

GPAT
2027-28



BIOPHARMACEUTICS

CLASS- 21



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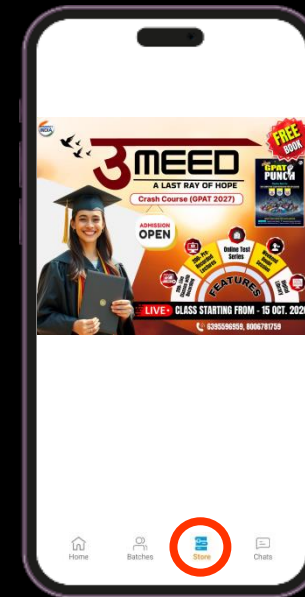
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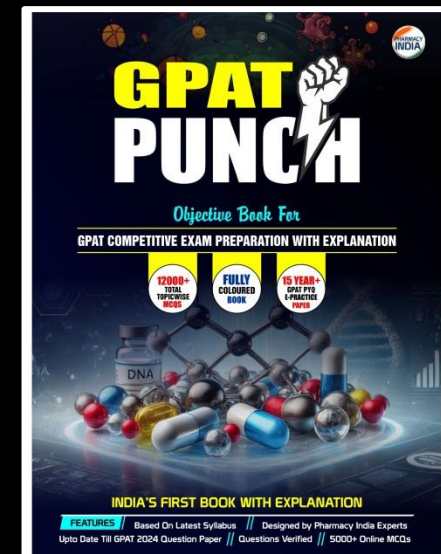


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01.

Match the following concept in List I with parameters in List II
[GPAT-2023 SHIFT-I]

List I (Concept)	List II (Parameters)
1. Volume of distribution	[P] Measure volume of real physiological plasma
2. Evans blue	[Q] Human serum albumin
3. 3.5–5%	[R] Volume of blood
4. Metallothionein	[S] Ratio of body drug content to plasma concentration
	[T] Protein present in kidney to bind metal



(a) 1-[P], 2-[Q], 3-[R], 4-[S]

(b) 1-[T], 2-[S], 3-[R], 4-[Q]

(c) 1-[S], 2-[P], 3-[Q], 4-[T]

(d) 1-[R], 2-[Q], 3-[S], 4-[T]



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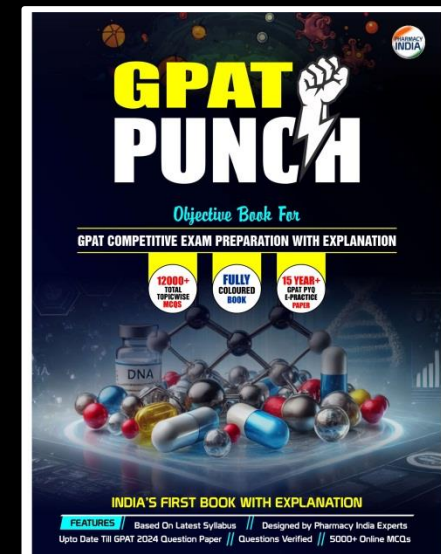


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(a) 1-[P], 2-[Q], 3-[R], 4-[S]

(b) 1-[T], 2-[S], 3-[R], 4-[Q]

(c) 1-[S], 2-[P], 3-[Q], 4-[T]

(d) 1-[R], 2-[Q], 3-[S], 4-[T]



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Explanation:

Concept	Correct Match	Reason
Volume of distribution (Vd)	[S] Ratio of drug content in body to plasma concentration	$V_d = (\text{Amount of drug in body}) / (\text{Plasma concentration})$
Evans blue	[P] Measure volume of plasma	Binds albumin, stays in plasma → plasma marker
3.5–5%	[Q] Human serum albumin	Normal albumin % in plasma
Metallothionein	[T] Protein binding metals in kidney/liver	Detoxifies Zn, Cu, Cd



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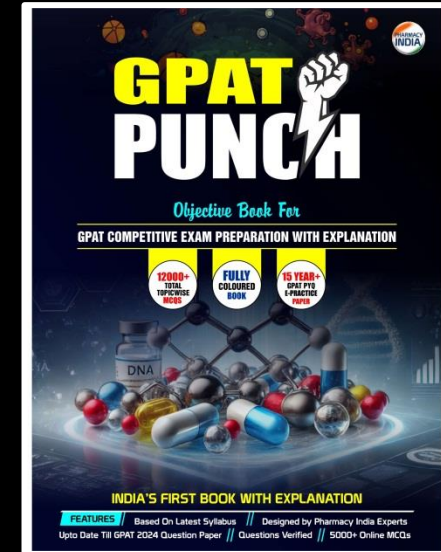
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02.

Which of the following characteristics is most likely to be associated with a high apparent volume of distribution

[GPAT-2023 SHIFT-II]

- (a) Penetration across the blood brain and blood testis barriers
- (b) Extensive binding to plasma protein
- (c) Extensive binding to tissue constituents
- (d) Distribution into total body water



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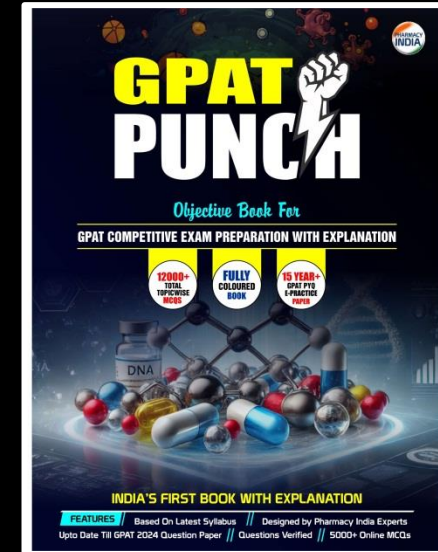
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(b) Extensive binding to plasma protein

(c) Extensive binding to tissue constituents

(d) Distribution into total body water



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Explanation:

- **High V_d occurs when drug leaves plasma and distributes to tissues.**
- **Extensive plasma protein binding keeps drug in blood → low V_d .**
- **Extensive tissue binding (e.g., chloroquine → eye & muscle) → high V_d .**
- **Clinically, high V_d drugs need loading dose adjustments.**



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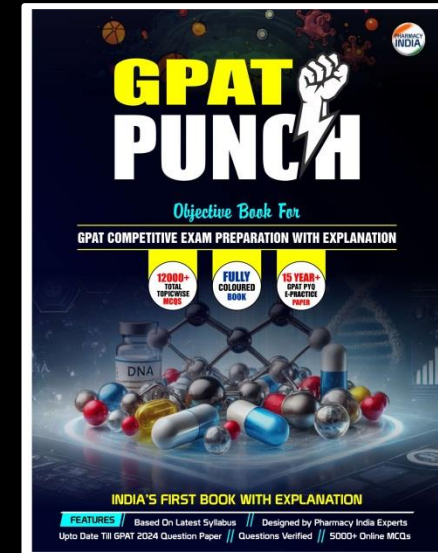


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03.

The intracellular fluid volume including those of blood cells is approximately [GPAT-2022]

- (a) 7 L
- (b) 17 L
- (c) 37 L
- (d) 27 L



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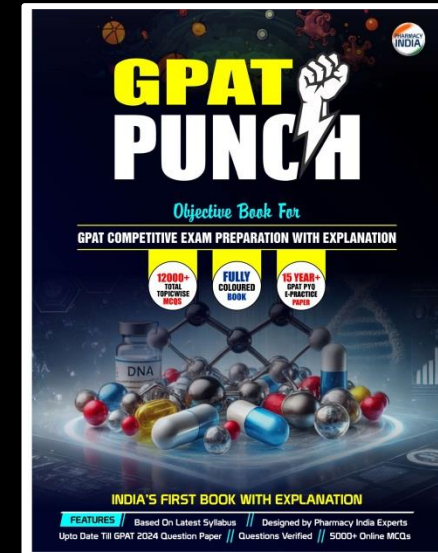


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- (a) 7 L
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Explanation:

Compartment	Approx. Volume (L)	% of Body Wt
Total body water	42 L	60%
Extracellular fluid	15 L (Plasma 3 L + Interstitial 12 L)	20%
Intracellular fluid (incl. RBCs)	27 L	40%

- **Intracellular = largest fluid compartment.**
- **Important for drug distribution into cells and organelles.**



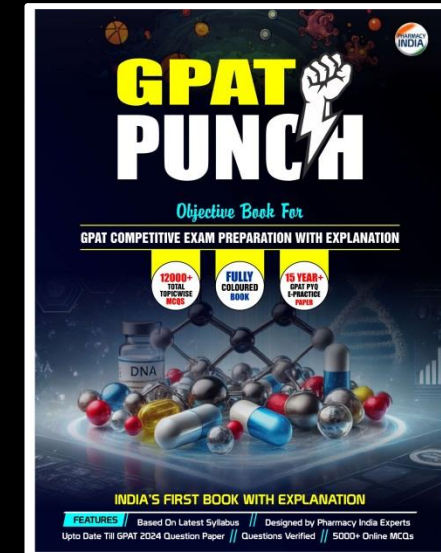
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04. **Distribution is perfusion-rate limited in case of**
[GPAT-2022]

- (a) Ionic drugs
- (b) Lipophilic drugs
- (c) Polar drugs
- (d) Water soluble drugs



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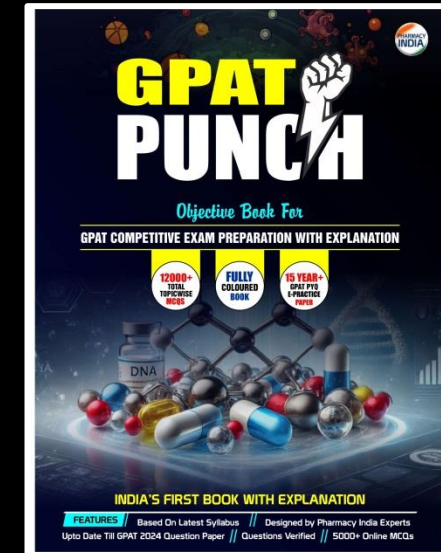
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[GPAT-2022]

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(b) Lipophilic drugs

(c) Polar drugs

(d) Water soluble drugs



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Explanation:

- **Lipophilic drugs cross membranes rapidly → rate-limited by blood flow (perfusion).**
- **Example: thiopental → quick brain entry due to high perfusion.**
- **Hydrophilic or polar drugs → permeability-limited (membrane is barrier).**
- **Hence perfusion-limited distribution = typical of lipid-soluble agents.**



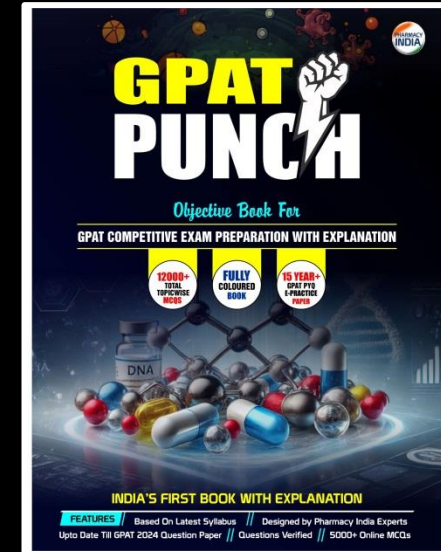
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05. Volume of blood that flows per unit time per unit volume of the tissue is [GPAT-2019]

- (a) Residence time
- (b) Elimination rate
- (c) Gastric emptying rate
- (d) Perfusion rate



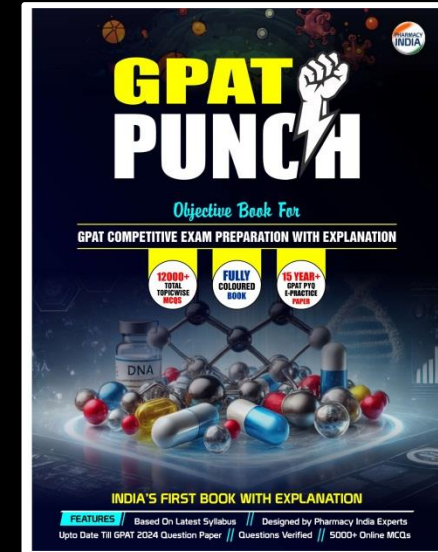
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- (a) Residence time
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- (c) Gastric emptying rate
- (d) Perfusion rate



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Explanation:

- **Perfusion rate = Blood flow / Tissue volume.**
- **Determines distribution into highly perfused tissues (kidney, liver, brain).**
- **Low perfusion tissues (fat, cartilage) → slower drug distribution.**
- **Perfusion rate-limited distribution → hallmark of lipophilic drugs.**



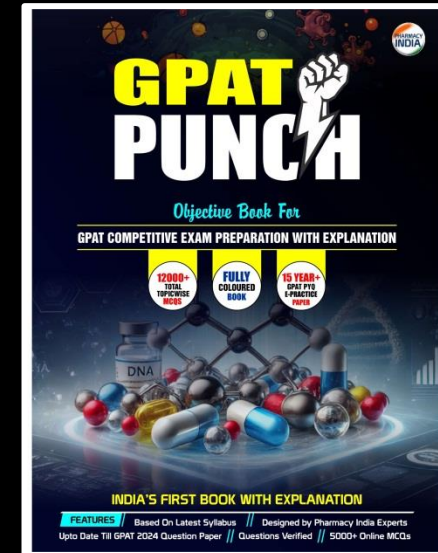
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06. Apparent volume of distribution will be highest in case of the drug with % plasma protein binding [GPAT-2017]

- (a) 10
- (b) 89
- (c) 50
- (d) 68



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06.

