DRUG CALCULATION QUESTIONS

The following calculation questions have been drawn from various sources.
They are not indicative of the standard applied in the RPSGB pre-registration exam

R Sinclair, Pharmacy 18.8.2005

DRUG CALCULATIONS

Drug calculation questions are a major concern for most pre-registration pharmacists and are also a worry for those involved in pre-registration training. When it is obvious that people are struggling with what are basic calculations, as part of a test exam or at their workdesk, one would be right to question their ability to accurately calculate doses in critical situations or environments such as on the Ward.
The vast majority of necessary calculations are likely to be relatively straightforward and it is infrequent that one needs to use any complicated formulas. However on those rare occasions when such formulae are required e.g. loading and maintenance doses of Gentamicin or Vancomycin, there are usually electronic aids available to reduce the possibility of calculation errors. It is vital however that any person performing calculations using some automatic process can understand and explain how the final dose is actually arrived at through the calculation..

So why is maths seen as being difficult ? That's a difficult question and is posed in the negative but probably relates to the use of single letters rather than words as symbols

How can we make maths easy ? That is simpler and is more positive. One easy way for those who find it difficult is to change formulas into sentences or to read formulas out aloud.

For Pharmacy Staff - Know your units and remember some simple ratios. One of the most useful is 1% w/v is equivalent to 10mg in 1ml. It is then easy to calculate that 0.5mg/ml is 0.05% w/v and 34.562mg/1ml is 3.4562%

Maths is just another language that tells us how we measure and estimate and these are the two key words.
When you look at a calculation question do two things :-

1) Estimate the **range** and **units** the answer will be in, before starting to calculate, in your head.
   This will often give you clues as to which answer is correct in multiple choice questions and may eliminate several answers that will then be obviously wrong
   e.g. a dose of 60gms of an antibiotic is probably wrong, 6gms might be right, 6mg is almost certainly wrong - except maybe for children / neonates
   A dilution of an ointment will usually be w/w but may also be v/w

2) Eliminate the unnecessary 'values' or 'numbers'
   e.g. a 60kg woman requires a 25% dilution of Betnovate ointment to be applied to her lower limbs twice a day. What weight of White soft paraffin is required to supply 500gms.
   This is a simple calculation - its 75% of 500gms or 375gms. The rest is Betnovate
   Note that just for this you do not need to know the strength of Betnovate and the woman's weight is irrelevant.

Many of the RPSGB questions are this simple. However there has been a growing tendency to make them more difficult as pre-reg and pharmacists problems with calculations have been recognised as a major concern.

Finally - don't try and be too clever and don't try and be too simple. Some questions in the RPSGB are simple calculations. Others may need the use of additional knowledge of some kind unrelated to the pure calculation. Asking the equivalence between solid doses and liquid doses may need you to check which salt is being used and to then calculate X gms base = Y gms salt from info in the BNF (Phenytoin is a common example)

This Booklet is not designed to train you in undertaking Pharmaceutical calculations per se but to assist with calculation questions such as are found in the RPSGB exam and elsewhere and also hopefully the application of the language of maths to everyday situations.. With many of the questions provided here, you should be able to substitute alternative values or to re-arrange the formulas used and create additional test calculations of your own. Except where posed as multiple choice questions, there is no set time limit to questions. Some questions may be easily answered in seconds , others may take several minutes and calculations to arrive at a final set of answers. For multiple choice questions , the RPSGB allow 1.7 minutes per question (1 min 42 seconds) for open book qustions and 1.2 minutes (1 min 12 seconds) for closed book questions

Chapter 1

These questions involve simple calculations or slightly more complex calculations based around items relating to pharmacy. However like all calculations they are designed to test your ability to recognise the relationships between numbers and how to manipulate them. For the more adventurous (or in fact for those who find them difficult), try substituting algebraic values and producing simple formulae for these questions. While this could be done for each question, the equations for each question would be of little individual value for memorising to use elsewhere as they are not universal (See appendix) . Deriving them yourself would be useful as you will learn a little about the language of and use of maths..

1) Potassium Citrate Mixture BPC contains 30% Potassium Citrate w/v and 1% Quillaia Tincture. v/v What quantity of each would be required to manufacture 750mls Potassium Citrate Mixture BPC.

2) Digitoxin injection contains 0.2mg of active ingredient in each 1ml. Express this as a percentage.

