SUBCUTANEOUS INJECTION OF INSULIN AND ARE CALIBRATED IN *UNITS* RATHER THAN *MILLILITERS*. INSULIN IS A HORMONE USED TO TREAT PATIENTS WHO HAVE INSULIN-DEPENDENT DIABETES MELLITUS (IDDM). IT IS SUPPLIED AS A PREMIXED LIQUID MEASURED IN STANDARDIZED UNITS OF POTENCY RATHER THAN BY WEIGHT OR VOLUME. THESE STANDARDIZED UNITS ARE CALLED **USP UNITS**, WHICH ARE OFTEN SHORTENED TO *UNITS*. THE MOST COMMONLY PREPARED CONCENTRATION OF INSULIN IS 100 UNITS PER MILLILITER, WHICH IS REFERRED TO AS *UNITS 100 INSULIN* AND IS ABBREVIATED AS U-100 ON INSULIN LABELS. ALTHOUGH A 500 UNIT CONCENTRATION OF INSULIN (U-500) IS ALSO AVAILABLE,



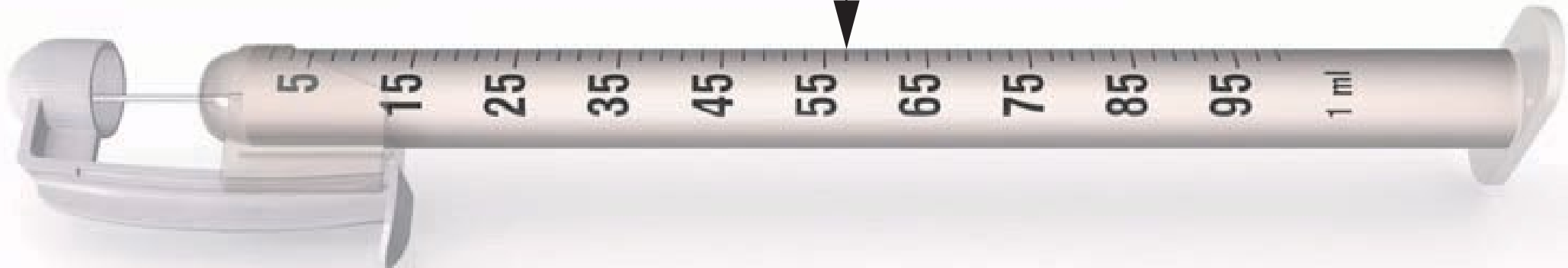
SHOWS A *SINGLE-SCALE STANDARD* 100 UNIT INSULIN SYRINGE CALIBRATED IN 2 UNIT INCREMENTS. ANY ODD NUMBER OF UNITS IS MEASURED BETWEEN THE EVEN CALIBRATIONS. THESE CALIBRATIONS AND SPACES ARE VERY SMALL, SO THIS IS NOT THE SYRINGE OF CHOICE FOR A PERSON WITH IMPAIRED VISION. **A SINGLE-SCALE STANDARD 100 UNIT INSULIN SYRINGE WITH 22 UNITS OF INSULIN.**

THE DUAL-SCALE VERSION BELOW OF THIS SYRINGE IS EASIER TO READ. SHOWS A *DUAL-SCALE* 100 UNIT INSULIN SYRINGE, ALSO CALIBRATED IN 2 UNIT INCREMENTS. HOWEVER, IT HAS A SCALE WITH *EVEN* NUMBERS ON ONE SIDE AND A SCALE WITH *ODD* NUMBERS ON THE OPPOSITE SIDE. BOTH THE EVEN AND ODD SIDES ARE SHOWN. EACH LINE ON THE BARREL REPRESENTS 2 UNITS.



Even side showing 74 units

Odd side showing 57 units





A 50 UNIT LO-DOSE INSULIN SYRINGE, SHOWN, IS A SINGLE-SCALE SYRINGE WITH 50 UNITS. IT IS CALIBRATED IN 1 UNIT INCREMENTS



A 30 unit Lo-Dose insulin syringe, shown above, is a syringe with 30 units. It is calibrated in 1 unit increments and is used when the dose is less than 30 units

MEASURING A SINGLE DOSE OF INSULIN IN AN INSULIN SYRINGE

INSULIN IS AVAILABLE IN 100 UNITS/ML MULTIDOSE VIALS. THE MAJOR ROUTE OF ADMINISTRATION OF INSULIN IS BY SUBCUTANEOUS INJECTION. *INSULIN IS NEVER GIVEN INTRAMUSCULARLY.* IT CAN ALSO BE ADMINISTERED WITH AN INSULIN PEN THAT CONTAINS A CARTRIDGE FILLED WITH INSULIN OR WITH A CSII PUMP (CONTINUOUS SUBCUTANEOUS INSULIN INFUSION). THE CSII PUMP IS USED TO ADMINISTER A PROGRAMMED DOSE OF A RAPID-ACTING 100 UNITS INSULIN AT A SET RATE OF UNITS PER HOUR.