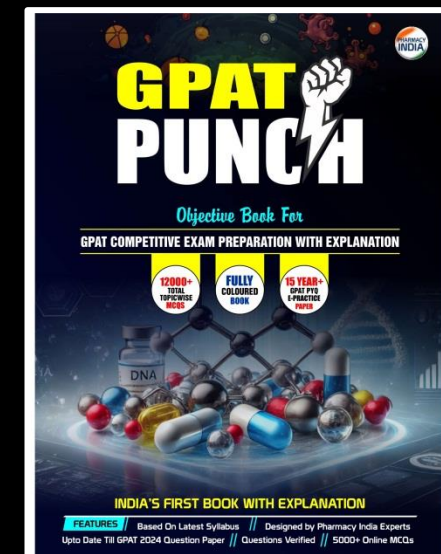
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(a) 10

(b) 89

(c) 50

(d) 68



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Explanation:

- **Low plasma protein binding → more free drug in plasma → more drug available to distribute into tissues → high V_d .**
- **High protein binding (e.g., warfarin ~99%) → drug remains confined to blood → low V_d .**
- **Example: Chloroquine has low protein binding but high tissue affinity → $V_d > 100$ L.**
- **Clinical significance: Drugs with high V_d often require loading doses.**





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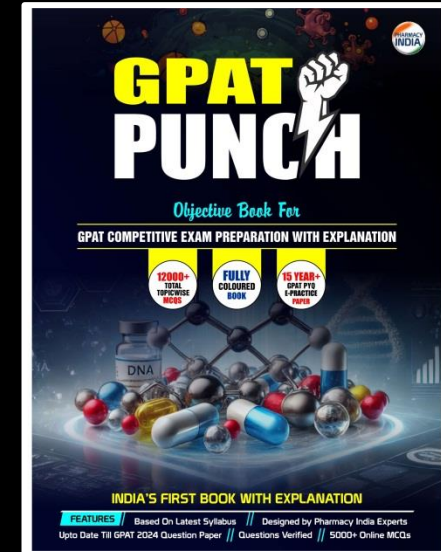
07. Concentration of drug in blood is 40 mg/mL. Dose of drug is 200 mg. Assuming minimal elimination, V_d will be [GPAT-2015]

(a) 5 L

(b) 0.5 L

(c) 2.5 L

(d) 3 L



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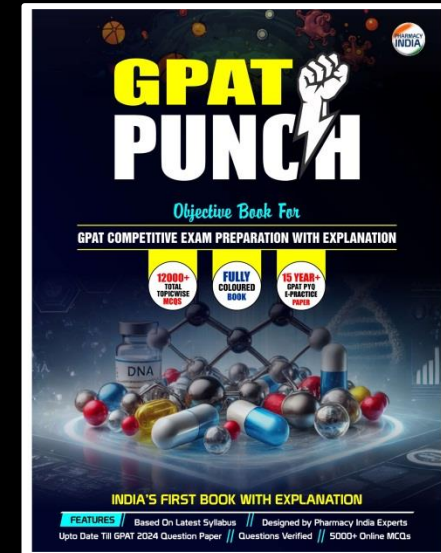
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(a) 5 L

(b) 0.5 L

(c) 2.5 L

(d) 3 L



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Explanation:

$$V_d = \frac{\text{Dose}}{\text{Plasma concentration}}$$

- Dose = 200 mg
- $C_p = 40 \text{ mg/mL} = 40 \text{ mg} \div 1 \text{ mL}$
- $V_d = 200/40 = 5 \text{ "mL"} = 0.5 \text{ L}$
- Key Points:
 - Low V_d means drug remains largely in plasma (poor tissue penetration).
 - Such drugs often have high plasma protein binding.
 - High V_d (>40 L) would suggest drug moves to tissues/fat stores.



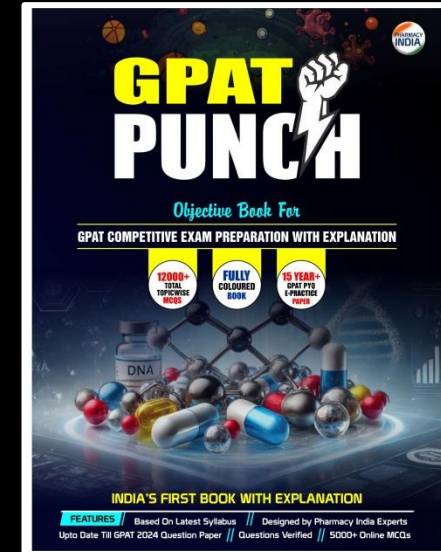
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08. Which is used as a marker to determine total body water volume [GPAT-2014]

- (a) Antipyrine
- (b) Mannitol
- (c) Evans blue
- (d) Raffinose



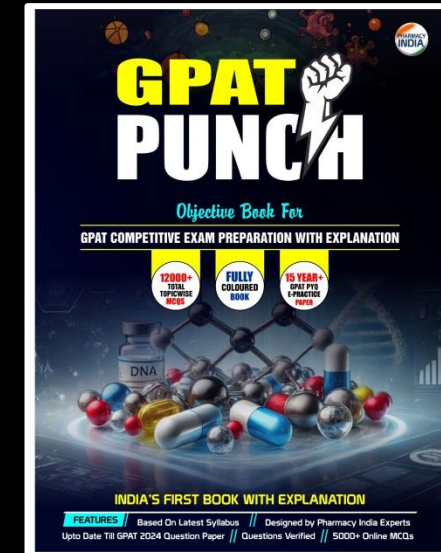
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Explanation:

Compartment	Marker Used
Plasma volume	Evans blue, Radio-iodinated albumin
Extracellular fluid	Mannitol, Inulin
Total body water	Antipyrine, Deuterium oxide (D_2O)

➤ Key Points:

- Antipyrine is lipid soluble → distributes in both ICF + ECF → reflects total body water.
- Mannitol & inulin do not enter cells → only measure ECF.
- Evans blue binds albumin → confined to plasma.



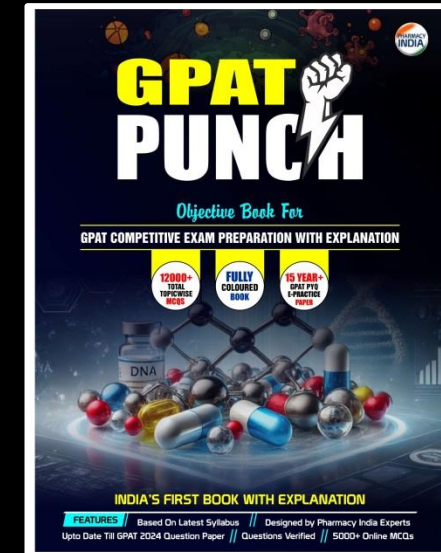
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09. Which marker is used for measuring the volume of plasma [GPAT-2013]

- (a) Deuterium oxide
- (b) Mannitol
- (c) Evans blue
- (d) Inulin



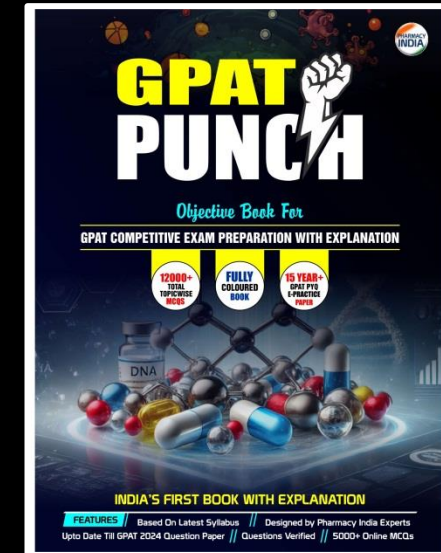
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- (c) Evans blue
- (d) Inulin



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Explanation:

- **Evans blue binds strongly to albumin → remains in intravascular space.**
- **Therefore, used to measure plasma volume accurately.**
- **Deuterium oxide → total body water.**
- **Mannitol/inulin → extracellular fluid volume.**



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10.

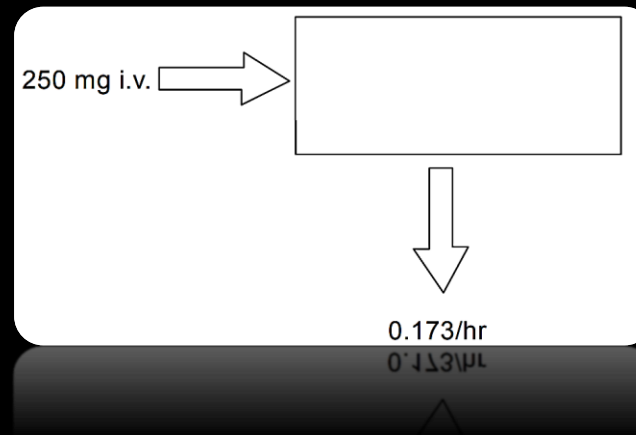
In a pharmacokinetic model depicted in the following scheme, what is the half-life of the drug if the apparent volume of distribution of the drug is 25 L [GPAT-2012]

Given:

Dose = 250 mg i.v.

$K_{el} = 0.173 \text{ hr}^{-1}$

$V_d = 25 \text{ L}$

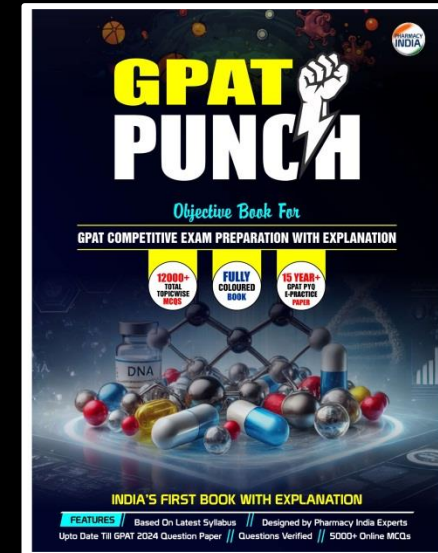


(a) 1.7 hrs

(c) 2 hrs

(b) 4 hrs

(d) 3 hrs



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10.

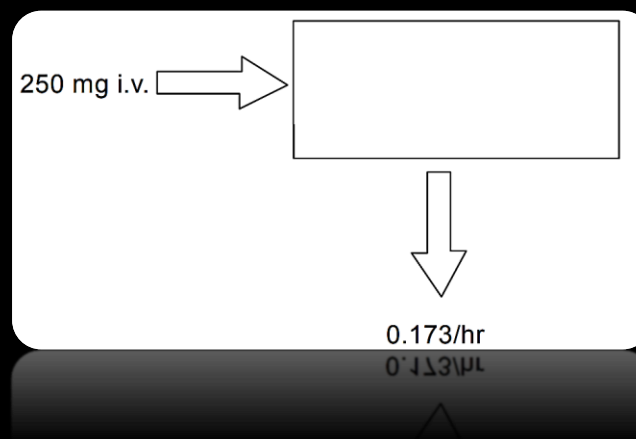
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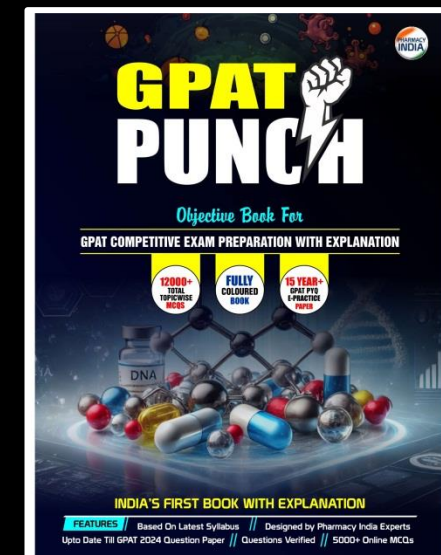


(a) 1.7 hrs

(c) 2 hrs

(b) 4 hrs

(d) 3 hrs



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Explanation:

Formula:

$$t_{\frac{1}{2}} = \frac{0.693}{k_{el}}$$
$$t_{1/2} = \frac{0.693}{0.173} \approx 4 \text{ hrs}$$

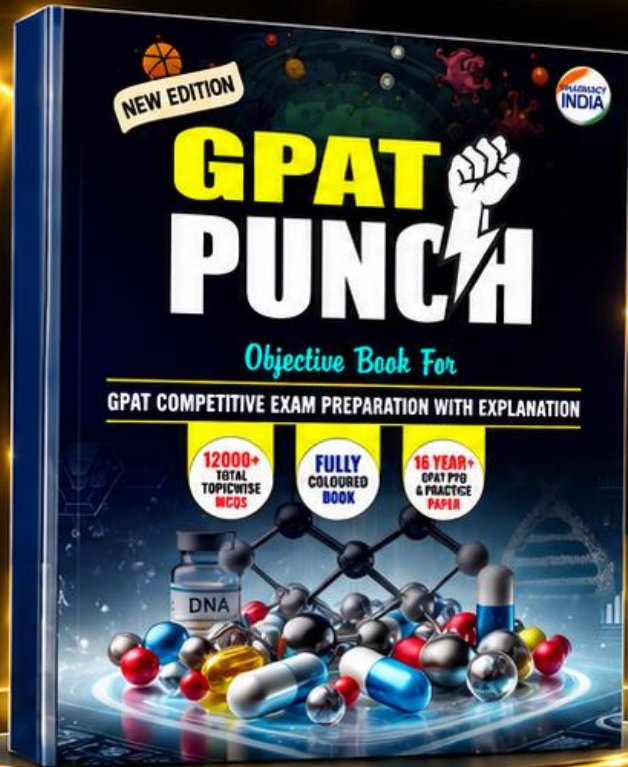
➤ Key Points:

- Half-life depends on elimination rate constant (k_{el}) and clearance, not directly on dose.
- Larger V_d generally increases half-life (if clearance constant).
- **Clinical: half-life guides dosing intervals.**

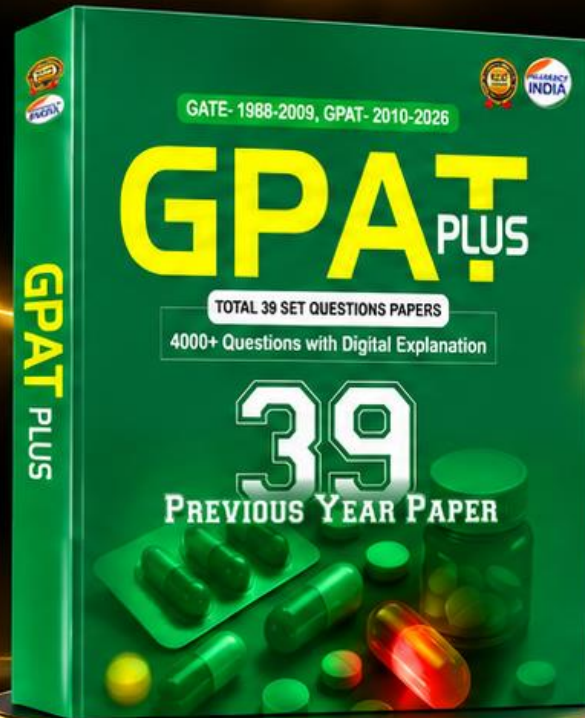


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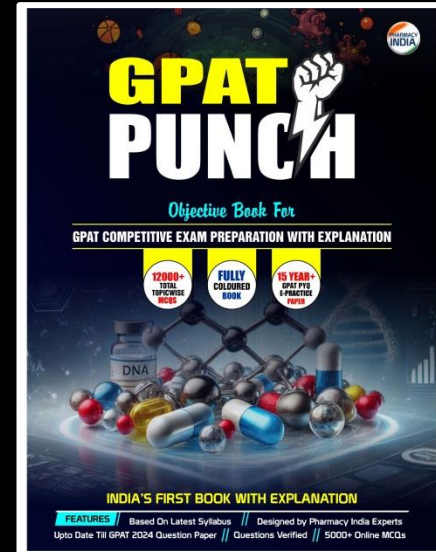


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11.