3) You are required to dispense 200gms of 0.25% Betamethasone cream. You only have a 2% Cream. The diluent to use is Aqueous Cream. What quantity of each will be required.

4) You are on the ward in a difficult situation. A Patient requires 750mls of 10% Glucose to be administered immediately. The ward only has bags containing Glucose 50% and Glucose 5%. You are able to remove fluid and add fluid aseptically easily in these bags but cannot wait until a 10% solution is delivered. What quantities of each would you need to use to produce 750mls of 10% Glucose.

5) You are required to produce a Copper Sulphate solution containing 600 ppm of Copper Sulphate. You have Copper Sulphate Crystals that are 97.5% pure (The impurities are not important.) The molecular weight of Copper Sulphate (is CuSO 4) 159.7 and the molecular weight of Copper Sulphate Crystals (CuSO4, 5H2O) is 249.7 (Assume these values are correct). What quantity of crystals are required to produce 1.5 Litres.

6) Some Quickies :-

Calculate the strengths as a percentage of the following solutions :-

a) When diluted 1 in 50 produces a 1 in 10,000 solution

b) When diluted 1 in 40 gives a solution containing 15mg in each 1ml

c) Contains 1 part per 10,000 of a drug with a molecular weight of 350

7) Some Quickies 2

Calculate the weights or volumes for 300gms or mls of the following

a) 12 % w/v
b) 3.2 % v/v
c) 5.5% v/w
d) 7.8 % w/w

8) Calculate the quantities required for the following TPN preparation :-

	Required :-	Quantity to be used :-
Ingredient A	50mg/100mls	
Ingredient B	0.25% w/v	
Ingredient C	100gms/Litre	
Ingredient D	1 ppm w/v	
ingredient E	3.2% v/v	
ingredient F	60gm	
Ingredient G	700 KCals (50kCals/gm)	

Total Volume of TPN required = 3,500mls

9) You are required to manufacture some Methylene Blue Suppositories. Each suppository is to contain 25 micrograms of Methylene Blue. You are to manufacture 20 Suppositories. Your balances (for weighing) are only accurate down to 100mcg. The suppositories will also contain 50% WS paraffin and the remainder of the Suppositories will be Cocoa Butter. The suppositories will weigh 5gms each. Allowing for an excess of 5% total mass, calculate the ingredients required and indicate the process you would use..

10) The molecular weight of Sodium Bicarbonate is 84.01. Calculate the strength of Sodium Bicarbonate Solution that would contain 5 mmols per litre as a percentage expressed to three significant figures.

11) Calculate the weight in milligrams that would be required to make 3 litres of a a 25 mmol / Litre solution of the following given their molecular weights :-

Calcium Gluconate	MW = 448.4
Calcium Lactate	MW = 308.3
Magnesium Chloride	MW = 203.3
Magnesium Sulphate	MW = 246.3
Potassium Chloride	MW = 74.55
Sodium Chloride	MW = 58.44

12) Express the answers to Q 11 as a percentage.

13) How many mmols of Sodium and Chloride are there in 0.9% Sodium Chloride for Injection, given that the MW = 58.44. Express your answer as mmol / Litre

14) How many mmols each are there of Sodium and Bicarbonate in 8.4% Sodium Bicarbonate in a 10ml minijet. The molecular weight of Sodium Bicarbonate is 84.1

15) The MW of Magnesium Sulphate is 246.3. Magnesium Sulphate Injection is normally supplied as a 50% solution. How many mEq of Magnesium per ml does this contain. Normal blood levels of Magnesium (Mg++) are 2.5mEq / Litre. How many mg of Magnesium Sulphate does this equate to per Litre (assuming it is present as sulphate).

16) Using only the Chlorides of Potassium, Sodium and Ammonia, you are asked to make a 5 Litre solution containing the following :-

Potassium	1.7 mEq /100ml
Sodium	6.3 mEq / 100ml
Chloride	15 mEq / 100ml

(MW NaCl = 58.44 KCl = 74.5 NH3Cl = 53.5)
Calculate the weight of each Chloride in the 5 Litre solution
What will be the mEq of ammonium ions in the final solution ?

17) You have been asked to make 100 suppositories each weighing 2gms.
The suppositories are each to contain 200mg Active Ingredient
The displacement value of The Active Ingredient is 2.5
Calculate the weight of Active Ingredient in the 100 suppositories and the total quantity of Suppository Base to be used.