THE *SOURCE* OF INSULIN (ANIMAL OR HUMAN) AND *TYPE* (RAPID, SHORT, INTERMEDIATE, OR LONG-ACTING) ARE INDICATED ON THE LABEL. TODAY, THE MOST COMMONLY USED *SOURCE* IS HUMAN INSULIN. INSULIN FROM A HUMAN *SOURCE* IS DESIGNATED ON THE LABEL AS RECOMBINANT DNA (RDNA ORIGIN). THE *TYPE* OF INSULIN RELATES TO BOTH THE *ONSET AND DURATION OF ACTION*. IT IS INDICATED BY THE UPPERCASE BOLD LETTER THAT FOLLOWS THE TRADE NAME ON THE LABEL, FOR EXAMPLE, HUMULIN **R (REGULAR)**, HUMULIN **L (LENTE)**, HUMULIN **N (NPH)**, AND HUMULIN **U (ULTRALENTE)**. THESE LETTERS ARE IMPORTANT VISUAL IDENTIFIERS WHEN SELECTING THE INSULIN TYPE.

Concentration

Trade Name

Exp. Date/Control No. W6 344J AMX

Lilly NDC 0002-8315-01
10 mL HI-310
100 units per mL

Humulin[®] N
NPH
human insulin
(rDNA origin)
isophane suspension

U-100

3 0002-8315-01 9

Important: See enclosed insert.
Keep in a cold place. Avoid freezing.
Shake carefully.
Eli Lilly and Company Indianapolis, IN 46285, USA

Generic name

Source

Type	Name		How It Works
Rapid Acting (generic)	Humalog (lispro)	Novolog (aspart)	Rapid-acting insulin covers insulin needs for meals eaten at the time of injection. Usually taken 15 minutes before meals or given just after a meal. This type of insulin is also given to cover until longer-acting insulins take effect.
Onset	15–30 minutes	10–20 minutes	
Peak	30 minutes to 2 $\frac{1}{2}$ hours	1–3 hours	
Duration	3–5 hours	3–5 hours	
Short Acting regular	Humulin R, Novolin, or Semilente	Velosulin (for use in an insulin pump)	Short-acting insulin covers insulin needs for meals eaten within 30–60 minutes. Usually taken 30 to 40 minutes before meals.
Onset	30 minutes to 1 hour	30 minutes to 1 hour	
Peak	2–5 hours	2–3 hours	
Duration	5–8 hours	2–3 hours	
Intermediate Acting	NPH (N)	Lente (L)	Intermediate-acting insulin covers insulin needs for about half the day or overnight. Taken up to 1 hour before meals. This type of insulin is often combined with rapid- or short-acting insulin.
Onset	2–4 hours	1–2 $\frac{1}{2}$ hours	
Peak	4–10 hours	4–12 hours	
Duration	14–16 hours	12–18 hours	
Long Acting	Ultralente (U)	Lantus (glargine)	Long-acting insulin covers insulin needs for about 1 full day, not timed to meals. Some are given once or twice daily, and others once a day. Lantus once a day should be given at the same time. This type of insulin is often combined, when needed, with rapid- or short-acting insulin.
Onset	30 minutes–3 hours	1–1 $\frac{1}{2}$ hours	
Peak	peakless	No peak time; insulin is delivered at a steady level	
Duration	20–36 hours	20–24 hours	