The volume of distribution of a drug administered at a dose of 300 mg and exhibiting 30 microgram/mL instantaneous concentration in plasma shall be [GPAT-2010]

- (a) 10 L
- (b) 100 L
- (c) 1.0 L
- (d) 0.1 L



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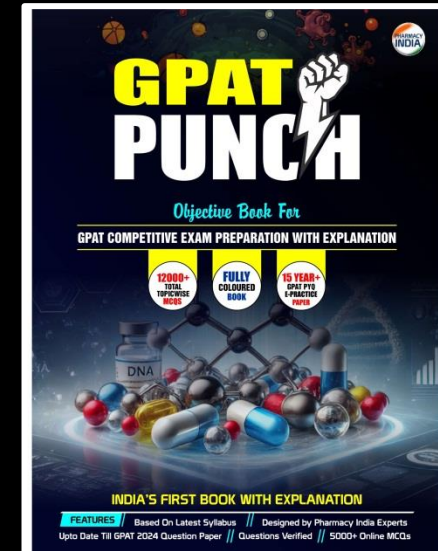


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The volume of distribution of a drug administered at a dose of 300 mg and exhibiting 30 microgram/mL instantaneous concentration in plasma shall be [GPAT-2010]

- (a) 10 L
- (b) 100 L
- (c) 1.0 L
- (d) 0.1 L



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Explanation:

$$V_d = \frac{Dose}{Plasma\ concentration}$$

➤ Dose = 300 mg = 300,000 µg

➤ Cp = 30 µg/mL = 30,000 µg/L

➤ Vd = 300,000 ÷ 30,000 = 10 L

➤ Key Points:

- Vd values close to ECF (~15 L) → drug distributes mainly in extracellular water.
- If Vd > 40 L → strong tissue binding.
- If Vd < 5 L → confined to plasma.



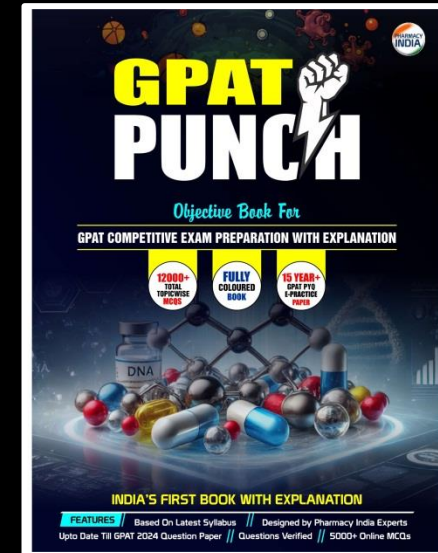
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12. The initial distribution of a drug into the tissue is determined chiefly by [GATE-1999]

- (a) Rate of blood flow to the tissue
- (b) Plasma protein binding of the drug
- (c) Affinity for the tissue
- (d) Stomach emptying time



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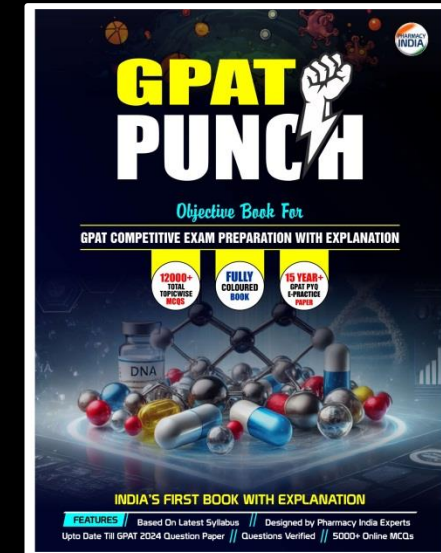
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(c) Affinity for the tissue

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Explanation:

- Initially, perfusion rate determines how fast drug reaches tissue.
- Organs with high perfusion (liver, kidney, brain) receive drug rapidly.
- Later phases depend on tissue binding and partition coefficient.
- Plasma protein binding affects extent, but not the initial rate.



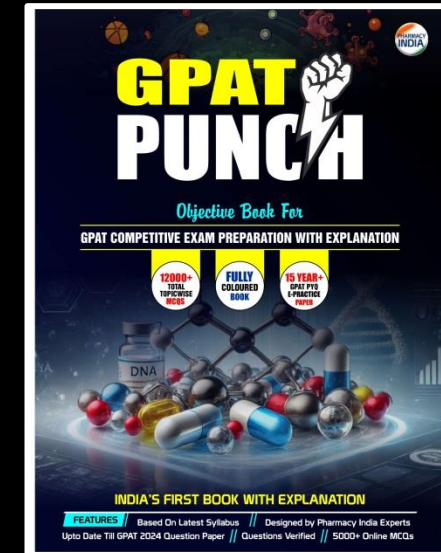
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13. The procedure of transporting a drug from the bloodstream to tissues is called as

- (a) Absorption
- (b) Dissolution
- (c) Distribution
- (d) Elimination



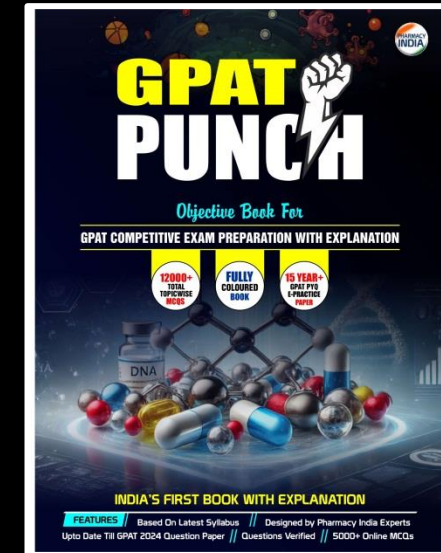
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- (a) Absorption
- (b) Dissolution
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- (d) Elimination



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Explanation:

- **1Distribution = reversible transfer of drug between blood/plasma ↔ tissues.**
- **Affected by perfusion rate, tissue binding, protein binding, membrane permeability.**
- **Unlike absorption (entry into blood), distribution refers to post-absorption movement.**
- **Plays key role in volume of distribution, half-life, and tissue drug levels.**



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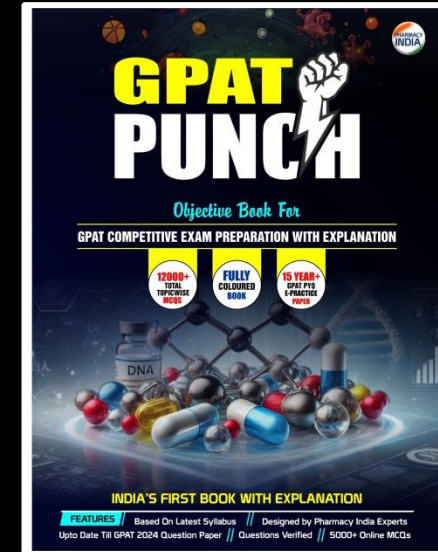


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14.

It is defined as the distribution of a drug between plasma and the rest of the body after oral or parenteral dosing.

- (a) Volume of distribution (VD)
- (b) Apparent volume of distribution
- (c) Phagocytosis
- (d) None of the above



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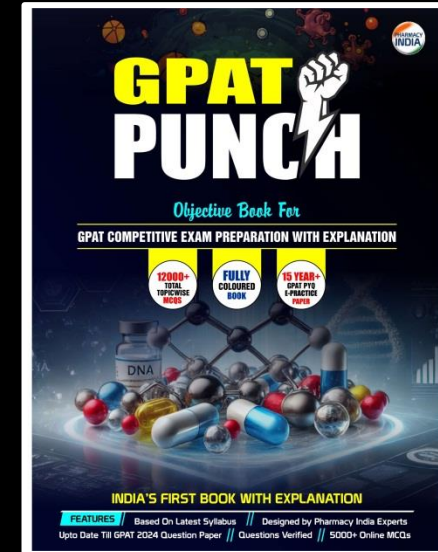


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- (a) Volume of distribution (VD)
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- (c) Phagocytosis
- (d) None of the above



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Explanation:

- **V_d = theoretical volume that would contain total drug if concentration were same as plasma.**
- **Indicates extent of distribution, not an actual physical volume.**
- **Small V_d → drug restricted to plasma.**
- **Large V_d → drug extensively distributed to tissues.**



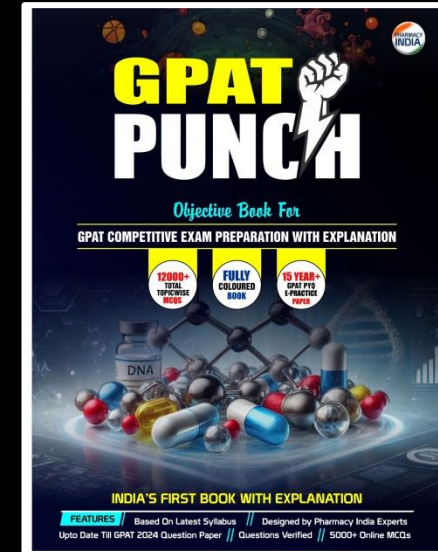
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15. The drugs having molecular size _____ easily cross capillary membrane

- (a) <500–600 d
- (b) <100–200 d
- (c) <300–600 d
- (d) <600–900 d



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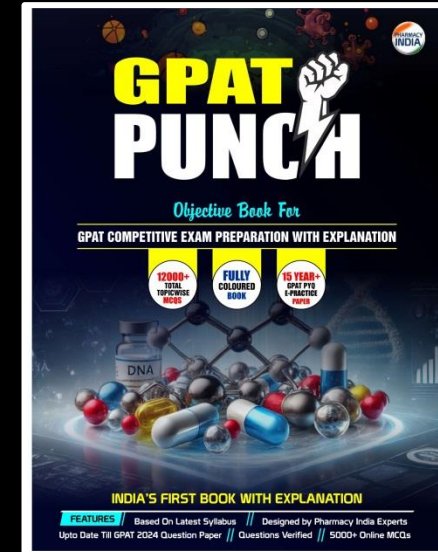
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(a) <500–600 d

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(c) <300–600 d

(d) <600–900 d



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Explanation:

- **Molecular weight <500 Da → easy diffusion across capillary membranes.**
- **Larger molecules (e.g., proteins, antibodies) → limited distribution.**
- **Lipophilicity also aids passive diffusion across membranes.**
- **Special transporters may carry larger molecules but slower.**



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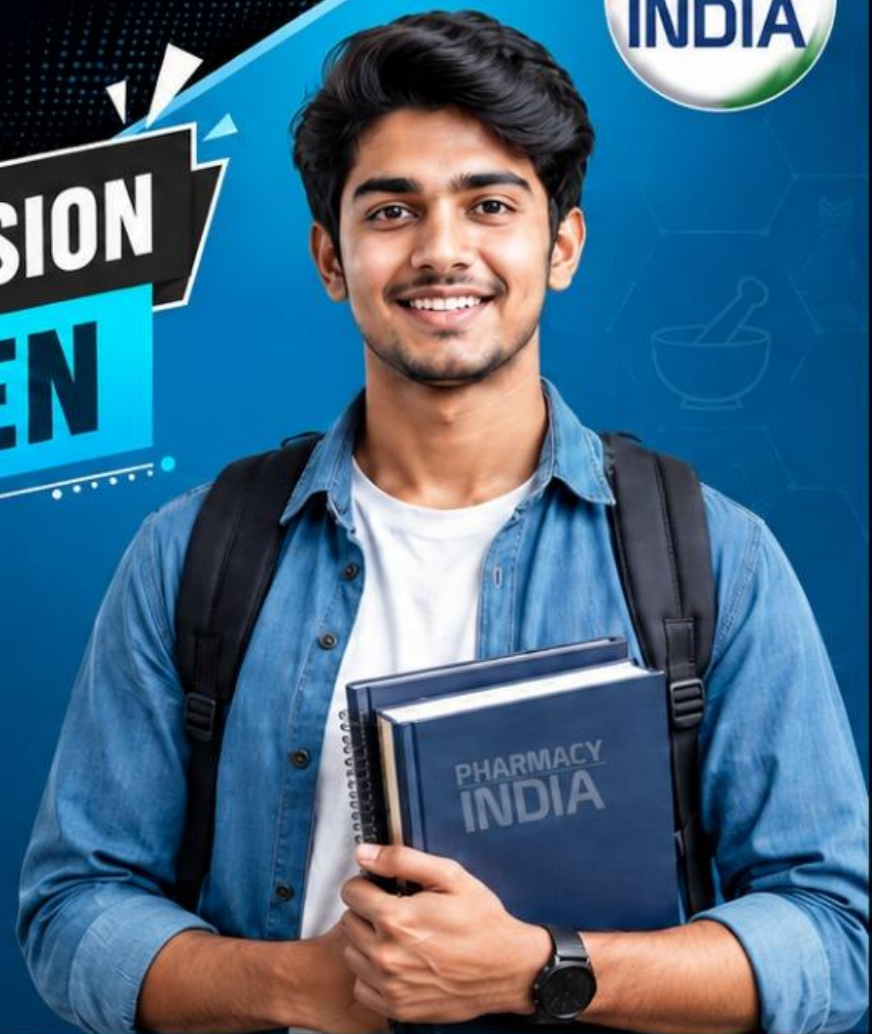
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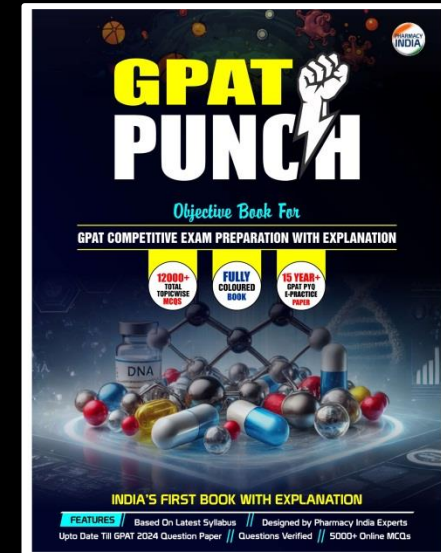


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16. _____ is located at the sertoli-sertoli cell junction

[GPAT-2008]

- (a) Blood testis barrier
- (b) Blood CSF barrier
- (c) Blood cellular barrier
- (d) All of the above



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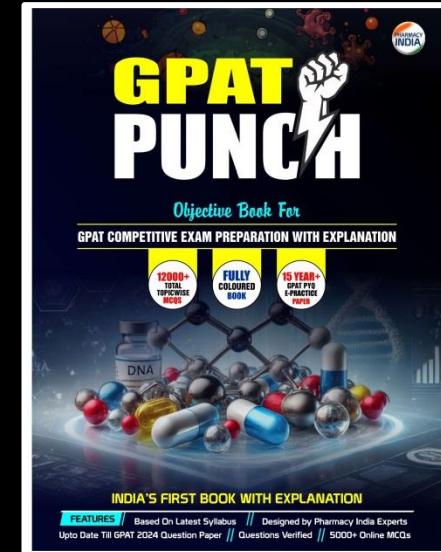
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16.