18) Approximately how many millimols of Sodium are there in a 500ml infusion of Sodium Bicarbonate 1.26% (Relative weights of the Ions Na = 23 Bicarbonate = 61)

<u>Section 2 - Quick Questions</u>

19) What quantity of solid is required to make 450mls of a 7.5% w/v Solution
20) What quantity of ingredient is required to make 650mls of a 1 in 15 w/v solution
21) What volume of a liquid preparation containing 250 micrograms in 1ml is equivalent to a 40mg Capsule
22) What daily dose of a drug is required for a 23Kg teenager if the recommended dose is 7.5mg/kg/QDS
23) How much of Drug A is there in 100mls if, when diluted 1 in 800 there are 50 micrograms per ml in the final solution
23) Express the following quantities as a percentage of 100gms
    i) 12gms
    ii) 240mg
    iii) 750 micrograms
    iv) 27.5mls
    v) 0.01 Litres
    vi) 1,000mg
25) What quantity of Chlorhexidine is required to make 350mls of solution such that when diluted 100 times, the final solution contains 0.004% Chlorhexidine ?
26) What is 40mg in 5ml expressed as a percentage ?
27) How many milligrams are in 25mls of a 0.15% Solution ?
28) How many grams of a 1 in 400 ointment contain 2gms active ingredient ?
29) How many times must you dilute a 5% solution to give a 1 in 10,000 dilution ?
30) What is the daily dose in mls of a 50mg in 25ml injection for a patient weighing 80Kg if the dose is 50mcg/kg/6hrs.
31) What volume of Syrup should be added to 75mls Simple Linctus to prepare Simple Linctus Paediatric
32) What quantity of Dihydrocodeine is required to make 750mls of a 30mg in 10ml solution
33) What dilution of Concentrated Chloroform Water is required to produce Double Strength Chloroform Water
34) A patient is prescribed an I/V injection of 0.6mg of a drug. The drug is only available as a 125micrograms in 2ml injection.
35) The correct dose of Duffocillin is 150 Micrograms/ Kilo. You have a patient who weighs 70Kg . If the strenth of Dufocillin injection is 250mg in 5ml, what is the volume of the correct dose ?

Chapter 2

1) What quantity of Adrenaline in mg is there in a 20ml vial of 1in 200,000 Adrenaline

2) A 1 litre infusion of NaCl 0.9% is being given over 16 hours using a standard giving set. If the rate at which the infusion is run is 21 drops per minute, over what time will the infusion actually run. (assume 20 drops per ml)

3) You have been asked to prepare a loading dose of Digoxin for a patient of 0.75mg to be given over 1 hour in 0.9% NaCl. by I/V infusion. Calculate what you require..
Finally is this an appropriate loading dose and is the method of administration acceptable.

4) A Patient receives Diamorphine infusion over 24 hours. They currently receive a dose of 150mg over a 24 hour period using a syringe pump that is calibrated to 48mm / 24 hours (some syringe pumps are calibrated in mm/hr). You increase the rate of infusion to 72mm / 24 hours. What dosage will they now receive ? What problem must you now account for.

5) A Drug representative offers you a special deal on Wonder Drug "Meetoo". You will get a 10% discount as free stock for the next two years providing you buy it through him. You currently use around 10,000 boxes of wonderdrug "Meetoo" every month and each box costs £1.00 and you send in your first order for 10,000. Your order arrives and you unpack 11,000 boxes (i.e. it includes your free stock). You look at the Invoice and note a price. How much should you be charged.

6) Calculate the dose of drug X for a 2 stone child if the recommended dose is 2.4mg/kg.

7) The recommended dose of drug A is 15mg/kg/day in divided doses.
On admission, Mrs. X says she is on three 250mg capsules twice daily. Her weight is 72kg.
Comment on her current dose and make some recommendations.

8) A 70kg patient requires Dobutamine at a dose of 10mcg/kg/min and Dopamine 2.5mcg/kg/min.

(a) Calculate the dose of each drug in (i) mg/min
(ii) mg/hr

(b) Calculate the dose in mls per hour if the infusions are prepared as below :
Dobutamine 250mg in 50mls dextrose 5%
Dopamine 200mg in 50mls dextrose 5%

(c) The patient's urine output improves and his dose of Dobutamine is reduced to 8mcg/kg/min.
Calculate his new dose in mls/hr.