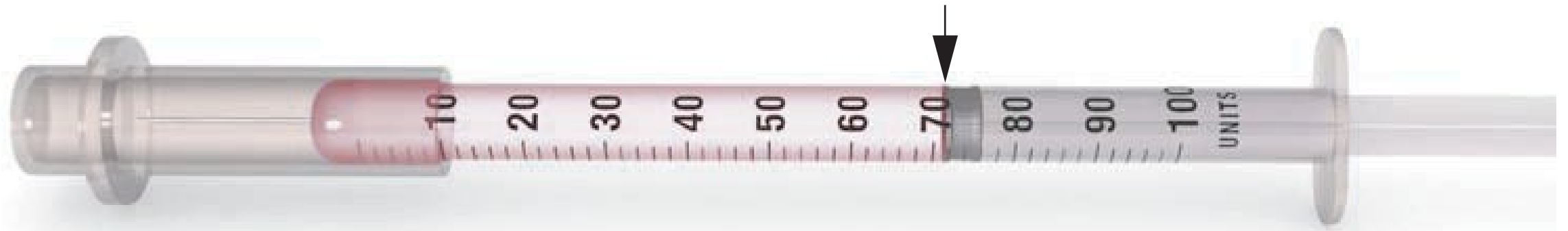
THIS IS THE TABLE OF DIFFERENT TYPES OF INSULIN

Premixed Insulin Combinations

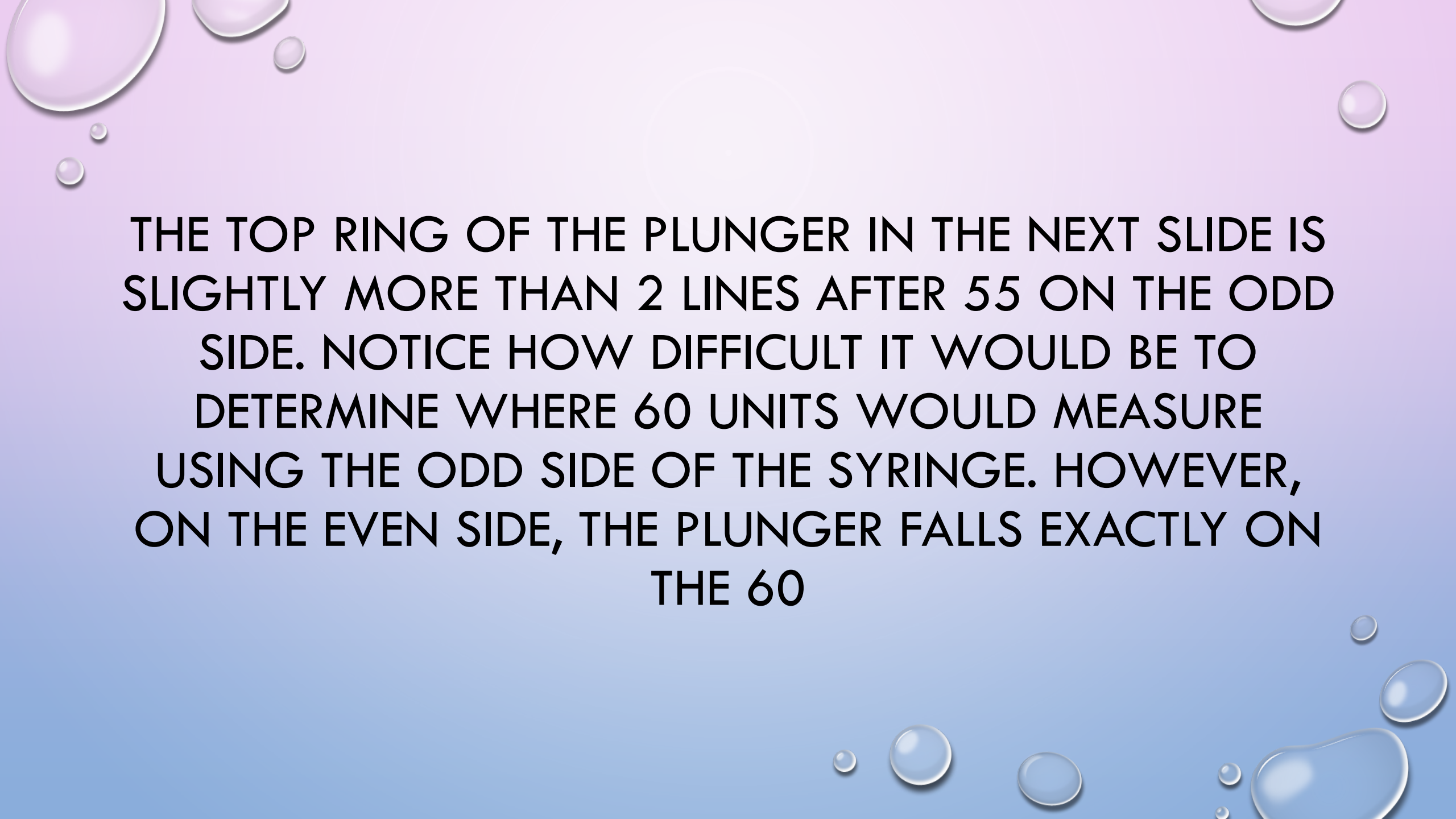
How It Works

Premixed	Humulin 70/30	Novolin 70/30	Novolog 70/30	Humulin 50/50	Humalog mix 75/25	<p>Premixed insulin is a combination of specific proportions of intermediate-acting and short-acting insulin. The numbers after the name indicate the percentage of each insulin.</p> <p>These products are generally taken twice a day before mealtime, 15–45 minutes before meals.</p>
Onset	30 minutes	30 minutes	10–20 minutes	30 minutes	15 minutes	
Peak	2–4 hours	2–12 hours	1–4 hours	2–5 hours	30 minutes–2 $\frac{1}{2}$ hours	
Duration	14–24 hours	up to 24 hours	up to 24 hours	18 to 24 hours	16–20 hours	