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[GPAT-2008]

- (a) Blood testis barrier
- (b) Blood CSF barrier
- (c) Blood cellular barrier
- (d) All of the above



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Explanation:

- **Sertoli cells in seminiferous tubules form tight junctions → blood–testis barrier (BTB).**
- **Prevents entry of harmful chemicals/drugs to spermatogenic cells.**
- **Clinical significance: certain drugs (antibiotics, anticancer agents) fail to reach testes.**
- **Protects germ cells from immune attack.**



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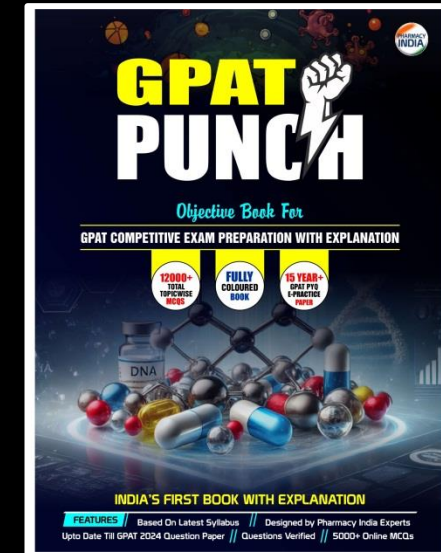


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17.

The volume of distribution of drug is

- (a) An expression of total body volume
- (b) A measure of total fluid volume
- (c) A relationship between total amount of drug in the body and plasma concentration
- (d) Proportional to bioavailability of the drug



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17.

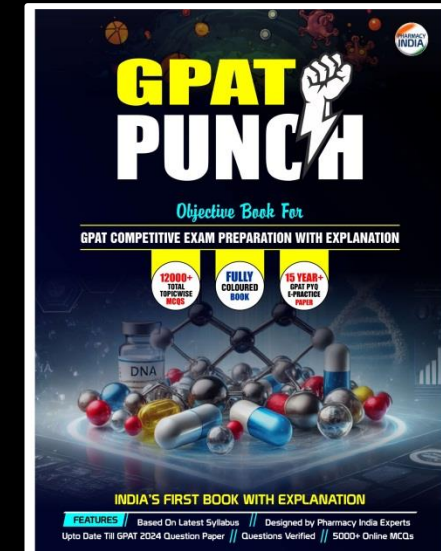
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(d) Proportional to bioavailability of the drug



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Explanation:

- **$V_d = \text{Amount of drug in body} \div \text{Plasma concentration.}$**
- **It is a theoretical value, not a real physical volume.**
- **Reflects extent of drug distribution into tissues.**
- **Large $V_d \rightarrow$ extensive tissue binding; Small $V_d \rightarrow$ drug confined to plasma.**



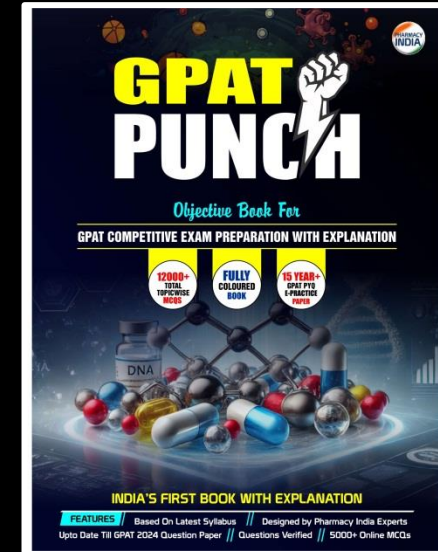
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18. Movement of drug across the membrane is called as

- (a) Symport
- (b) Antiport
- (c) Drug transport
- (d) Absorption



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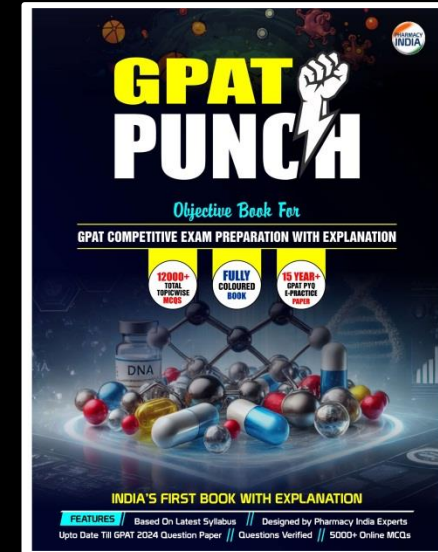
18. Movement of drug across the membrane is called as

(a) Symport

(b) Antiport

(c) Drug transport

(d) Absorption



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Explanation:

- **Drug transport = passage of drug molecules across membranes (lipid bilayer, capillaries, BBB).**
- **Mechanisms: passive diffusion, facilitated diffusion, active transport, endocytosis.**
- **Symport/antiport → specific transporter-mediated mechanisms.**
- **Absorption is specific to entry from site of administration into plasma, while transport is broader.**



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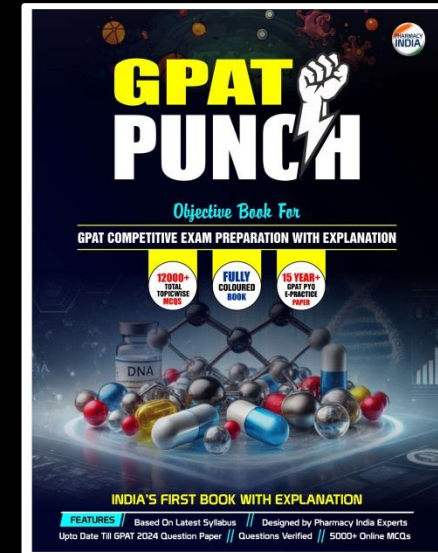


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19.

Which of the following is known as Tamoxifen binding site

- (a) Site III
- (b) Site I
- (c) Site II
- (d) Site IV



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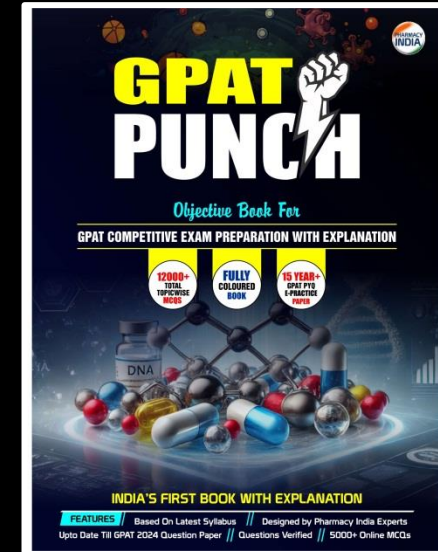


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19.

Which of the following is known as Tamoxifen binding site

- (a) Site III
- (b) Site I
- (c) Site II
- (d) Site IV



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Explanation:

- **Albumin binding sites:**
 - **Site I (Warfarin site)**
 - **Site II (Diazepam site)**
 - **Site III (Tamoxifen site)**
- **Binding to plasma protein sites affects drug–drug interactions.**
- **Tamoxifen binds at Site III on albumin.**
- **Competition at the same site can alter free drug levels.**



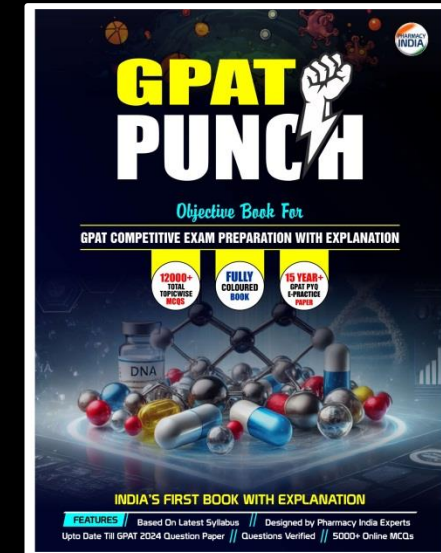


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20.

Plasma protein binding _____ the volume of distribution of drugs

- (a) Increases
- (b) Decreases
- (c) No change
- (d) None of the above



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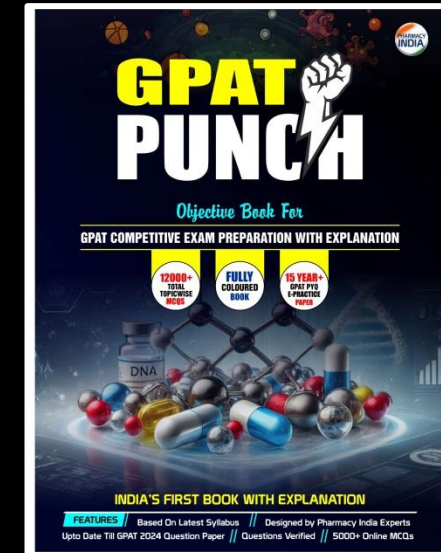
20. Plasma protein binding _____ the volume of distribution of drugs

(a) Increases

(b) Decreases

(c) No change

(d) None of the above



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Explanation:

- Plasma protein-bound drug → remains in plasma compartment, unable to cross membranes.
- Therefore, V_d decreases with higher protein binding.
- Example: Warfarin (high protein binding, low $V_d \sim 0.1$ L/kg).
- Drugs with weak binding (e.g., digoxin, chloroquine) → high V_d .



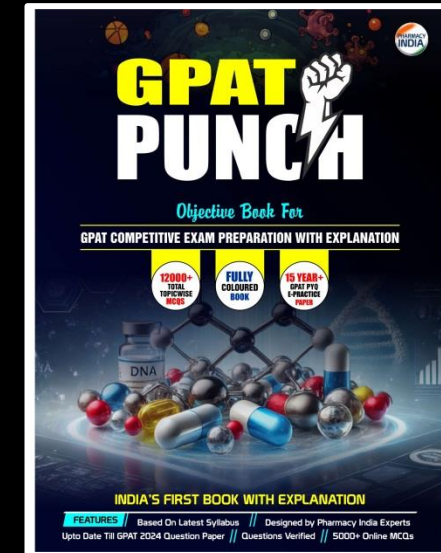
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21. Following intravenous administration, drugs are distributed fastest to

- (a) The skin, kidney, and brain
- (b) The liver, kidney, and brain
- (c) The liver, adipose, and brain
- (d) The liver, kidney, and adipose



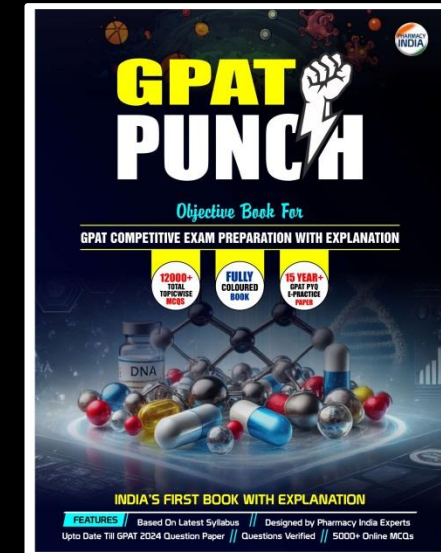
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- (b) The liver, kidney, and brain**
- (c) The liver, adipose, and brain
- (d) The liver, kidney, and adipose



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Explanation:

- **Drugs first reach well-perfused organs (liver, kidney, brain).**
- **Later → less perfused tissues (muscle, skin).**
- **Slowest → fat, bone, cartilage.**
- **This is due to high perfusion rate in liver/kidney/brain.**



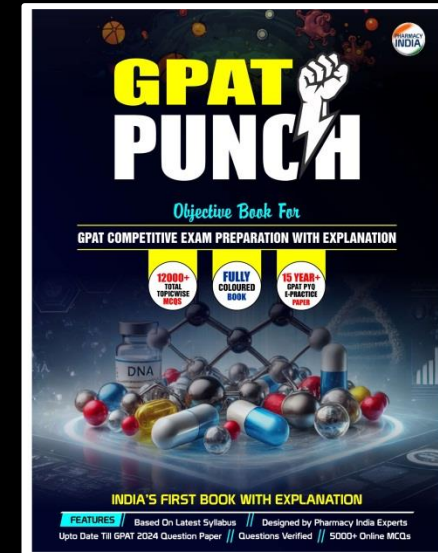
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22. Which of the following strategies are widely used to improve or promote transport of drug to brain

- (a) Glycosylation
- (b) Use of mannitol
- (c) Prodrug approach
- (d) All of the above



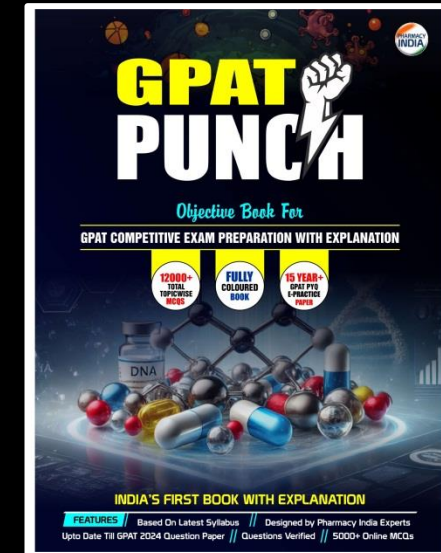
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Explanation:

- **Glycosylation → increases lipophilicity & transport.**
- **Mannitol infusion → temporarily opens tight junctions of BBB.**
- **Prodrug approach → modify structure to cross BBB (e.g., L-Dopa → Dopamine).**
- **All are valid techniques to enhance CNS penetration.**

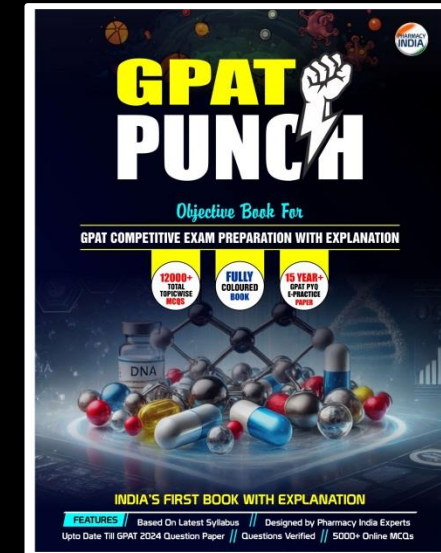


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23. Acidic drugs have
- (a) Low V_d
 - (b) High V_d
 - (c) No V_d
 - (d) None of the above



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23.

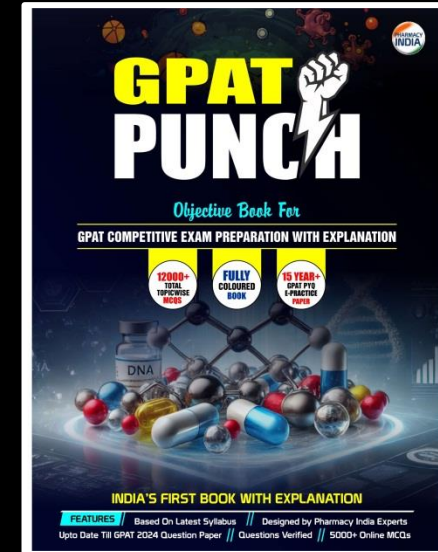
Acidic drugs have

(a) Low V_d

(b) High V_d

(c) No V_d

(d) None of the above



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Explanation:

- **Acidic drugs (e.g., warfarin, salicylates) bind strongly to albumin in plasma.**
- **Binding reduces tissue distribution → low Vd.**
- **Conversely, basic drugs bind α 1-acid glycoprotein → more tissue binding → high Vd.**
- **Clinical: Protein-binding displacement can cause toxicity.**



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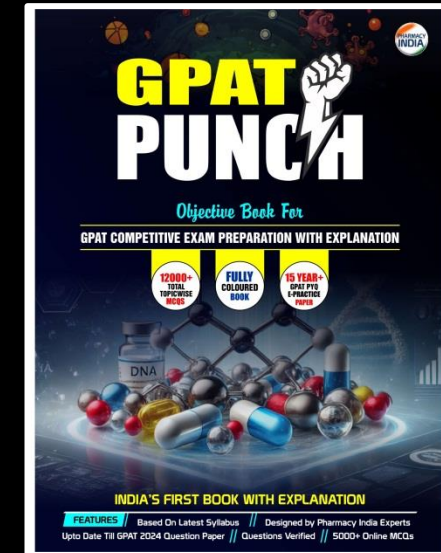


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24.