9) Drug H is to be given as 500mg in 1L of sodium chloride 0.9% over 12 hours.
calculate the drip rate if the drug is administered using
(a) Solution set (1ml = 20 drops)
(b) Burette set (1ml = 60 drops)

10) The reading on a syringe driver administering drug C is 3.5mls/hr. The additive label says '250mg in 50ml' and the patient's weight is 70kg. What dose of drug C is the patient receiving in mcg/kg/min?

11) Drug J is available as 125mg and 50mg capsules. Mr N weighs 82kg and has been prescribed 12mg per kg daily in 2-3 divided doses. How would you label the bottles of capsules ?

12) Miss Beed is currently on a Heparin infusion. It's 4pm and you notice her pump is bleeping showing an occlusion and she presses the 'stop' button. The SHO walks onto the ward and asks you how much heparin she has had so far today. The last rate set on the pump was 2ml/hr and it had not been altered since it was set up at 6am. Her prescription reads 25,000 units in 50mls sodium chloride 9%.
How would you calculate the amount she's had so far ?

13) Baby S requires an antibiotic suspension for a chest infection. She weighs 15kg and has been prescribed a dose of 7.5mg/kg/day for 7 days divided as a TDS regimen
The strength of the suspension is 250mg in 5mls.
What dosage would you put on the prepared medicine label ?
How should the dose be measured and administered ?

14) A nurse asks you how to make a solution of drug R for a soak. She requires 2L of a 1 in 10,000 solution and she has a concentrate of 10g/l. How much of the concentrate does she need ?

15) How much of ingredient X is required to make up 150mls of a 3% solution

a) 4.5mg
b) 4.5gm
c) 3.33gm
d) 1.5gm
e) 1.5mg

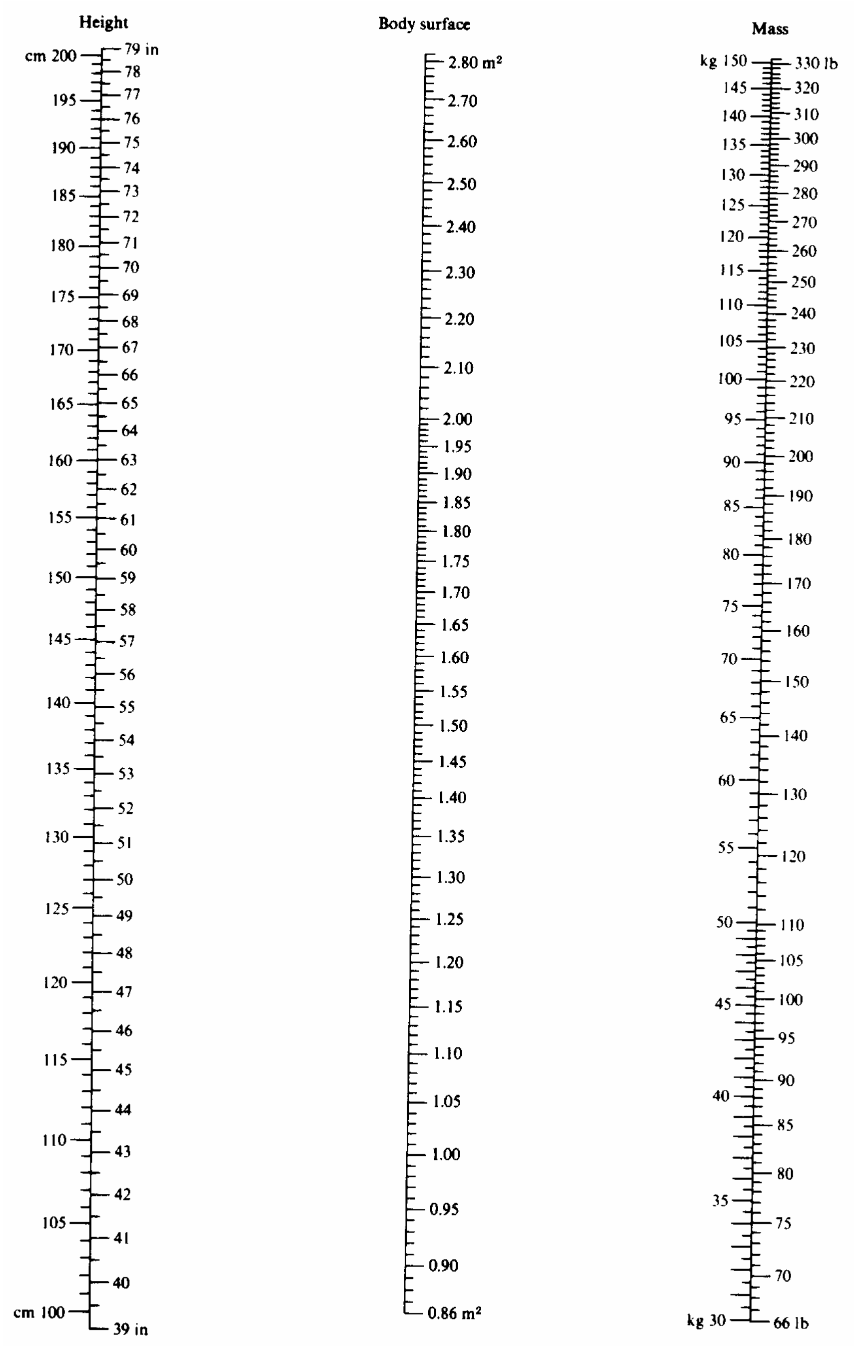
16) You are asked to calculate the initial dose of aminophylline injection for a 5 year old child weighing 18Kg who is having breathing difficulties. Each ampoule contains 250mg in 25ml. What is the correct dosage if the recommendation is that you administer 5mg / kg