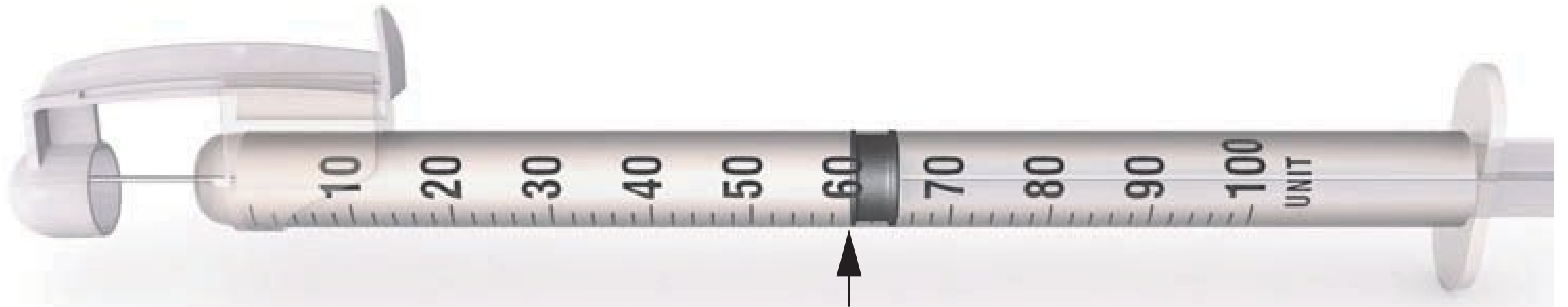
THIS IS A TABLE OF OTHER INSULINS



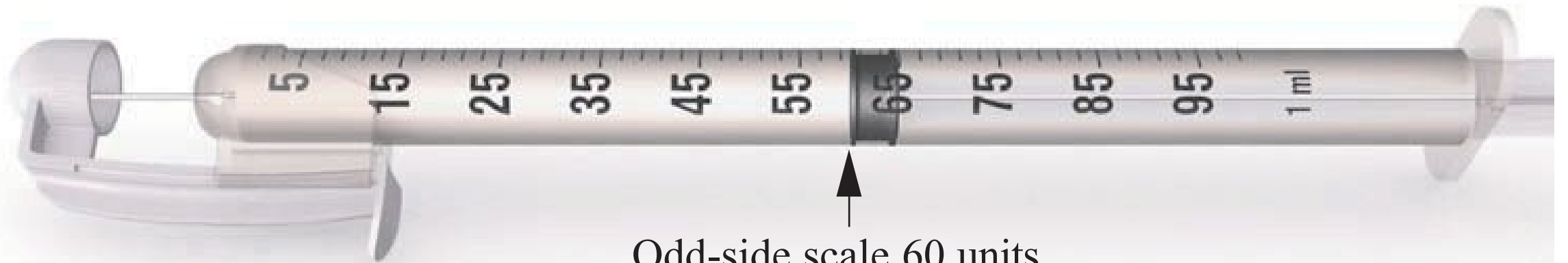
The top ring of the plunger is one line after 70. Because each line represents 2 units, the dose is 72 units of insulin.



THE TOP RING OF THE PLUNGER IN THE NEXT SLIDE IS SLIGHTLY MORE THAN 2 LINES AFTER 55 ON THE ODD SIDE. NOTICE HOW DIFFICULT IT WOULD BE TO DETERMINE WHERE 60 UNITS WOULD MEASURE USING THE ODD SIDE OF THE SYRINGE. HOWEVER, ON THE EVEN SIDE, THE PLUNGER FALLS EXACTLY ON THE 60