Low molecular weight drugs have

- (a) Low V_d
- (b) High V_d
- (c) No V_d
- (d) None of the above



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24.

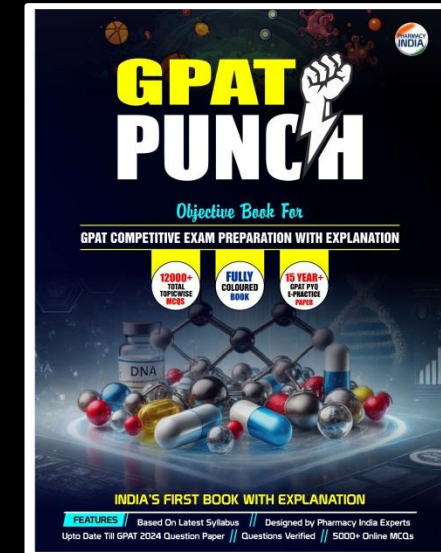
Low molecular weight drugs have

(a) Low V_d

(b) High V_d

(c) No V_d

(d) None of the above



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Explanation:

- **Small molecules (<500 Da) diffuse easily across membranes.**
- **Low MW → higher distribution → high Vd.**
- **Especially true for lipophilic small molecules.**
- **Contrast: High MW drugs (proteins, monoclonal antibodies) → remain in plasma (low Vd).**

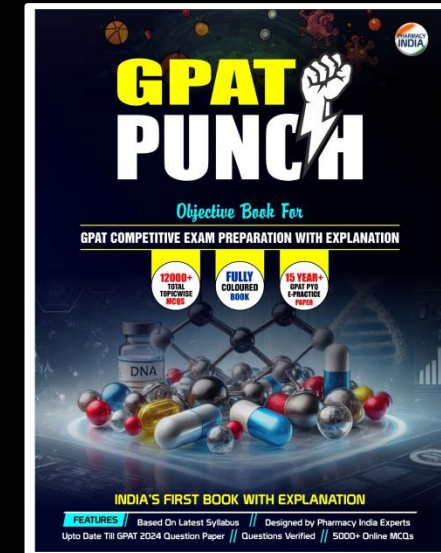


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25. **Drug permeation through BBB can be improved by**
- (a) Glycosylation
 - (b) Mannitol
 - (c) Dihydropyridine redox system
 - (d) All of the above

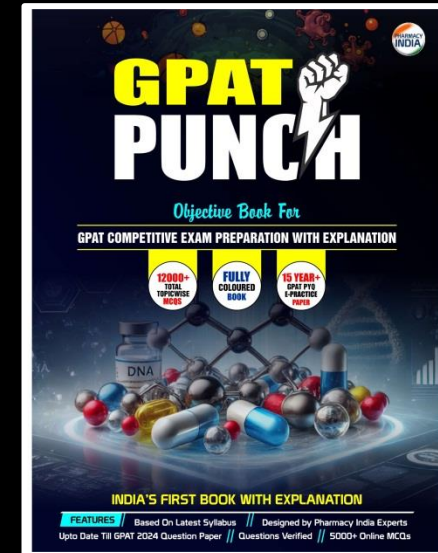


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- (a) Glycosylation
 - (b) Mannitol
 - (c) Dihydropyridine redox system
 - (d) All of the above**



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Explanation:

- **Glycosylation: increases lipophilicity → better BBB penetration.**
- **Mannitol: osmotic agent → transiently disrupts BBB tight junctions.**
- **Dihydropyridine redox system: carrier-mediated transport.**
- **All these approaches aim to overcome the restrictive nature of BBB.**



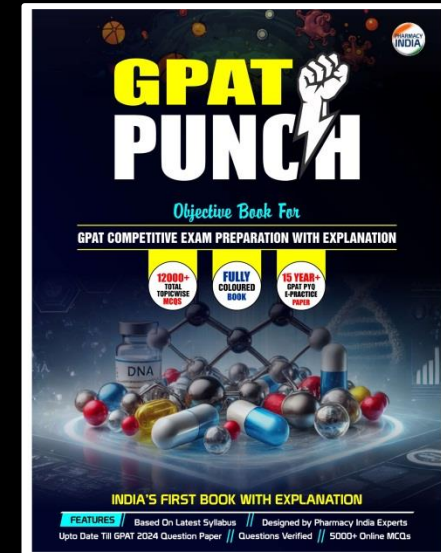
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26. Which of the following is an example of a perfusion-rate limited drug distribution?

- (a) Polar drugs
- (b) Lipophilic drugs
- (c) Ionic drugs
- (d) Hydrophilic drugs



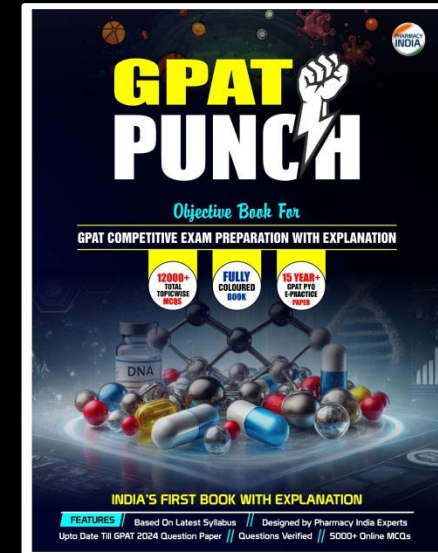
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26. Which of the following is an example of a perfusion-rate limited drug distribution?

- (a) Polar drugs
- (b) Lipophilic drugs
- (c) Ionic drugs
- (d) Hydrophilic drugs



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Explanation:

- Lipophilic drugs cross cell membranes very easily.
- For them, the limiting factor is blood flow (perfusion rate), not membrane permeability.
- Example: Thiopental rapidly distributes to brain because of high cerebral blood flow.
- In contrast, polar/hydrophilic drugs are permeability-limited.



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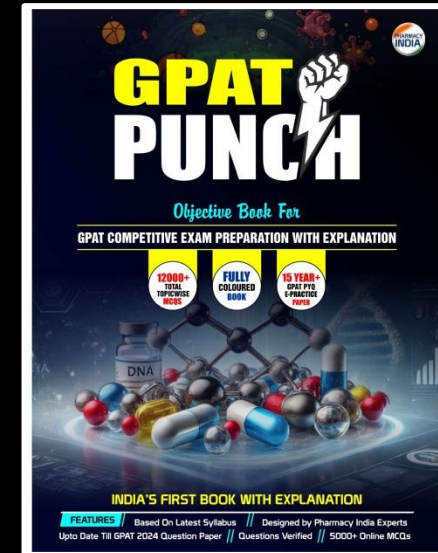


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27.

Which of the following represents a permeability-rate limited distribution?

- (a) Non-polar drugs
- (b) Lipophilic drugs
- (c) Polar drugs
- (d) Volatile anesthetics



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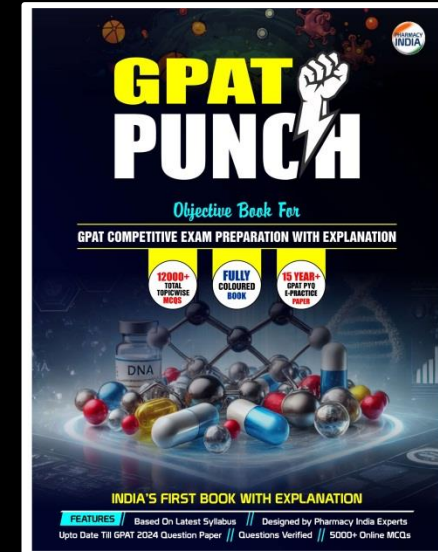


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Which of the following represents a permeability-rate limited distribution?

- (a) Non-polar drugs
- (b) Lipophilic drugs
- (c) Polar drugs
- (d) Volatile anesthetics



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Explanation:

- Polar/hydrophilic drugs cross biological membranes poorly.
- For them, distribution depends on membrane permeability, not perfusion.
- Example: Aminoglycosides → hydrophilic antibiotics → accumulate slowly in tissues.
- Thus, they have low V_d and slow tissue entry.



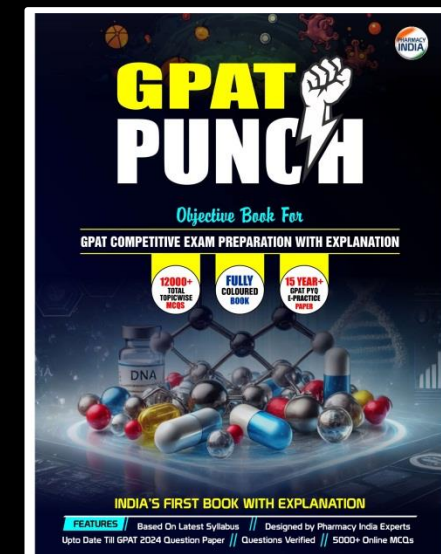


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28.

Volume of distribution of a drug is affected by

- (a) Plasma protein binding
- (b) Tissue binding
- (c) Partition coefficient
- (d) All of the above



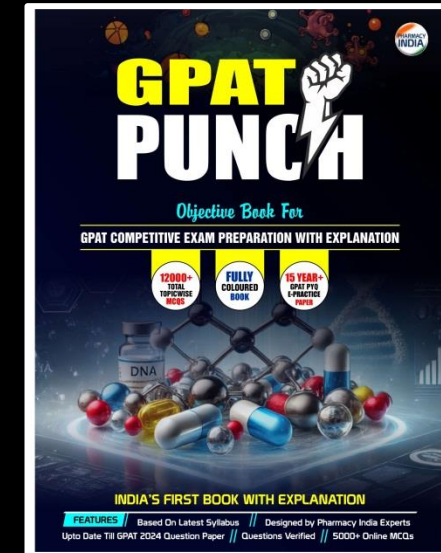
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- (a) Plasma protein binding
- (b) Tissue binding
- (c) Partition coefficient
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Explanation:

Factor	Effect on Vd	Example
Plasma protein binding	$\uparrow$ binding $\rightarrow$ $\downarrow$ Vd	Warfarin
Tissue binding	$\uparrow$ binding $\rightarrow$ $\uparrow$ Vd	Digoxin (binds cardiac tissue)
Partition coefficient	$\uparrow$ lipophilicity $\rightarrow$ $\uparrow$ Vd	Chloroquine



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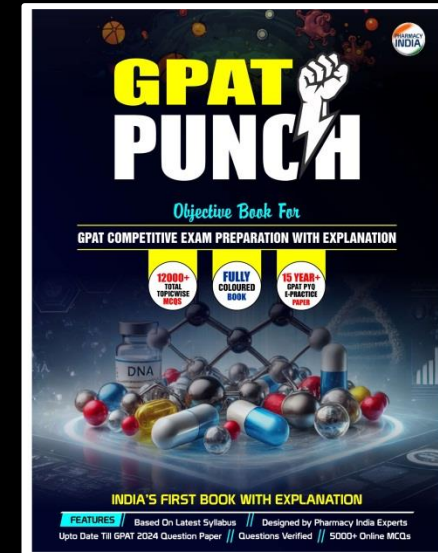
Basic drugs bind predominantly to

(a) Albumin

(b) Globulin

(c) α 1-acid glycoprotein

(d) Fibrinogen



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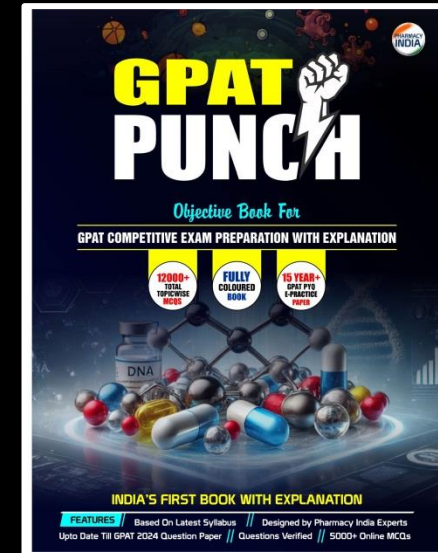
Basic drugs bind predominantly to

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(c) α 1-acid glycoprotein

(d) Fibrinogen



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Explanation:

- **Albumin → binds acidic drugs (warfarin, salicylates).**
- **α 1-acid glycoprotein → binds basic drugs (propranolol, lidocaine).**
- **Binding affects distribution, free drug concentration, drug interactions.**
- **In disease (e.g., inflammation), α 1-acid glycoprotein $\uparrow$ → more binding of basic drugs → reduced free fraction.**



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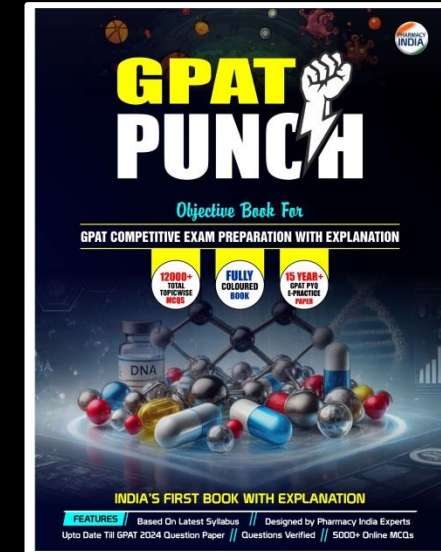


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30.