a) 90gm
b) 9gm
c) 900mg
d) 90mg
e) 9mg

17) A patient is being given Chloramphenicol eye drops 0.5% for an eye infection.
i) How much drug is contained in 5ml.
ii) How much drug is contained in 1 drop if each 1ml = 20 drops

i)	a)	500mg	ii)	a)	1mg
	b)	250mg		b)	500 micrograms
	c)	100mg		c)	250 micrograms
	d)	50mg		d)	125 micrograms
	e0	25mg		e)	62.5 micrograms

18) The recommended dose of drug F is 25 mg / metre^2. Mr X weighs 70kg and is 1.85m tall. Calculate the dose that is is required using the nomogram provided on the next page.


Height
Body surface
Mass
cm 200
79 in
cm 100
39 in
2.80 m²
0.86 m²
kg 150
330 lb
kg 30
66 lb

19) What weight or volume of Drug X would be contained in 600mls of a 0.02% solution ?

a) 12mcg
b) 120mcg
c) 1.2mg
d) 12mg
e) 120mg

20) How much active substance is required to manufacture a batch of granules for a compressed tablet with a batch size of 420Kg to produce tablets with a mean weight of 700mg and an active substance content of 600mg which includes an overage of 5%

a) 400kg
b) 380Kg
c) 378Kg
d) 360Kg
e) 265Kg

21) A drug has a half life of 7 hours. The drug is administered by I/V and immediately after administration, its plasma level is 68mcg/ml. What would the plasma concentration be after 28 hours ?

a) 2.13mcg/ml
b) 4.25mcg/ml
c) 8.5mcg/ml
d) 17mcg/ml
e) 34mcg/ml

22) A 25 year old patient takes a single benorilate tablet twice a day. However it is not controlling her pain sufficiently and she is taking Paracetamol as well. How many Paracetamol tablets can she safely take in any 24 hour period ?

a) 2
b) 3
c) 4
d) 6
e) 8

23) You are asked to make 200mls of a Copper Sulphate Solution such that when diluted 40 times, a 1 in 8000 solution is obtained. What weight of Copper Sulphate do you need ?

a) 0.1gm
b) 0.5gm
c) 1.0gm
d) 1.5gm
e) 5.0gm

24) You are asked to send 100mls of a solution of concentrate X, which when diluted with water 1 in 10 produces a 1 in 1000 solution. You have a 500ml bottle of a 20% concentrate. Which of the following is the correct formula ?

a) 2.5ml concentrate, water to 100ml
b) 5.0ml concentrate, water to 100ml
c) 7.5ml concentrate, water to 100ml
d) 12.5ml concentrate, water to 100ml
e) 22.5ml concentrate, water to 100ml

25) A patient is admitted to hospital after taking an overdose of drug X. The patient is comatose and it will not be possible to treat the patient until the blood levels fall below 10mg/L. How long will this take to the nearest hour given that the half life of the drug is 13 hours and the current level is 84mg/L

a) 65 hours
b) 52 hours
c) 39 hours
d) 26 hours
e) 13 hours

26) Please calculate the amount of product and water in the following preparation:-

How much benzalkonium chloride (1:750 solution), will you need to make one litre of a 1:3000 benzalkonium chloride solution for use as a wet dressing?