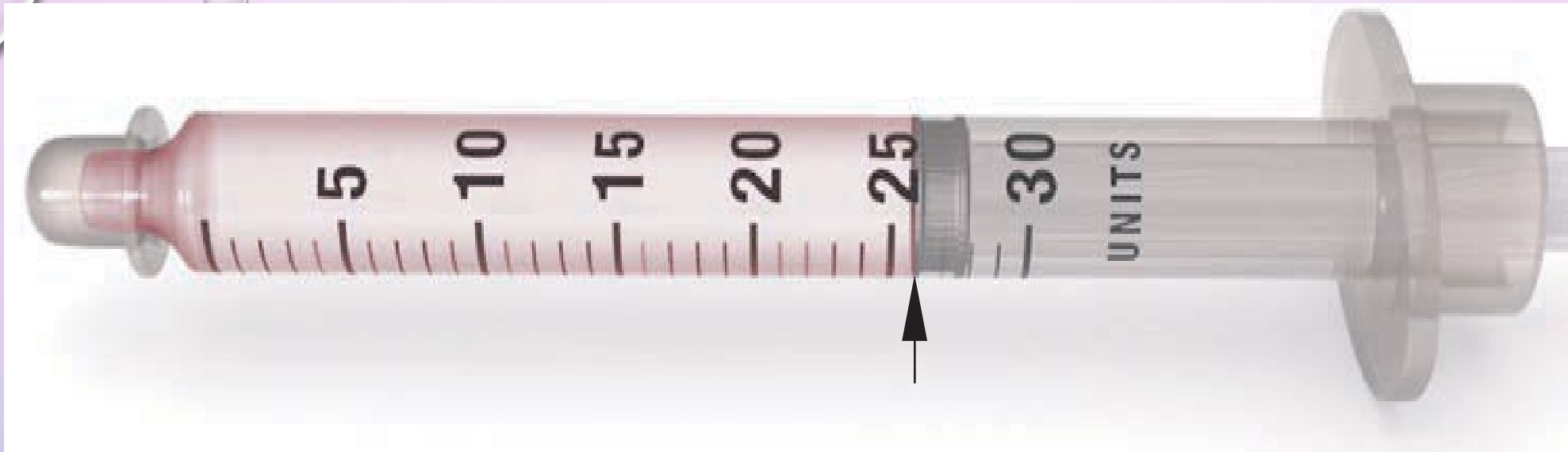
Even-side scale 60 units



Odd-side scale 60 units



THE PHYSICIAN PRESCRIBED 26 UNITS OF HUMULIN L INSULIN SUBCUTANEOUSLY AC BREAKFAST. READ THE LABEL TO DETERMINE THE SOURCE OF THE INSULIN AND PLACE AN ARROW AT THE APPROPRIATE LEVEL OF MEASUREMENT ON THE INSULIN SYRINGE IN