Acidic drugs bind predominantly to

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- (d) Lipoprotein



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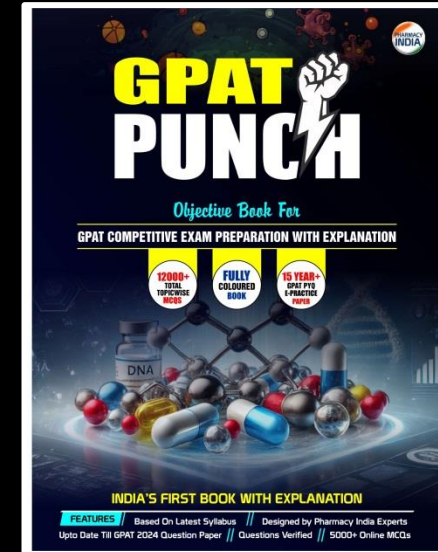
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(c) α 1-acid glycoprotein

(d) Lipoprotein



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Explanation:

- **Albumin is the major plasma protein (~3.5–5%).**
- **Strongly binds acidic drugs: salicylates, warfarin, sulfonamides.**
- **Binding is reversible → maintains free drug concentration.**
- **Competition for albumin binding may lead to drug–drug interactions (e.g., warfarin + sulfonamide → bleeding risk).**



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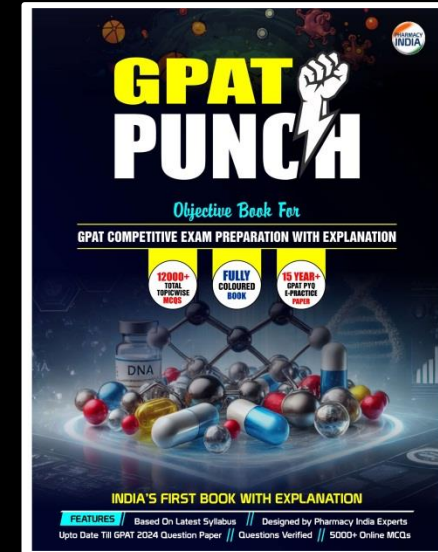


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31.

Binding of drug to plasma protein results in

- (a) Increased free drug concentration
- (b) Prolonged half-life of drug
- (c) Increased clearance of drug
- (d) Rapid elimination



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31.

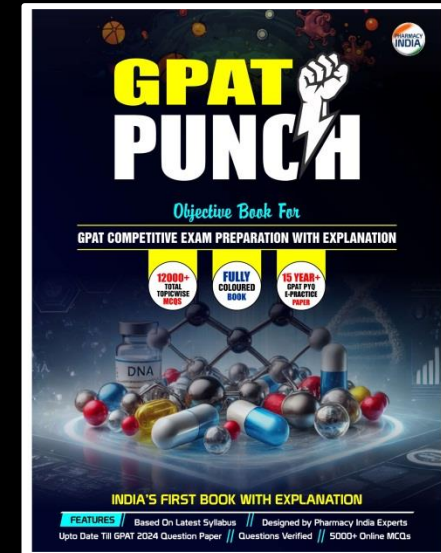
Binding of drug to plasma protein results in

(a) Increased free drug concentration

(b) Prolonged half-life of drug

(c) Increased clearance of drug

(d) Rapid elimination



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Explanation:

- Protein-bound drug is not filtered by kidney → slower elimination.
- Acts as a reservoir → prolongs half-life and duration of action.
- Only free drug is pharmacologically active.
- Displacement from protein can cause sudden ↑ free drug → toxicity.



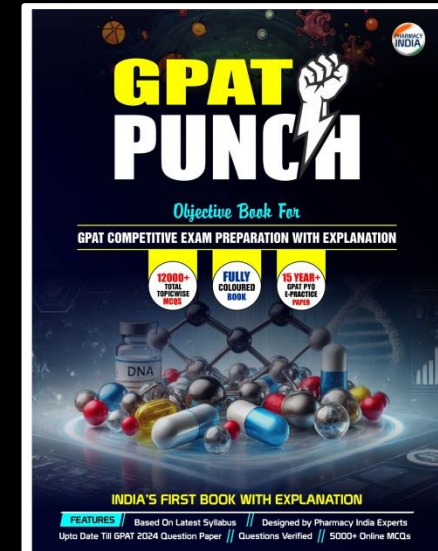
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32. Which of the following is the most important barrier for drug distribution into brain?

- (a) Endothelial tight junctions
- (b) Astrocytic end-feet
- (c) P-glycoprotein efflux pump
- (d) All of the above



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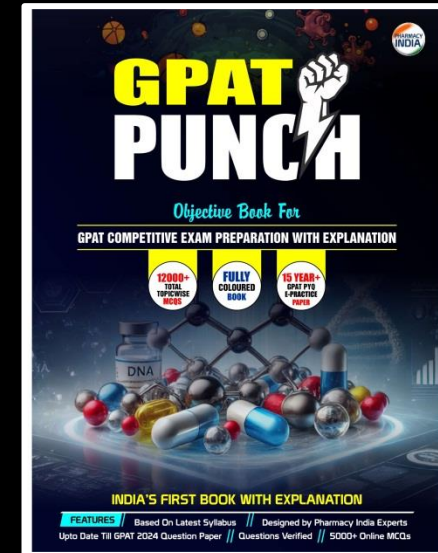


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- (c) P-glycoprotein efflux pump
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Explanation:

- **Blood-brain barrier (BBB) has tight endothelial junctions → restrict paracellular transport.**
- **Astrocytic processes surround capillaries → add an additional protective layer.**
- **P-glycoprotein efflux pump actively removes lipophilic drugs.**
- **Together → BBB restricts entry of many drugs, esp. hydrophilic ones.**



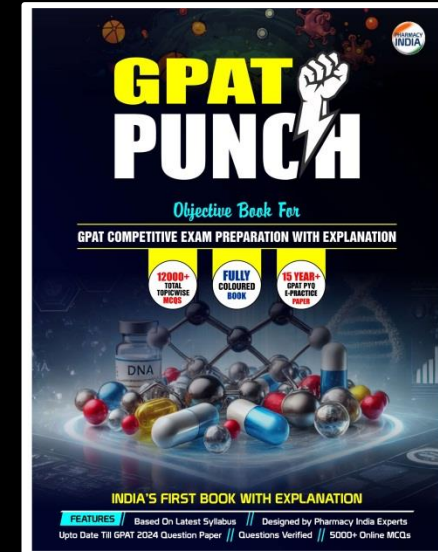
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33. Which of the following conditions may alter plasma protein binding of drugs?

- (a) Liver disease
- (b) Renal failure
- (c) Burns
- (d) All of the above



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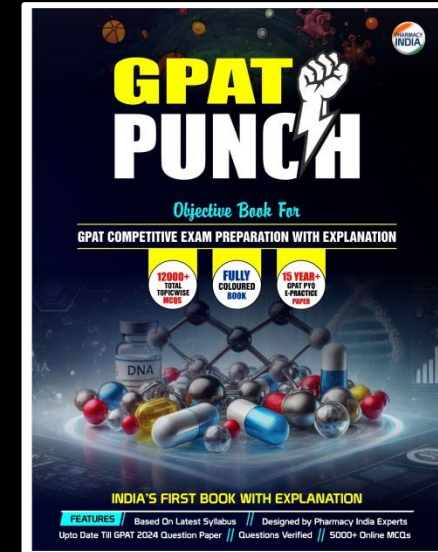


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- (a) Liver disease
- (b) Renal failure
- (c) Burns
- (d) All of the above



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Explanation:

- **Liver disease → ↓ albumin synthesis → less binding of acidic drugs.**
- **Renal failure → accumulation of waste products that displace drugs from proteins.**
- **Burns → loss of proteins → ↓ binding capacity.**
- **Altered binding → ↑ free drug concentration → toxicity risk.**



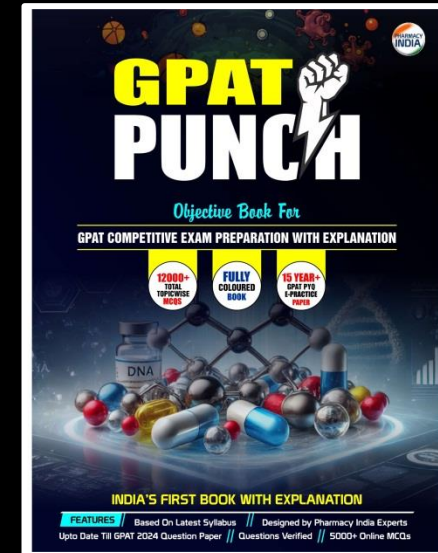
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34. **Binding of acidic drugs to albumin is affected by**

- (a) Bilirubin
- (b) Fatty acids
- (c) Sulfonamides
- (d) All of the above



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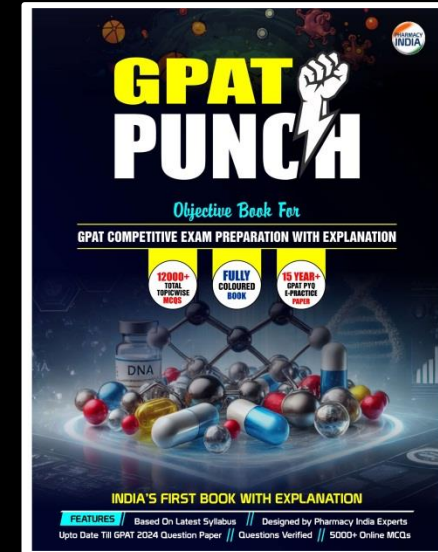


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- (a) Bilirubin
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- (c) Sulfonamides
- (d) All of the above**



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Explanation:

- Albumin binding sites can be displaced by bilirubin, fatty acids, sulfonamides.
- Displacement increases free drug fraction.
- Example: Sulfonamides displace bilirubin from albumin in neonates → kernicterus.
- Clinical: monitor closely in patients with jaundice or drug interactions.



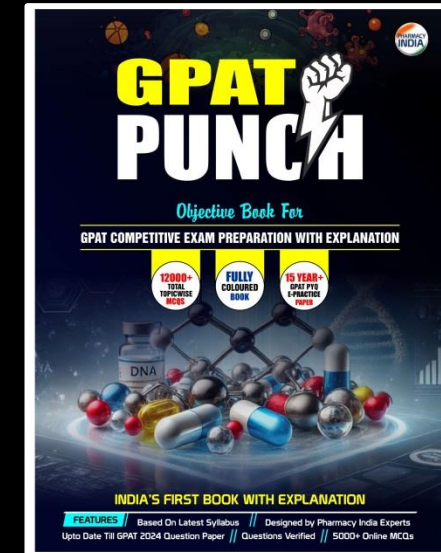
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35. The drug having very high tissue binding will show

- (a) High plasma concentration
- (b) High volume of distribution
- (c) High clearance
- (d) Short half-life

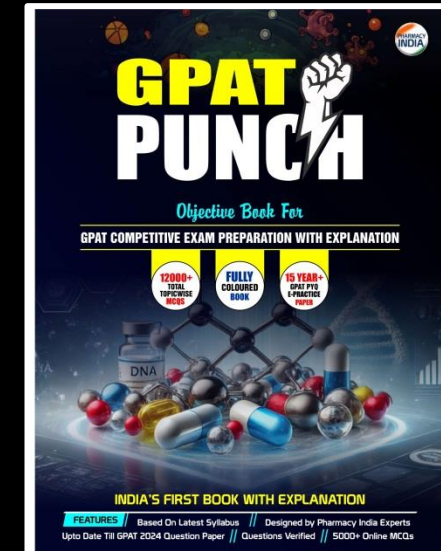


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- (a) High plasma concentration
 - (b) High volume of distribution
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Explanation:

- **Tissue binding removes drug from plasma → V_d increases.**
- **Example: Chloroquine, digoxin → $V_d > 100$ L.**
- **Plasma concentration may remain low even if total drug in body is high.**
- **Clinically: High tissue binding → longer half-life → risk of accumulation.**



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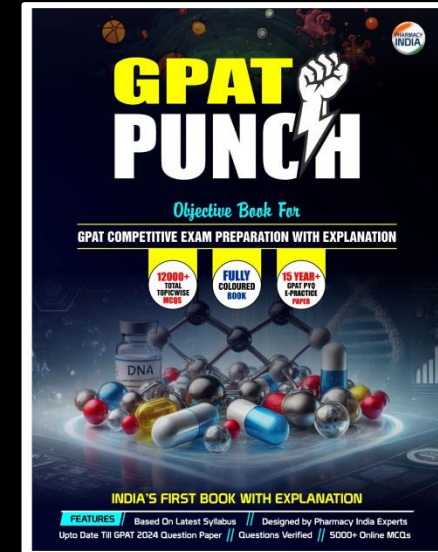


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36.

The drug having very high plasma protein binding will show

- (a) Low volume of distribution
- (b) High clearance
- (c) High tissue penetration
- (d) Short half-life



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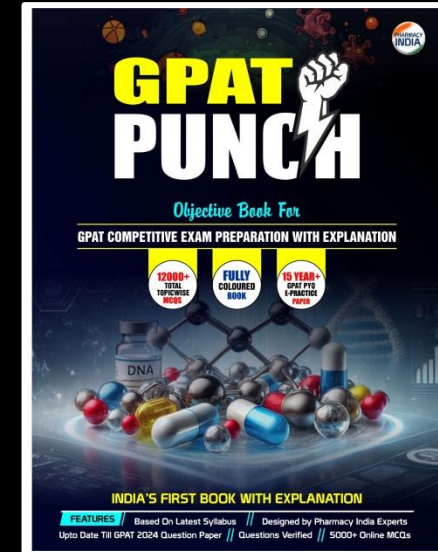


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- (c) High tissue penetration
- (d) Short half-life



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Explanation:

- **Plasma protein binding → drug stays confined to vascular compartment.**
- **This leads to low V_d , because little drug leaves plasma.**
- **Example: Warfarin, phenytoin → highly bound to albumin.**
- **Clinically, displacement interactions can dangerously ↑ free drug levels.**



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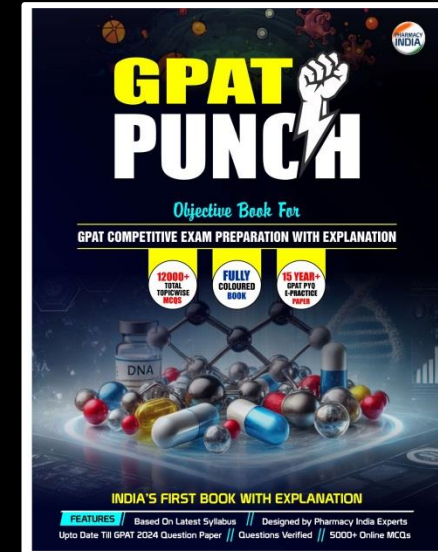


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37.

Which drug is known to have a very large apparent volume of distribution due to extensive tissue binding?

- (a) Digoxin
- (b) Warfarin
- (c) Aspirin
- (d) Theophylline



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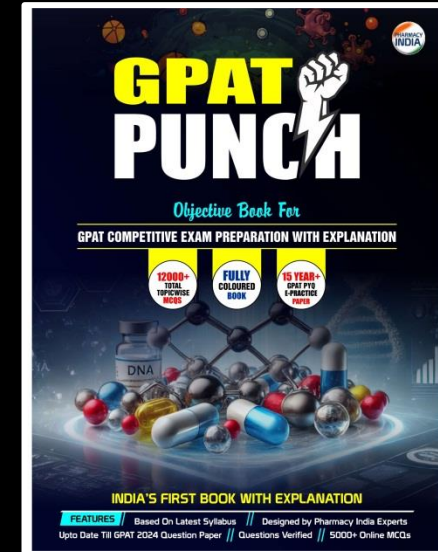


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Explanation:

- **Digoxin binds extensively to cardiac and skeletal muscle.**
- **Apparent $V_d > 500$ L, far more than total body water.**
- **Low plasma levels may not reflect high total body drug content.**
- **Requires careful dosing → toxicity risk in cardiac tissues.**



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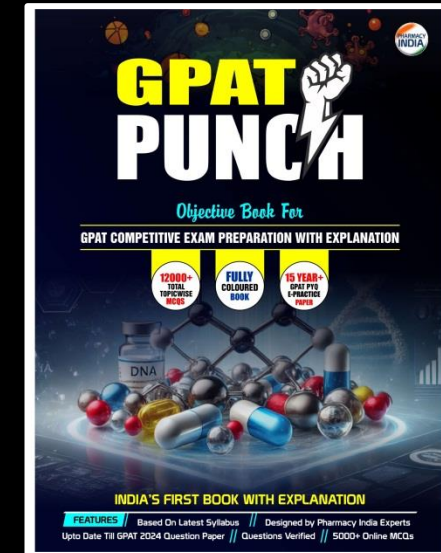


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38.