Benzalkonium chloride solution _____ ml
Water _____ ml

27) Write down the concentrations and units for the following products:

a) clotrimazole 1% cream = _____ g clotrimazole / _____ g total product

how much drug will a patient receive from each 5g applicatorful ?

b) Albuterol 0.083% solution for inhalation contains
____ g Albuterol / _____ ml

how much Albuterol is there in each 3ml container _____ g Albuterol

c) Timolol Eye Drops 0.25% x 15ml contains
____ g Timolol / _____ ml

how much drug will be in each 15ml bottle of solution ?
how much drug will the patient receive in each drop, assuming 20 drops/ml ?
how much benzalkonium chloride, used at 0.1% concentration as a preservative, will the patient receive in each drop ?

d) SSKI is short for “Saturated Solution of Potassium Iodide.”
Potassium Iodide becomes saturated at a concentration of 1g/ml.
What percent strength will this solution contain ?

e) A patient is instructed to dilute 0.3ml of SSKI in one glass (assume 8oz) of water and drink QID. How much potassium iodide will the patient receive each day ?

28) Please calculate the normal or therapeutic ranges in SI units of the following drugs or electrolytes from the normal or therapeutic ranges given in commonly-used U.S. units.

a. Phenytoin Therapeutic serum concentration range 10-20 mg/L.

Calculate the serum concentration values in units of µMol/L. given that Phenytoin MW: 252. Therapeutic phenytoin SI range = µMol/L

b. Theophylline. Therapeutic serum concentration range 10-20 mg/L.

Calculate the serum concentration values in µMol/L. given that Theophylline MW: 180. Therapeutic theophylline SI range= µMol/L

c. Chloride. Normal serum concentration range 95-105 mEq/L.

Calculate the serum concentration values in units of mMol/L. given that Chloride MW: 35.5. normal chloride SI range = mMol/L

.

d Carbon dioxide. Normal serum concentration range 22-28 mEq/L.

Calculate the serum concentration values in units of mMol/L. given that CO2 MW: 44. normal CO2 SI range = mMol/L

29) Penopril, an Intravenous antibiotic is prescribed for your patient. The preparation comes as a 4gm in 50ml infusion pack and the recommended dose is 50mg/Kg per day in four divided doses. How much of the infusion will be required for each dose for your patient whose weight is 95Kg

30) On the ward with a junior doctor, he asks you to calculate the oral Digoxin maintenance dose for a Fred Smith. Fred is 1.75 metres tall and weighs 76Kg and is 85 years old. His serum creatinine is currently 125 micromoles / ml. The doctor wants a serum concentration of 1.5mcg/ml. Calculate the maintenance dose to the nearest microgram.

You may need <u>some</u> <u>or</u> <u>all</u> of the following formulas and values : -
Ideal Body Weight = (0.9H -88) for males H = Height in cm
Creatinine Clearance = (1.23 (140 - Age) x Wt) / (Serum Creatinine)
Digoxin bioavailability = 0.7
Digoxin clearance = (0.8 x Wt) + CL_{CR}
S = 1 (Salt Value)
C = 1.5 mcg/L
T = 24 hrs

31) You are on the Oncology day unit checking the prescription chart for Fred Ment. Fred was born in 1938 and is written up for Carmustine to treat a tumour of the brain. Fred weighs 60kgm. The drug is to be given by intermittent infusion in 0.9% Sodium Chloride. Fred has been prescribed a dose of 400mg. You decide to check his dose and see that the recommendation is 200mg/m^2 . You check Freds height with him as he looks quite short and he tells you his height is about 5 ft 3 inches. Is this the correct dose for Fred and if not, what is ? (Use the nomogram for Q18).