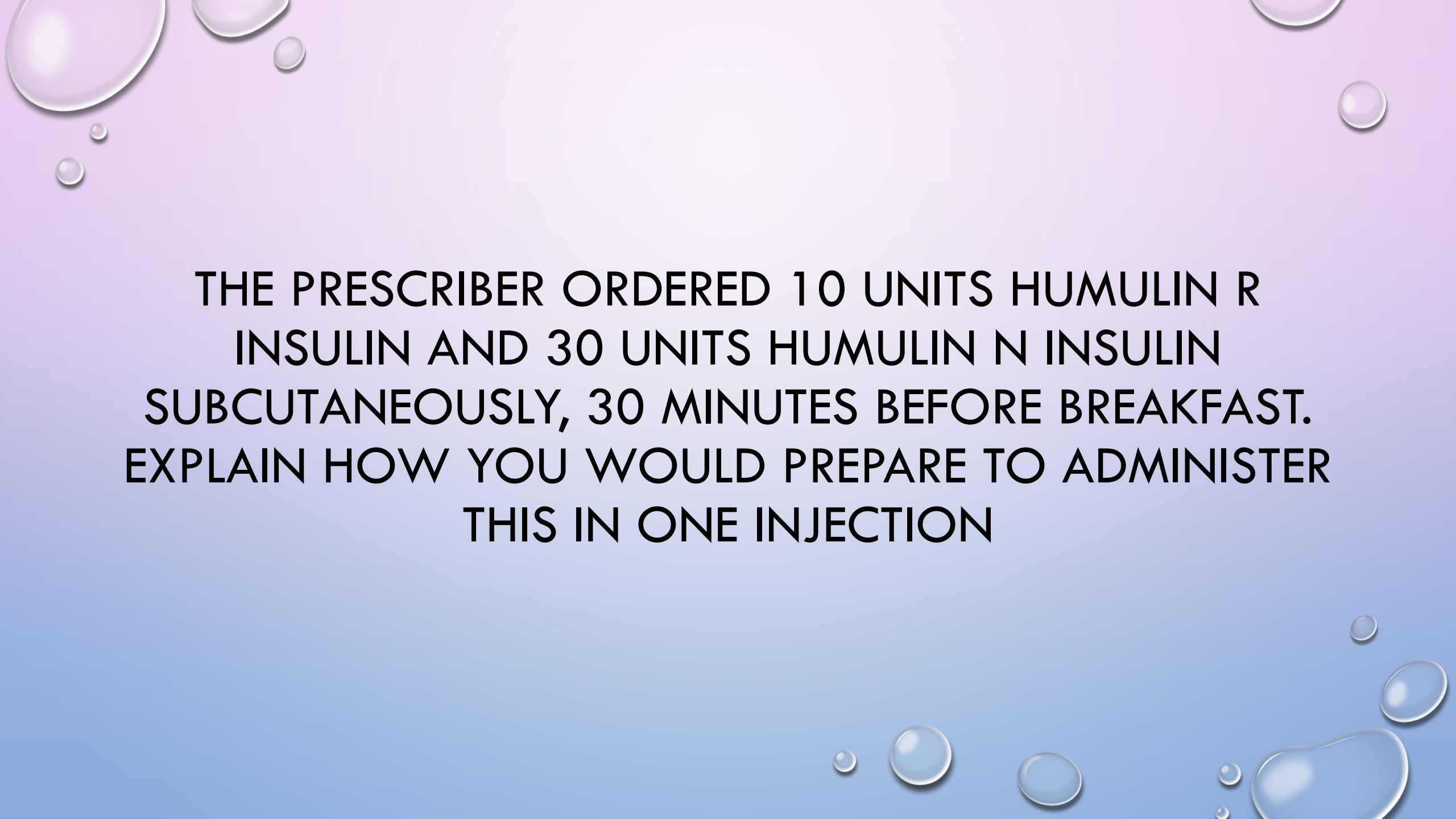


ORIGIN), AND THE ARROW SHOULD BE PLACED ONE LINE AFTER 25, AS SHOWN IN FIGURE

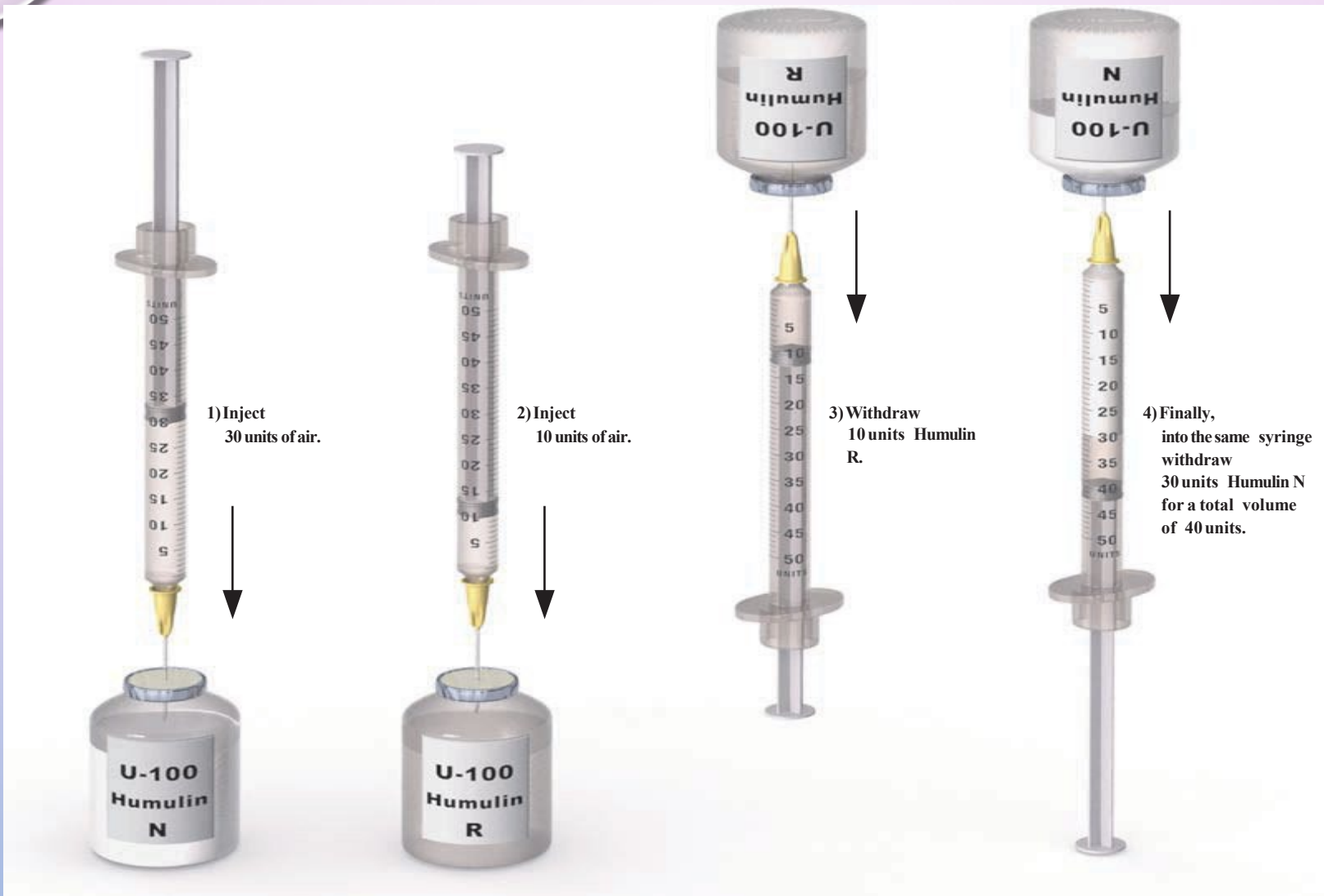
MEASURING TWO TYPES OF INSULIN IN ONE SYRINGE

INDIVIDUALS WHO HAVE IDDM OFTEN MUST HAVE TWO TYPES OF INSULIN ADMINISTERED AT THE SAME TIME. IN ORDER TO REDUCE THE NUMBER OF INJECTIONS, IT IS COMMON PRACTICE TO COMBINE TWO INSULINS (USUALLY A RAPID-ACTING WITH EITHER AN INTERMEDIATE- OR A LONG-ACTING) IN A SINGLE SYRINGE. THE IMPORTANT POINTS TO REMEMBER ARE THESE:

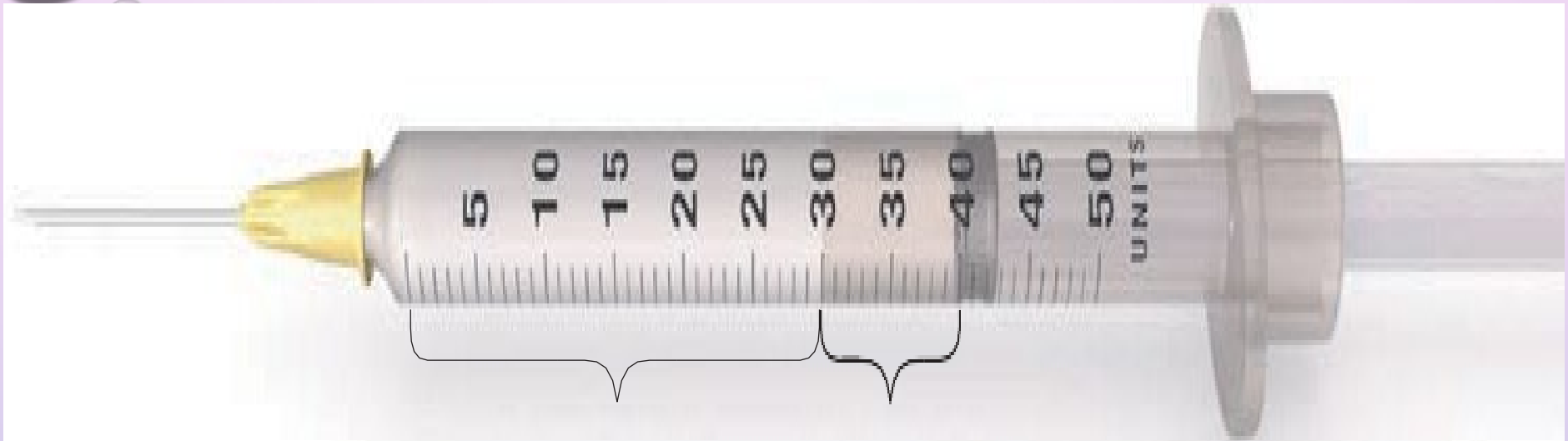
THE TOTAL VOLUME IN THE SYRINGE IS THE SUM OF THE TWO INSULIN AMOUNTS.
THE SMALLEST CAPACITY SYRINGE CONTAINING THE DOSE SHOULD BE USED TO MEASURE THE INSULINS
BECAUSE THE ENLARGED SCALE IS EASIER TO READ AND THEREFORE MORE ACCURATE.
THE AMOUNT OF AIR EQUAL TO THE AMOUNT OF INSULIN TO BE WITHDRAWN FROM EACH VIAL MUST BE
INJECTED INTO EACH VIAL.
YOU MUST INJECT THE AIR INTO THE INTERMEDIATE- OR LONG-ACTING INSULIN BEFORE YOU INJECT THE
AIR INTO THE REGULAR INSULIN.
THE REGULAR (RAPID-ACTING) INSULIN IS DRAWN UP *FIRST*; THIS PREVENTS CONTAMINATION OF THE
REGULAR INSULIN WITH THE INTERMEDIATE OR LONG-ACTING INSULIN.
THE INTERMEDIATE-ACTING OR LONG-ACTING INSULINS CAN PRECIPITATE; THEREFORE, THEY MUST BE
MIXED WELL BEFORE DRAWING UP AND ADMINISTERED WITHOUT DELAY.
ONLY INSULINS FROM THE SAME SOURCE SHOULD BE MIXED TOGETHER, FOR EXAMPLE, HUMULIN **R** AND
HUMULIN **N** ARE BOTH HUMAN INSULIN AND CAN BE MIXED.
IF YOU DRAW UP TOO MUCH OF THE INTERMEDIATE OR LONG-ACTING INSULIN, YOU MUST DISCARD THE
ENTIRE MEDICATION AND START OVER.
THE STEPS OF PREPARING TWO TYPES OF INSULIN IN ONE SYRINGE ARE SHOWN BELOW.



THE PRESCRIBER ORDERED 10 UNITS HUMULIN R
INSULIN AND 30 UNITS HUMULIN N INSULIN
SUBCUTANEOUSLY, 30 MINUTES BEFORE BREAKFAST.
EXPLAIN HOW YOU WOULD PREPARE TO ADMINISTER
THIS IN ONE INJECTION