Which of the following is a determinant of drug distribution?

- (a) Lipid solubility
- (b) pKa of drug and pH of tissue
- (c) Blood flow to tissue
- (d) All of the above



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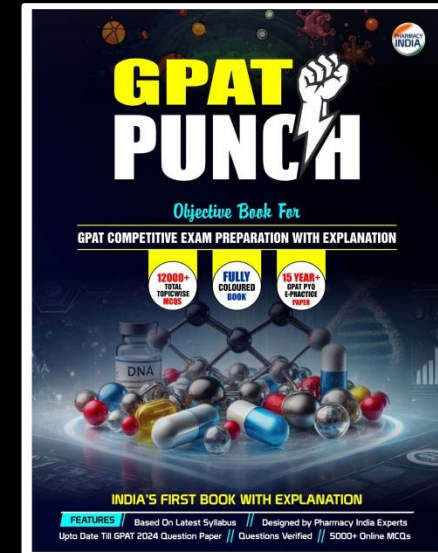


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- (d) All of the above



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Explanation:

Factor	Effect on Distribution	Example
Lipid solubility	↑ lipophilicity → better membrane crossing	Thiopental (fast CNS entry)
pKa & pH	Ion trapping in acidic/basic compartments	Weak bases trapped in stomach
Blood flow	Highly perfused organs get drug first	Brain, kidney, liver



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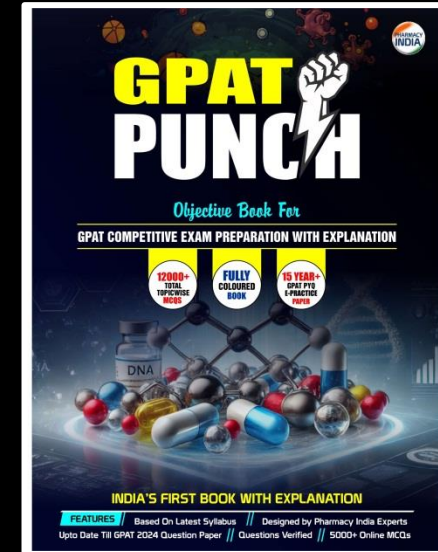


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39.

The blood-brain barrier is least permeable to

- (a) Lipid-soluble drugs
- (b) Water-soluble drugs
- (c) Unionized small molecules
- (d) Gaseous anesthetics



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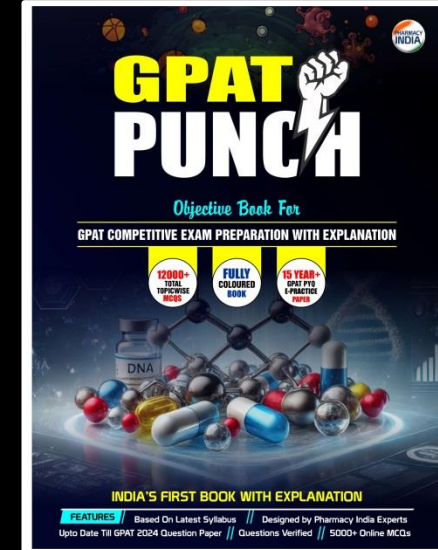


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Explanation:

- BBB allows lipid-soluble, unionized, small molecules.
- **Hydrophilic/water-soluble drugs cross poorly.**
- **Exceptions: if transporter proteins exist (e.g., glucose, L-Dopa).**
- **Efflux pumps (P-glycoprotein) further restrict entry of many drugs.**



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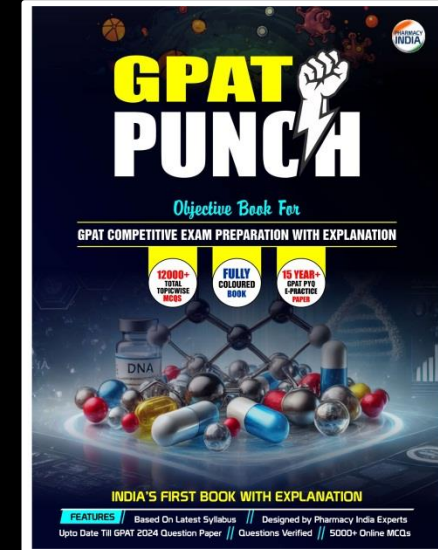


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40.

Which of the following conditions may increase α 1-acid glycoprotein levels, thereby altering drug binding?

- (a) Inflammation
- (b) Cancer
- (c) Trauma
- (d) All of the above



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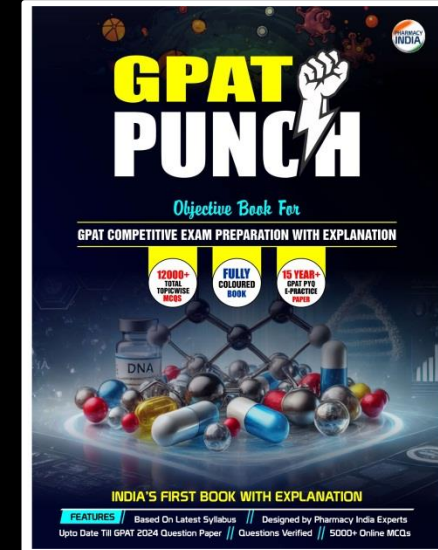


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- (d) All of the above



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Explanation:

- α 1-acid glycoprotein binds basic drugs (e.g., propranolol, lidocaine).
- Its levels $\uparrow$ in inflammation, trauma, cancer, myocardial infarction.
- Higher protein levels $\rightarrow$ less free drug available $\rightarrow$ lower pharmacological activity.
- Important consideration for dose adjustment in diseased patients.



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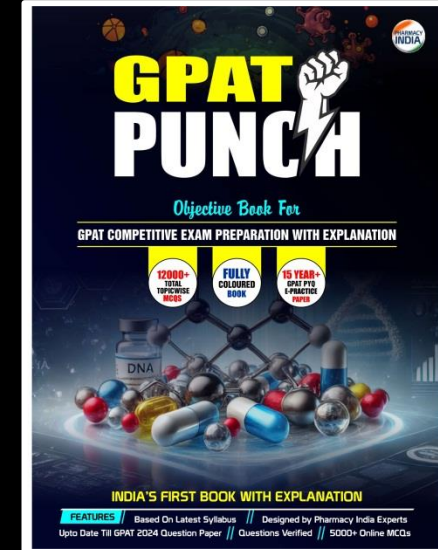


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41.

In neonates, drug distribution differs from adults because

- (a) Plasma protein binding is lower
- (b) Body water content is higher
- (c) Fat content is lower
- (d) All of the above



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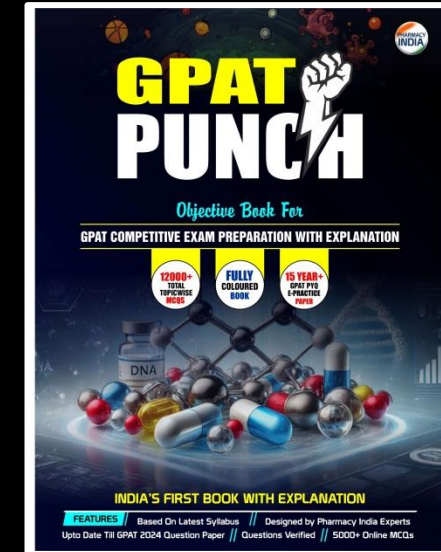


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- (b) Body water content is higher
- (c) Fat content is lower
- (d) All of the above**



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Explanation:

- Neonates have low albumin levels → less binding of acidic drugs.
- High body water (70–75%) → hydrophilic drugs have $\uparrow$ Vd.
- Low fat content → lipophilic drugs have $\downarrow$ storage.
- Clinical: dose adjustment needed for neonates (risk of toxicity).



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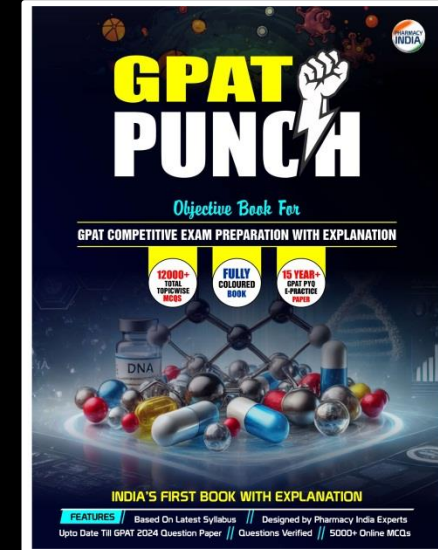


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42.

Which drug is displaced from albumin binding by sulfonamides, causing kernicterus in neonates?

- (a) Bilirubin
- (b) Digoxin
- (c) Theophylline
- (d) Chloroquine



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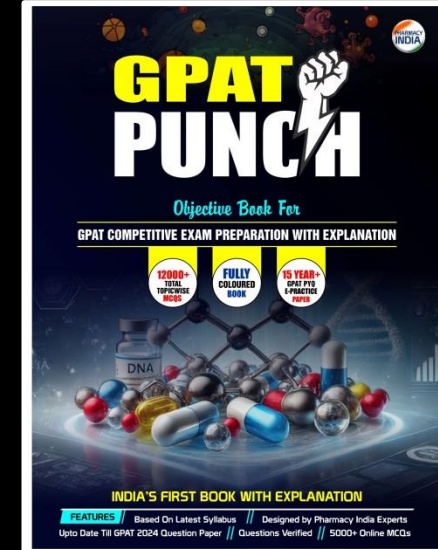


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- (d) Chloroquine



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Explanation:

- **Sulfonamides compete with bilirubin for albumin binding.**
- **Free bilirubin crosses BBB in neonates → deposits in basal ganglia.**
- **Leads to kernicterus (bilirubin encephalopathy).**
- **Hence sulfonamides contraindicated in neonates.**



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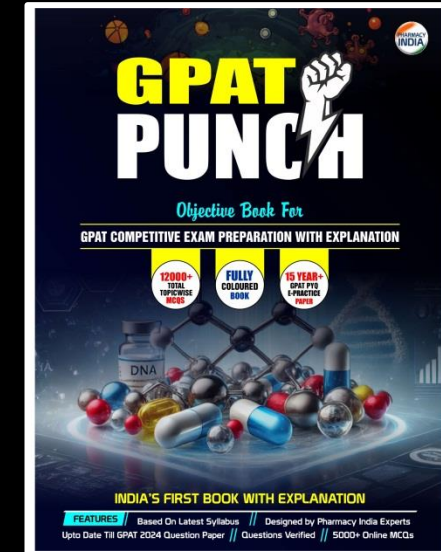


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43.

The drug that binds extensively to melanin and accumulates in the eye is

- (a) Chloroquine
- (b) Warfarin
- (c) Lidocaine
- (d) Aspirin



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43.

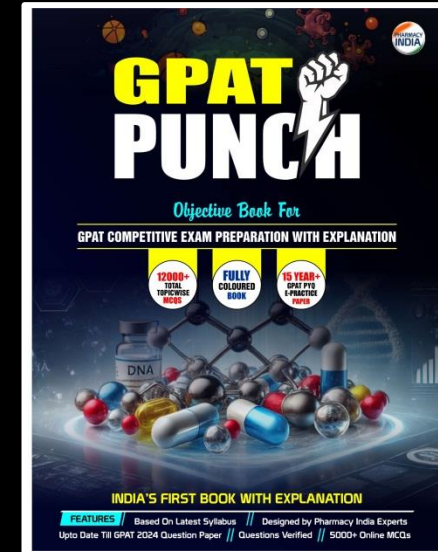
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Explanation:

- **Chloroquine has high affinity for melanin in retina.**
- **Long-term therapy → retinopathy, vision disturbances.**
- **This is an example of tissue binding leading to toxicity.**
- **Monitoring is essential during chronic use.**



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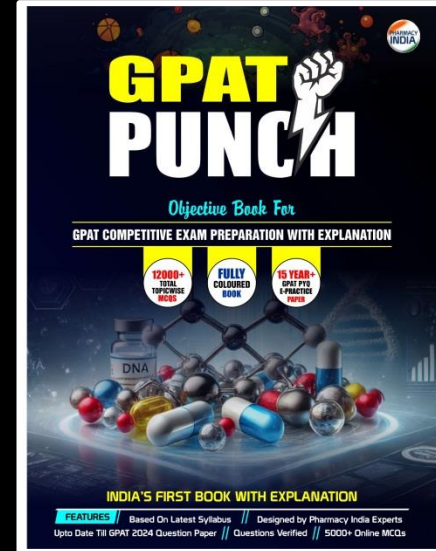


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44.

Which of the following compartments is the first site of drug distribution after i.v. administration?

- (a) Intracellular fluid
- (b) Plasma
- (c) Fat
- (d) Bone



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44.

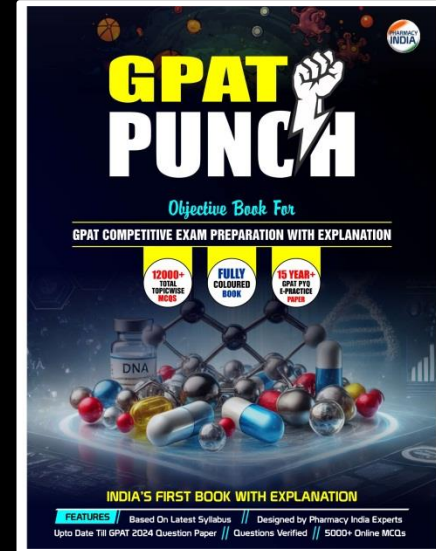
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(a) Intracellular fluid

(b) Plasma

(c) Fat

(d) Bone



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Explanation:

- **After i.v. dosing, drug first appears in plasma (vascular compartment).**
- **From plasma, distributes to interstitial fluid → intracellular fluid.**
- **Final distribution depends on lipophilicity, binding, and perfusion.**
- **Plasma concentration is the basis for PK calculations.**



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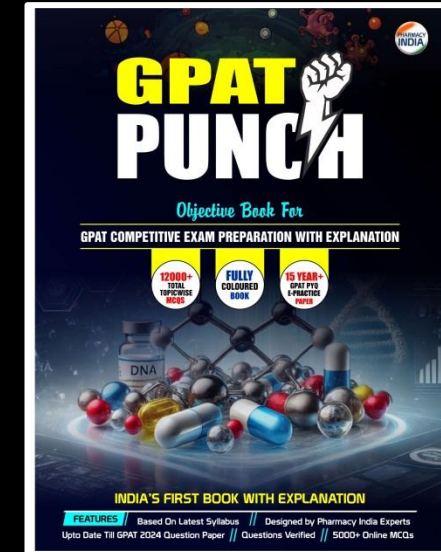


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45.