32) You have 10% Coal Tar Ointment and Coal Tar. A Doctor prescribes Coal Tar Ointment 12%. Assuming no waste, what weight of Coal Tar Ointment 10% and Coal Tar (assume w/w) will you need to supply 120gms of 12% Ointment

a)	108gms Ointment,	12 gms Coal Tar
b)	112.6gms Ointment,	7.4gms Coal Tar
c)	117.33 gm Ointment	2.67 gms Coal Tar
d)	118gms Ointment	2gms Coal Tar
e)	118.3 gms Ointment	1.7gms Coal Tar

33) You receive a prescription for Acecor for a child but the dose is 6.25mg QDS. The only available preparation are capsules containing 25mg. You discuss this with the paediatrician and agree to supply powders made with lactose that each weigh 200mg.
You are required to supply 30 days treatment. What weight of lactose needs to be added to the capsules to manufacture the powders ? Each capsule weighs 75mg

a) 15.125gm
b) 21.75gm
c) 22.8gm
d) 23.625gm
e) 24.75gm

34) You are about to manufacture a mass that will be used to produce a batch of 1 million tablets
The tablets will weigh 250mg each and the weight of active ingredient will be 100mg
A binder of methylcellulose is to be used representing a total weight of 5% of the final weight.
This will be added as a 25% solution and the solvent will be lost through drying.
What volume of the Methylcellulose solution will be required ?

a) 10 Litres
b) 25 Litres
c) 50 Litres
d) 75 Litres
e) 100 Litres

35) A Pharmacist keeps a stock of Methadone for his single addict.
He notices that a 5 litre supply will supply this addicts needs for 14 days.
After a short while the Pharmacist agrees to take on the addicts partner.
He notices that the 5 litre supply now lasts for only 10 days.
The addict informs him that he will be going on a long holiday but his partner will be remaining behind.
For how long will a 5 litre supply meet the addicts partners needs ?
(calculate to the nearest day)
What is ‘odd ‘ about this calculation ?

Chapter 3

1) You receive a prescription for Morphine Sulphate Mixture to be extemporaneously made by a supplier and purchased in. The mixture is for a child to use and the requested dose is 13mg in 5ml. You check with the doctor and confirm the strength.. Having bought 500mls of this mixture you then decide to clarify its CD status. The Schedule indicates that Morphine below 0.2% calculated as anhydrous Morphine is CD invoice POM otherwise it should be treated as a full CD POM.

MW Morphine = 303.4 Morphine (Anhyd) = 285.4
Morphine Sulphate = 758.8
Morphine is monovalent i.e. $(Morphine)_2$ SO4

Which CD classification does this preparation come under ?

2) A Patient is prescribed Prednisolone as a descending dose course.
The patient is to take 60mg OD reducing by 10mg every 2 days until a dose of 10mg is reached. She is then to take 10mg for 7 days and 5mg for 7 days and then stop.
How many 5mg tablets would be need to be supplied
If using both 25mg and 5mg tablets, how many tablets would need to be supplied ?
What is the total dose of Prednisolone taken ?

3) A 5 year old Child has been admitted to your ward with Herpes Simplex Encephalitis.
The Child weighs 15Kg is 80cm tall and has a Body Surface Area of $0.6m^2$.
The child is prescribed Aciclovir I/V at a dose of 500mg per m^2 8hrly for 10 days
Which of the following is the correct dose for this child if following this regimen:-
Is this the recommended dosage for this condition ?

a) 0.1g tds
b) 0.3g tds
c) 300g tds
d) 7.5g tds
e) 30g tds

4) You receive a prescription for the following :-
Alendronic Acid Ointment 0.3% w/w in white soft paraffin x 75gms
Which of the following is the correct formula :-

	Alendronic Acid	**White Soft Paraffin**
a)	2.25gms	to 75gms
b)	225mg	to 75gms
c)	22.5mg	to 75gms
d)	225mcg	to 75gms
e)	22.5 micrograms	to 75gms

5) The required dosage for Dobutamine hydrochloride by intravenous infusion is 5mcg/Kg/minute. One 20ml vial of Dobutrex is added to 1 Litre of NaCl 0.9% w/v. For a 75Kg adult, the infusion rate per minute, should be set at:-

a) 1.0ml
b) 1.5ml
c) 2.0ml
d) 2.5ml
e) 3.0ml

6) A Doctor running a trial requests the appropriate dosage of Sodium Nitroprusside that he would need to administer to provide a dose of 4.4nanomoles / kg /minute
If the patient weighs 76Kg what volume will be administered in 24 hours by syringe pump.
MWt Sodium Nitroprusside = 298
Sodium Nitroprusside is supplied as a 50mg in 5ml Injection.