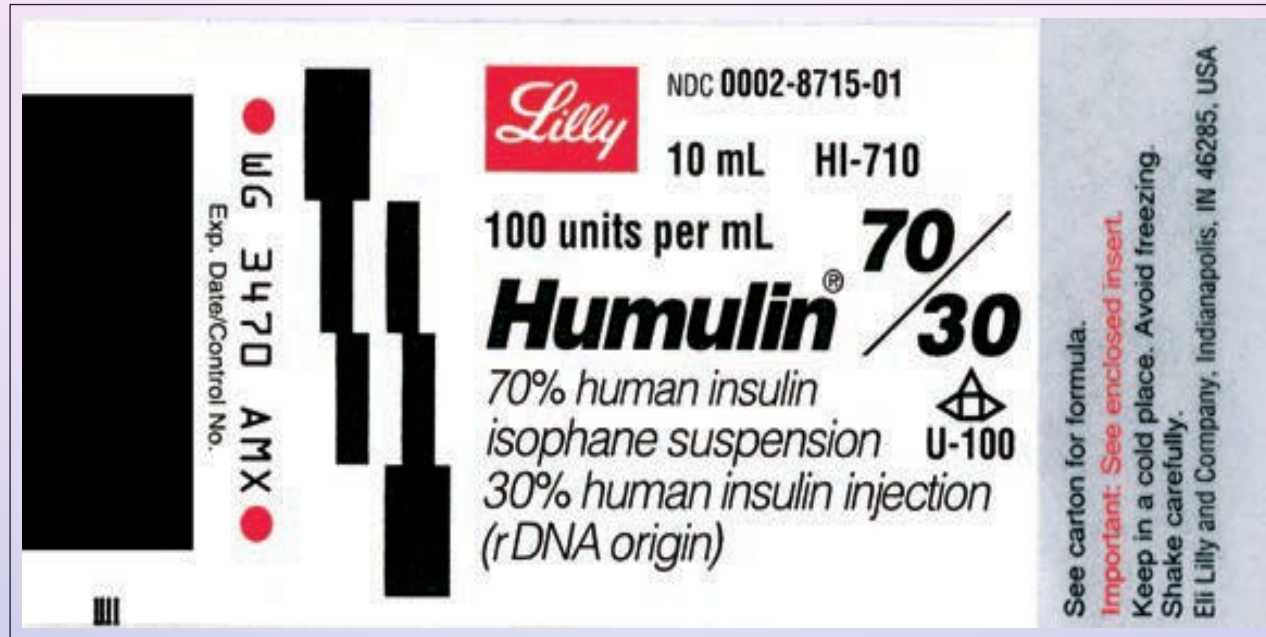


MIXING TWO TYPES OF INSULIN IN ONE SYRINGE.



30 units of Humulin N U-100 Insulin 10 units of Humulin R U-100 Insulin

THE TOTAL AMOUNT OF INSULIN IS 40 UNITS (10 + 30). TO ADMINISTER THIS DOSE, USE A 50 UNIT LO-DOSE SYRINGE. INJECT 30 UNITS OF AIR INTO THE HUMULIN N VIAL AND 10 UNITS OF AIR INTO THE HUMULIN R VIAL. WITHDRAW 10 UNITS OF THE HUMULIN R FIRST AND THEN WITHDRAW 30 UNITS OF THE HUMULIN N.



READ THE LABEL

ORDER: GIVE 35 UNITS OF HUMULIN 70/30 INSULIN SUBCUTANEOUSLY 30 MINUTES BEFORE BREAKFAST. USE THE LABEL SHOWN AND PLACE AN ARROW AT THE APPROPRIATE CALIBRATION ON THE SYRINGE



SUMMARY

IN THIS CHAPTER, THE VARIOUS TYPES OF SYRINGES AND NEEDLES WERE DISCUSSED. YOU LEARNED HOW TO MEASURE THE AMOUNT OF LIQUID IN VARIOUS SYRINGES. THE TYPES OF INSULIN, HOW TO MEASURE A SINGLE DOSE, AND HOW TO MIX TWO INSULINS IN ONE SYRINGE WERE EXPLAINED. PREFILLED, SINGLE-DOSE, AND SAFETY SYRINGES WERE ALSO PRESENTED.

MILLILITERS (ML), RATHER THAN CUBIC CENTIMETERS (CC), ARE THE PREFERRED UNIT OF MEASURE FOR VOLUME.

ALL SYRINGE CALIBRATIONS MUST BE READ AT THE TOP RING OF THE PLUNGER.

LARGE-CAPACITY HYPODERMIC SYRINGES (5, 12, 20, 35 ML) ARE CALIBRATED IN INCREMENTS FROM 0.2 ML TO 1 ML.

- SMALL-CAPACITY HYPODERMIC SYRINGES (2, 2 1/2, 3 ML) ARE CALIBRATED IN TENTHS OF A MILLILITER (0.1 ML).
- THE 1 ML HYPODERMIC (TUBERCULIN) SYRINGE IS CALIBRATED IN HUNDREDTHS OF A MILLILITER. IT IS THE PREFERRED SYRINGE FOR USE IN MEASURING A DOSE OF LESS THAN 1 MILLILITER.
 - THE CALIBRATIONS ON HYPODERMIC SYRINGES DIFFER; THEREFORE, BE VERY CAREFUL WHEN MEASURING MEDICATIONS IN SYRINGES.
 - INSULIN SYRINGES ARE DESIGNED FOR MEASURING AND ADMINISTERING U-100 INSULIN. THEY ARE CALIBRATED FOR 100 UNITS PER ML.