How many grams of a drug substance are required to make 120 mL of a solution each teaspoonful of which contains 3 mg of the drug substance?

1 teaspoonful = 5 mL

Each 5 mL of the solution contain 3 mg of drug.

3 mg of drug	⟶	5 mL
hence;		
X mg	⟶	120 mL

$$X = \frac{120 \times 3}{5} = 72\ mg\ or\ 0.072g$$

Pediatric Patients:

Neonate (newborn): from birth to 1 month.

Infant: 1 month to 1 year.

Early childhood: 1 year through 5 years.

Late childhood: 6 years through 12 years.

Adolescence:13 years through 17 years.

Proper drug dosing depends on a number of factors

- In the neonate, the biological functions of organs are underdeveloped. For instance, kidney function develops over the period of the first 2 years.
- On the other hand, in geriatrics (elderly people), the function capacity of most organ systems is declined.

Different rules of dosage in which the pediatric dose was a function of the adult dose, based on relative age or weight, were proposed for pediatrics:

Drug dosage based on Age:

Before the physiologic differences between adult and pediatric patients were clarified, Pediatric patients were treated with drugs as if they merely miniature adults.

Young's rule (based on age):

$$Child\ dose = \frac{Age}{Age + 12} \times Adult\ dose$$

Cowling's rule (based on age):

$$Child\ dose = \frac{Age\ at\ next\ birthday\ (in\ years)}{24} \times Adult\ dose$$

Fried's rule (base on age):

$$Child\ dose = \frac{Age\ (in\ months)}{150} \times Adult\ dose$$

Clark's rule (based on weight):

$$Child\ dose = \frac{weight\ (in\ lb)}{150\ (average\ weight\ of\ adult\ in\ lb)} \times Adult\ dose$$

Currently, when age is considered in determining dosage of a potent therapeutic agent, it is used generally in conjunction with another factor, such as weight.

TABLE 8.1 CALCULATION OF PEDIATRIC DOSAGES OF DIGOXIN BASED ON AGE AND WEIGHT

AGE	DIGOXIN DOSE (μg/kg)
Premature	15 to 25
Full term	20 to 30
1 to 24 months	30 to 50
2 to 5 years	25 to 35
5 to 10 years	15 to 30
Over 10 years	8 to 12

From the data in Table 8.1, calculate the dosage range for digoxin for a 20-month-old infant weighing 6.8 kg.

$$\frac{30\ \mu g}{x\ \mu g} = \frac{1\ kg}{6.8\ kg} \qquad \frac{50\ \mu g}{x\ \mu g} = \frac{1\ kg}{6.8\ kg}$$

$$x = 204\ \mu g; \qquad x = 340\ \mu g$$

Dose range, 204 to 340 μg, *answer.*

Drug Dosage Based on Body Weight

The usual doses of drugs are considered generally suitable for the majority of individuals likely to take the medication.

In some cases, the usual dose is expressed as a specific quantity of drug per unit of patient weight, such as milligrams of drug per kilogram of body weight (mg/kg).

Dosing in this manner makes the quantity of drug administrated specific to the weight.

The patient's weight is an important factor in dosing since the size of the body influences the drug's concentration in the body fluids and at its site of action.

Dose calculations based on body weight have become standard for certain drugs in dosing both adult and pediatric patients.

The following equation is used for determining the patient's dose base on patient's weight

$$Patient's\ dose\ (mg) = \frac{Drug\ dose\ (mg)}{1\ (kg)} \times Patien's\ weight\ (kg)$$

Example:

The usual initial dose of chlorambucil is 150 mcg/kg of body weight. How may milligrams should be administered to a person weighing 154 *Ib.* ?

150 mcg = 0.15 mg

154 *Ib.* = 70 kg

$$Patient's\ dose\ (mg) = \frac{Drug\ dose\ (mg)}{1\ (kg)} \times Patien's\ weight\ (kg)$$

$$Patient's\ dose\ (mg) = \frac{(0.15\ mg)}{1} \times 70$$

Patient's dose = 10.5 mg

Drug Dosage Based on Body Surface Area

The body surface area (BSA) method of calculating drug doses is widely used for **two** types of patient groups: cancer patients receiving chemotherapy and pediatric patients, with general exception of neonates who are usually dosed on a weight basis with consideration of age and a variety of biochemical, physiologic, functional, pathologic, and immunologic factors.

The average body surface area of the adults is considered to be 1.73 m^2.

Based on that, a useful equation for the calculation of dose based on BSA is:

$$Patient's\ dose\ (mg) = \frac{Patient's\ BSA\ (m^2)}{1.73\ (m^2)} \times Drug\ dose\ (mg)$$

If the adult dose of a drug is 100 mg, calculate the approximate dose for a child with a BSA of 0.83 m^2, using the equation

$$\text{Patient's dose} = \frac{\text{Patient's BSA } (m^2)}{1.73\ m^2} \times \text{Drug dose (mg)}$$

$$\text{Child's dose} = \frac{0.83\ m^2}{1.73\ m^2} \times 100\ mg = 47.97 \text{ or } 48\ mg, \textit{ answer.}$$

Note when dose is given based on amount of drug per specific area.