Ion trapping of drugs occurs due to

- (a) pH difference across membranes
- (b) Lipid solubility
- (c) Protein binding
- (d) All of the above



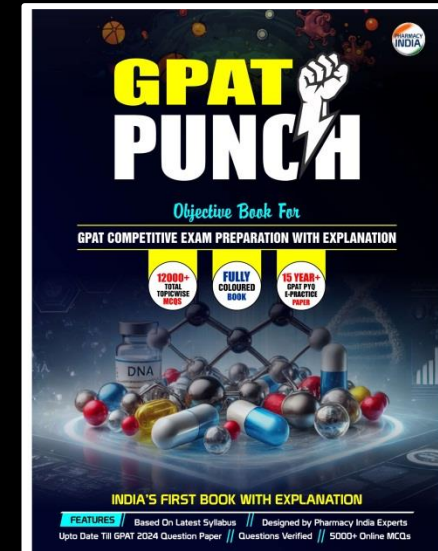
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- (a) pH difference across membranes**
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 - (c) Protein binding
 - (d) All of the above



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Explanation:

- **Weak acids/bases ionize differently at different pH.**
- **Ionized drugs cannot cross membranes easily.**
- **Example: Weak bases get trapped in acidic urine → principle of forced acid diuresis.**
- **Clinical: manipulating urine pH can enhance elimination (e.g., salicylate poisoning).**



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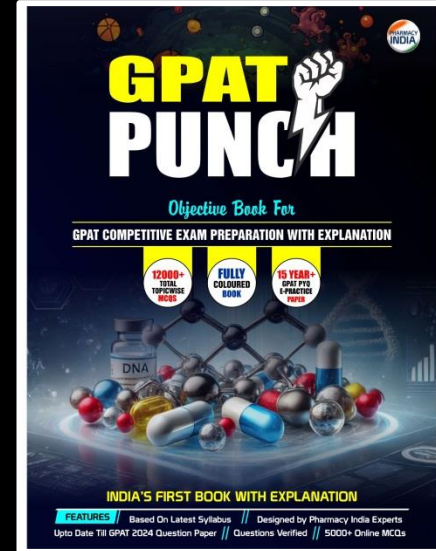


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46.

Which tissue acts as a reservoir for lipophilic drugs?

- (a) Brain
- (b) Fat (adipose tissue)
- (c) Bone
- (d) Liver



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46.

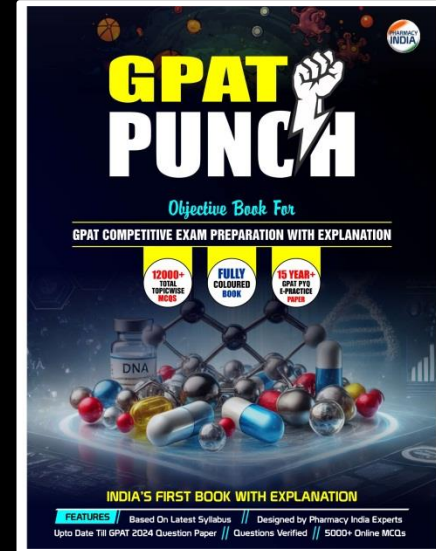
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(a) Brain

(b) Fat (adipose tissue)

(c) Bone

(d) Liver



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Explanation:

- **Adipose tissue stores lipophilic drugs (thiopental, DDT).**
- **Acts as a slow-release reservoir.**
- **Prolongs half-life of lipophilic compounds.**
- **Obese patients may retain drugs longer.**



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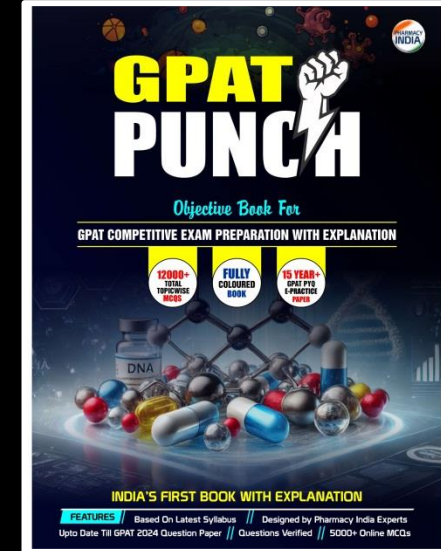


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47.

Which organ acts as a reservoir for tetracyclines and heavy metals?

- (a) Liver
- (b) Kidney
- (c) Bone
- (d) Fat



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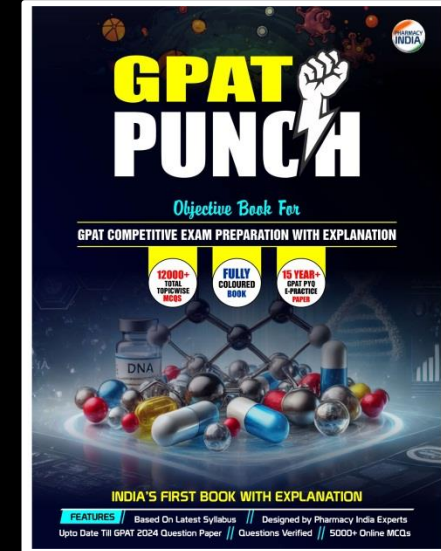


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Explanation:

- **Tetracyclines chelate calcium → deposited in bones & teeth.**
- **Heavy metals (lead, strontium) also accumulate in bone.**
- **This leads to long-term toxicity and staining of teeth.**
- **Bone binding can be both therapeutic (reservoir effect) and toxic.**



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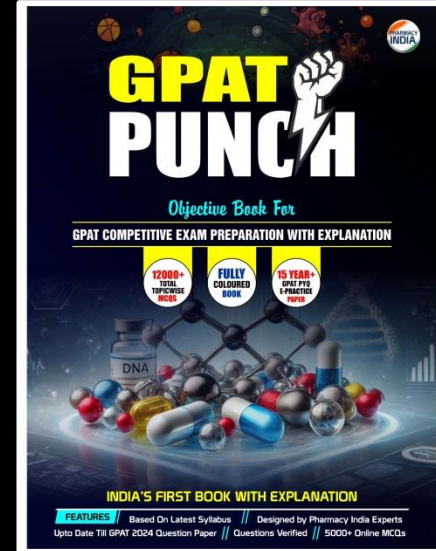


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48.

Redistribution of drugs is most important in the case of

- (a) Thiopental sodium
- (b) Warfarin
- (c) Digoxin
- (d) Phenytoin



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48.

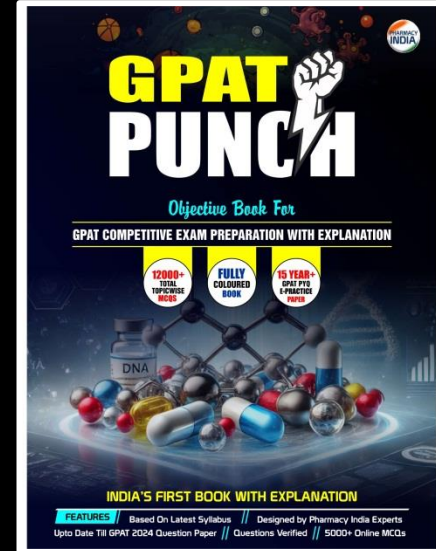
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(a) Thiopental sodium

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Explanation:

- Thiopental → ultra-short acting barbiturate.
- Initially distributes rapidly to brain → anesthesia.
- Later redistributes to muscle and fat → rapid recovery.
- Classic example of redistribution limiting drug action.



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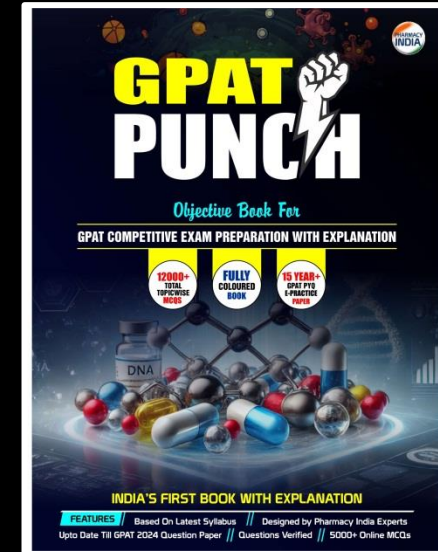


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49.

Which physiological factor favors drug distribution?

- (a) High blood perfusion
- (b) High tissue affinity
- (c) Large surface area
- (d) All of the above



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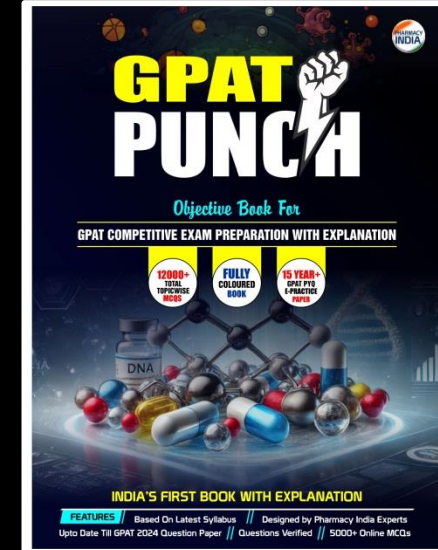


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Explanation:

- **High perfusion → faster distribution to organs (brain, kidney, liver).**
- **High tissue affinity → drug accumulates in specific tissues.**
- **Large surface area → greater distribution (capillary networks).**
- **All together determine rate & extent of drug distribution.**



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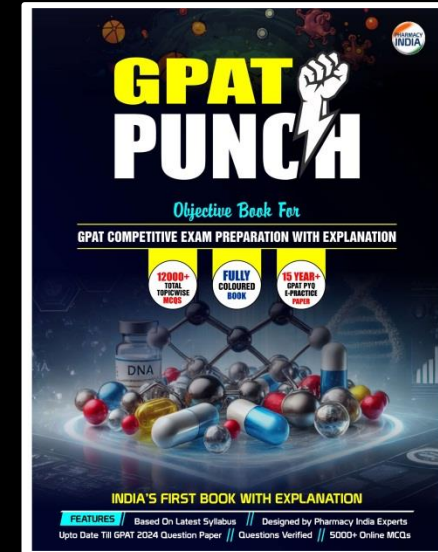


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50.

The main clinical significance of drug distribution is

- (a) Determines the half-life and dosing frequency**
- (b) Predicts tissue accumulation and toxicity**
- (c) Influences drug–drug interactions (via protein binding)**
- (d) All of the above**



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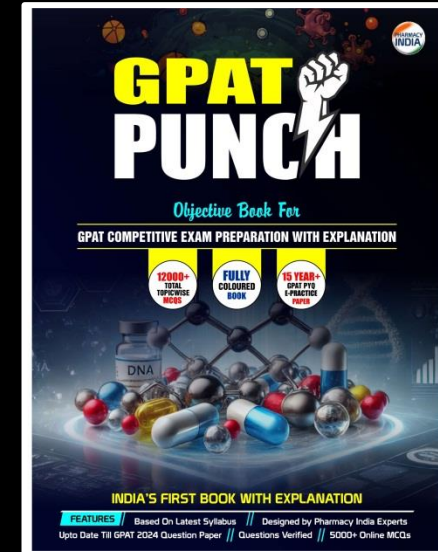


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Explanation:

- Volume of distribution (V_d) helps calculate half-life & dosing interval.
- Distribution patterns predict site-specific toxicity (chloroquine → eye, tetracycline → bone).
- Protein binding displacement → major cause of interactions.
- Overall, distribution is key to pharmacokinetics and clinical therapy.



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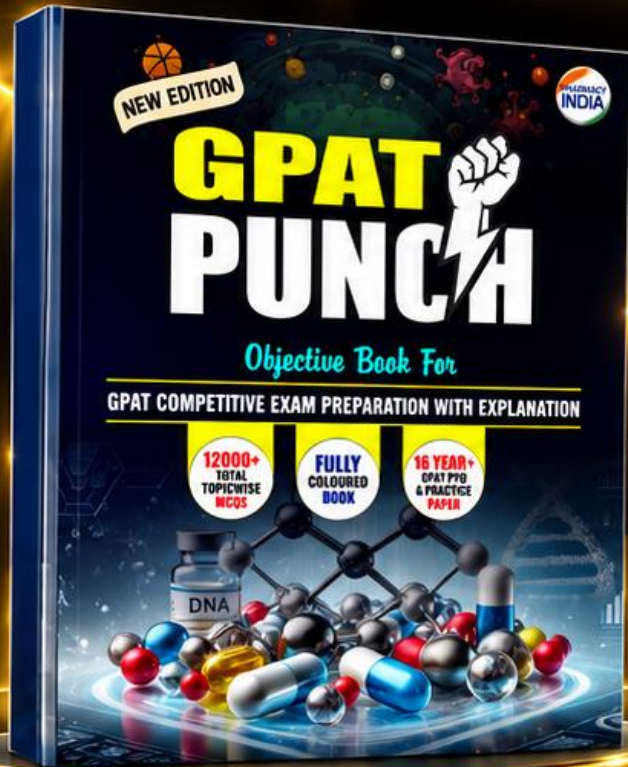


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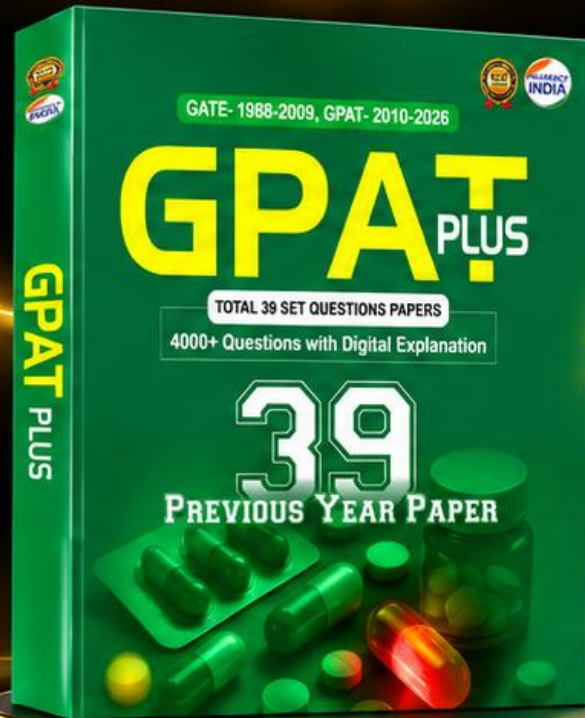


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