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# PHARMACEUTICS ( BIOPHARMACEUTICS AND PHARMACOKINETICS )

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

## GROUP – A ( Multiple Choice Type Questions )

1. Choose the correct alternatives for any ten of the following:

 $10 \times 1 = 10$ 

- i) Which of the following mechanism is responsible for gastrointestinal absorption of Vitamin  $B_1$  and  $B_2$ ?
  - a) Passive diffusion
  - b) Active transport
  - c) Facilitated diffusion
  - d) Pore transport.
- ii) Which form of novobiocin shows better bioavailability?
  - a) Sodium salf form
- b) Calcium salt form
- c) Potassium salt form
- d) Free acid form.

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- iii) After extravascular administration of a drug exhibiting two compartment characteristic, absorption rate constant (  $K_a$  ) can be determined by
  - a) Loo-Riegelman method
  - b) Wagner-Nelson method
  - c) Michaelis-Menten method
  - d) Rate constant determination method.
- iv) If the  $pK_a$  value of an weakly acidic drug is  $2 \cdot 1$ , then its percentage ionization in stomach (stomach pH =  $1 \cdot 1$ ) is approximately
  - a) 7·1

b) 6·1

c) 8·1

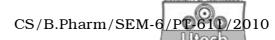
- d) 9·1.
- v) The slope of log ( % unabsorbed ) versus time plot is  $-\ 0.3.$  The first order absorption rate constant (  $K_a$  ) is
  - a) 0.6909/hr
- b) 0.5808/hr
- c) 7.0809/hr
- d) 8.0809/hr.
- vi) Which of the following gives a measure of the extent of absorption of a drug from its dosage form?
  - a) Cmax

b) tmax

c) AUC d)

all of these.

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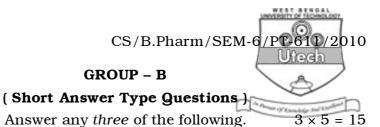


- vii) Which of the following blood protein is the binding site for steroids?
  - a) Human serum albumin
  - b) Alpha-1-acid glycoprotein
  - c) Lipoprotein
  - d) Alpha-1-globulin.
- viii) Which of the following methods is not conducive for drugs crossing the BBB ?
  - a) Use of permeation enhancers
  - b) Addition of polyoxyethylene groups to the parent drug
  - c) Osmotic disruption of the BBB using mannitol
  - d) Using dihydropyridine redox system as drug carriers to the brain.
- ix) Facilitated diffusion is a carrier mediated transport system which is characterized by
  - a) downhill process where energy is not required
  - b) downhill process where energy is required
  - c) uphill process where energy is not required
  - d) uphill process where energy is required.

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- x) Orally administered Sabin polio vaccine and large protein molecules are throught to be absorbed by
  - a) phagocytosis
- b) pinocytosis
- c) ion-pair transport
- d) none of these.
- xi) For majority of drugs that bind to extra-vascular tissues, the order of binding is
  - a) liver > kidney > lung > muscle
  - b) kidney > liver > musde > lung
  - c) muscle > lung > kidney > liver
  - d) lung > liver > kidney > musde.
- xii) Which of the following lubricant promotes disintegration as well as dissolution?
  - a) Magnesium stearate
  - b) Purified talc
  - c) Sodium lauryl sulphate
  - d) None of these.

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- 2. Write a short note on Placental barrier.
- 3. Why is Human Serum Albumin (HSA) considered a versatile protein for drug binding? With examples, name the various binding sites on HAS.
- 4. Compare the absorption characteristics of drugs absorbed by zero order with those absorbed by first order process after extra vascular administration.
- 5. After oral administration of a metoprolol succinate tablet ( 100 mg ), its pharmacokinetic is best fitted by the equation C = 0.5 (  $e^{-0.2t} e^{-0.4t}$  ), where 't' is in hours and 'C' is in  $\mu g/ml$ . Assuming one compartment kinetics determine the peak time, peak plasma concentration and AUC. Also calculate the plasma concentration after 2 hour administration of the drug. (Fraction bioavailable = 0.65).
- 6. Define the term 'method of residual'. Explain how it is applied in the determination of absorption and elimination rate constants.

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### (Long Answer Type Questions)

Answer any three of the following



- 7. a) Define the term 'dissolution' and 'dissolution rate'. Discuss the three theories of dissolution and with their mathematical equations. 1+1+8
  - b) What do you mean by sink condition and how is it maintained? 1+1
  - c) If a tablet follows Hixson and Crowell's cubic root law of dissolution having original drug content 125 mg. After 5 hour of dissolution amount of drug released was 98 mg, then calculate the dissolution rate constant.
- 8. a) In case of one compartment open model, what does the term 'open' indicate? Derive an expression for plasma concentration as a function of time after intravenous infusion of a drug following one compartment characteristics. Determine the loading dose and pharmacokinetic parameters including AUC.

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- b) A patient is to be given ceftriaxone by i.v. infusion. The plasma concentration obtained after 24 and 48 hours are 0.0008 and 0.00112  $\mu g/ml$  respectively. If the apparent volume of distribution is 25 litres, then find out the followings :
  - i) Elimination rate constant ( $K_E$ )
  - ii) Steady state concentration (  $C_{\rm SS}$  )
  - iii) Infusion rate (  $R_{\,0}$  ) to achieve the desired steady state
  - iv) Loading dose to obtain  $C_{SS}$  rapidly. 5

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- b) What are the objectives of bioavailability study?
- c) Write any one of the pharmacokinetic methods for determination of bioavailability.5
- d) Write details about metbod for enhancement of bioavailability.7
- 10. a) What is protein binding of drugs?

b) When is drug binding considered irreversible? What could be the possible consequences of such an interaction? 2+3

- c) Describe the different factors affecting protein binding of drugs.8
- 11. a) Show that after extravascular administration the  $C_{max}$  that can be attained is no more than 37% of maximum level attained with the same dose given as i.v. bolus. 7
  - b) A patient is given an antibiotic having  $t\,\frac{1}{2}$  of 4 hrs, by constant i.v. infusion at a rate of 3 mg/hr. At the end of 36 hr. the plasma drug concentration is  $2\cdot 2$  mg/L. Calculate the total body clearance,  $cl_t$  for this antibiotic. What is the volume of distribution,  $V_{\rm d}$  of the drug?

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