For Example:

Find the dose of the hypothetical drug (usual dose level is 300 mg/m^2) for a child determined to have a BSA of 1.25 m^2.

300 mg/m^2 * 1.25 m^2 = 375 mg dose, answer.

BSA of a patient could be obtained from a standard nomogram or by using the following equation:

$$Patient's\ BSA\ (m^2) = \sqrt{\frac{Patient's\ height\ (cm) \times Patient's\ weight\ (kg)}{3600}}$$

If the adult dose of a drug is 75 mg, what would be the dose for a child weighing 40 *Ib.* and measuring 32 in. in height using the BSA nomogram and BSA equation.

From the nomogram, the BSA = 0.60 m^2.
Therefore;

$$Patient's\ dose\ (mg) = \frac{0.60\ m^2}{1.73\ m^2} \times 75\ mg$$

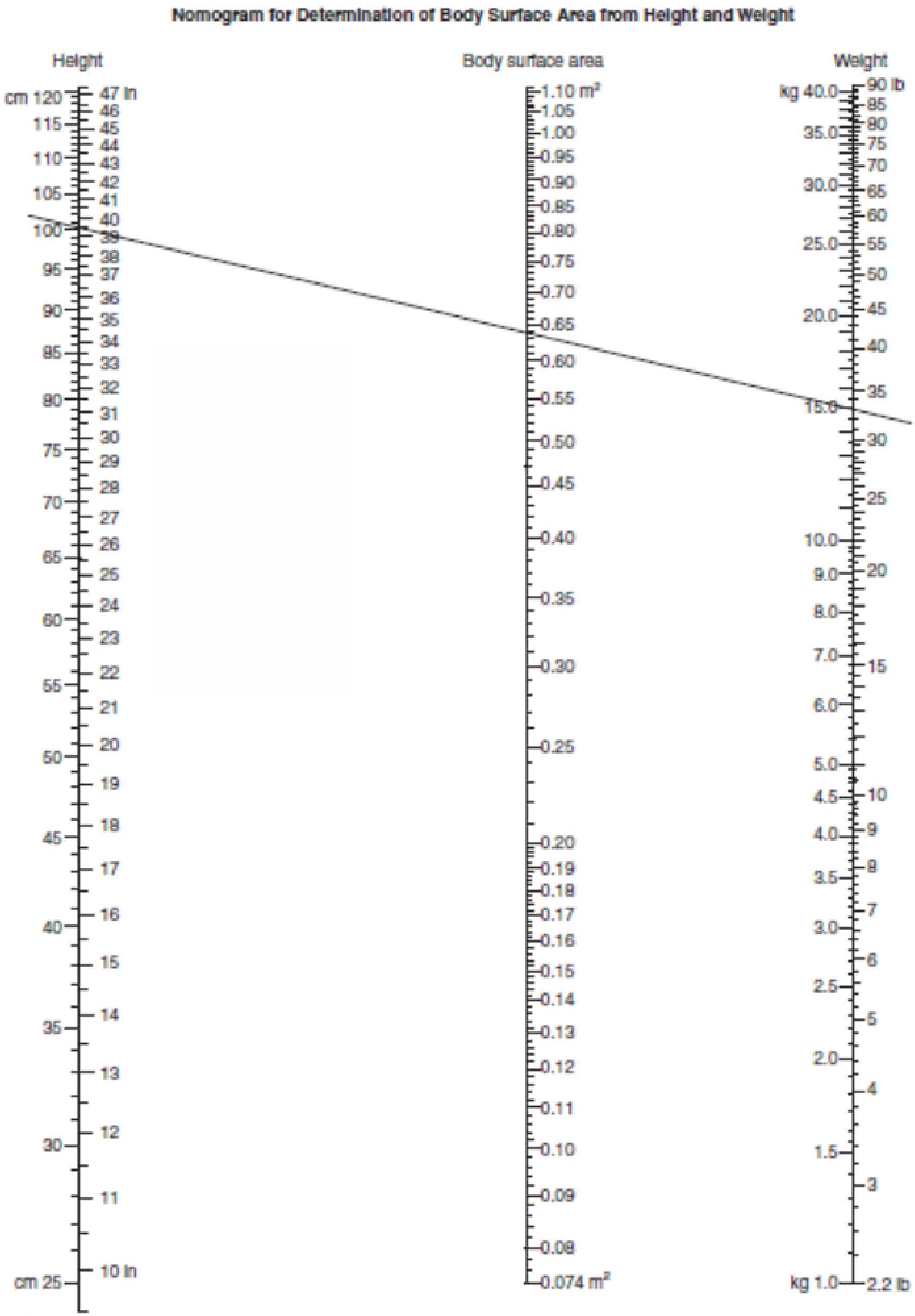
By equation
40 *Ib* = 18.2 kg
32 in. = 81.28 cm

$$Patient's\ BSA\ (m^2) = \sqrt{\frac{Patient's\ height\ (cm) \times Patient's\ weight\ (kg)}{3600}}$$

$$Patient's\ BSA\ (m^2) = \sqrt{\frac{81.28\ cm \times 18.2\ kg}{3600}}$$

$$Patient's\ BSA = 0.641\ m^2$$

Practice problems (no: 2, 3, 7, 8, 18, 36, 37, 39, 44, and 47) P/135



From the formula of Du Bois and Du Bois, *Arch Intern Med* 17, 863 (1916): $S = W^{0.425} \times H^{0.725} \times 71.84$, or $\log S = \log W \times 0.425 + \log H \times 0.725 + 1.8564$ (S = body surface in cm², W = weight in kg, H = height in cm).

FIGURE 8.1 Body surface area of children. *(From Diem K, Lentner C, Geigy JR. Scientific Tables. 7th Ed. Basel, Switzerland: JR Geigy, 1970:538.)*

Nomogram for Determination of Body Surface Area from Height and Weight

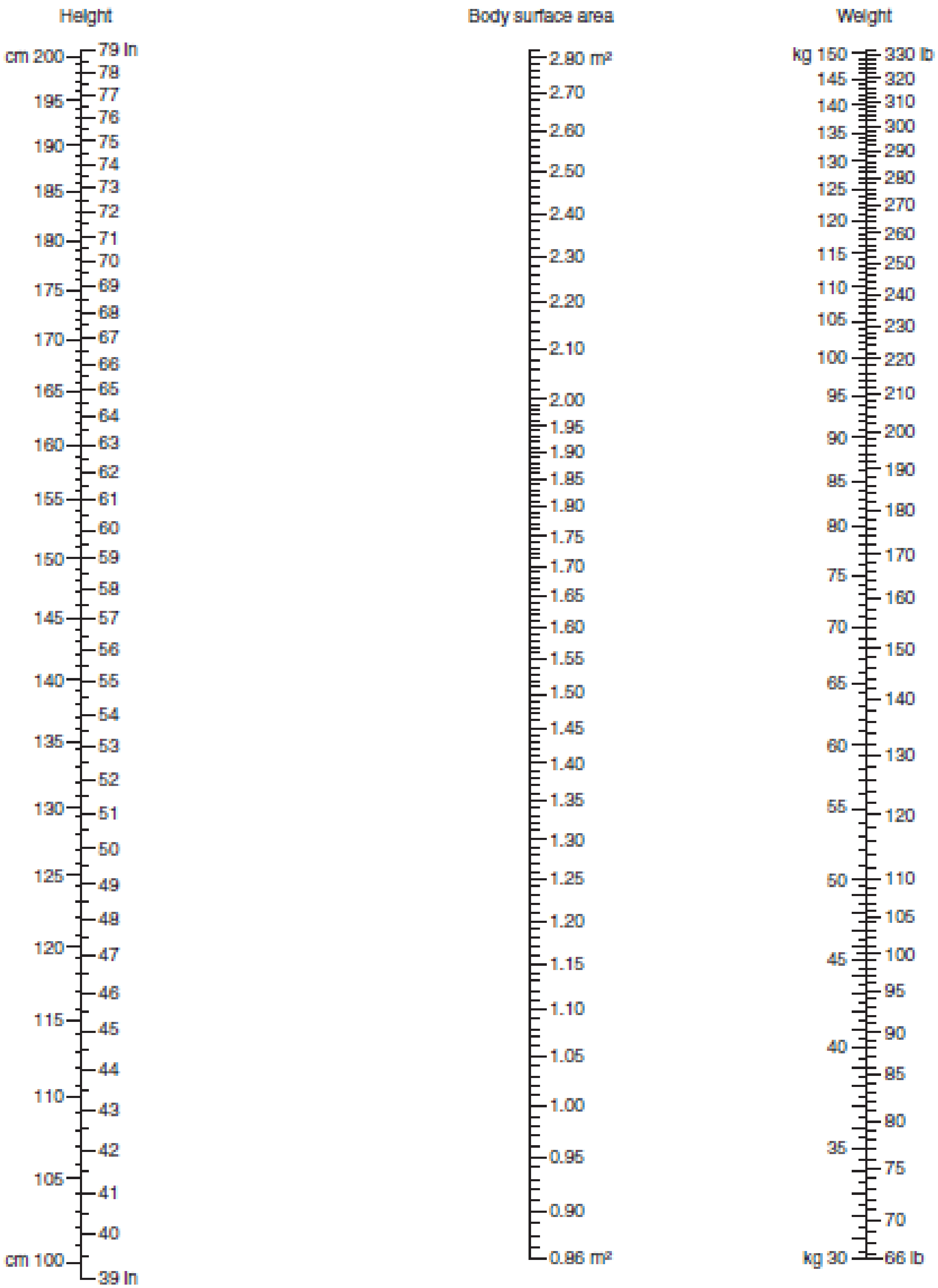


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FIGURE 8.2 Body surface area of adults. *(From Diem K, Lentner C, Geigy JR. Scientific Tables. 7th Ed. Basel, Switzerland: JR Geigy, 1970:538.)*