7) The half life of a drug is the time that it takes for the body concentration to approximately Halve. Values are approximate but complete the following table using the values given.
(Calculate the Time and Concentration values in Bold Font – last two columns)

Drug	Half Life in Hrs	Initial Conc	**Time to reach :-**	**Concentration after**
Digoxin	48	1.5mcg/L	**0.375mcg/l**	**1 day**
Theophylline	8	24mg/l	**1.5mg/l**	**1 day**
Phenytoin	24	20mg/L	**7.5mg/l**	**1 day**
Carbamazepine	35	14mg/l	**7mg/l**	**3 days**
Thyroxine	72	4mcg/L	**1mcg/L**	**3 days**
Amiodarone	360	18mcg/L	**1.25mcg/L**	**3 days**

8) An Infusion of Sodium Chloride 0.9% with 5% Glucose is to be infused over 12 hours. The total volume is 1.5 Litres. What drop rate needs to be set if the drop volume is 20 per ml.

9) Calculate the quantity of base required for 120 suppositories each containing 100mg Sodium Valproate Salt given a suppository mould capacity of 1gm. The base to be used is Theobroma oil and the displacement value for the salt is given as 1.6.
Use the formula :-

Quantity Base =
Number of Suppositories x Mould Capacity - (Quantity Drug (gms) / Displacement Value)

10) Your dispenser has made 250gms of Coal Tar 10% in White Soft Paraffin.
You check the prescription and realise that 250gms of 20% were required. What quantity of Coal Tar do you need to add to the 250gms of 10% to convert it to 20% dilution ?

11) The formula for Creatinine Clearance is :-

Creatinine Clearance (CLCR) = (C (140 - age) x Weight) / Serum Creatinine
C = 1.23 for males and 1.04 for females
Weight is in Kg
Serum creatinine in micromols/Litre
Creatinine Clearance is in mls / minute

Remember that

CLCR	= <10mls/min	Severe renal impairment
	= 10-20mls/min	Moderate renal impairment
	= >20mls/min and <50mls/min	Mild renal impairment
	= >20mls/min and <50mls/min	Mild renal impairment

Calculate the missing values from the following table. Try not to use a calculator !!

Patient Sex	Patient Age	Patient Weight	Serum Creatinine	Creatinine Clearance
F	65	55	280	*****
**	60	50	300	16.4
M	57	72	185	*****
F	85	55	350	*****
M	****	40	240	175

12) In the following table, the approximate equivalence of Diamorphine to Morphine BY POTENCY is given for each route. Fill in the missing equivalent doses.

Route	Equivalence	Diamorphine dose	Morphine dose
I.V.	3:1	30mg	
I.M.	2.5:1	60mg	
S.C.	2.1		50mg
P.R	2:1	30mg	
P.O.	1.5:1	10mg	

13) Dextromoramide is twice as potent as Morphine but is shorter acting and hence needs to be given every three hours. Calculate the dose of Dextromoramide that would be equivalent to 50mg Morphine Sulphate QDS.

14) According to the BNF (Pge 12 , Ed 43) The approximate dose of a drug for a child patient can be calculated from their Body Surface Area (BSA) in M^2 according to the following formula :-

(BSA / 1.8) x AD = calculated dose AD = Adult Dose

This is based on an ideal BDSA of 1.8 for a 70Kg adult

Fill in the missing values on the following chart
(You may need to refer to the BNF for one or two to calculate the BSA) :-

Body Weight	Age	Calculated BSA	Adult Dose	Calculated dose
		1.4	6gm/day x 6hrly	
		2.1	250mg	
		1.7		150mg
		2.7		20mg QDS
15	7		200micrograms	
	11	1.2	120mg TDS	

15) The standard formula for calculating the rate of administration using a syringe pump is as follows :-

R = (D x W x 60 x V) / (1000 x T)

Where :-

R = Rate in mls/hr D = Dose in mcg/Kg/Min
W = Weight in Kg V = Volume in Syringe in mls
T = Total amount of drug in syringe in mg

Fill in the missing values :-

R	**W**	**D**	**V**	**T**
	70	25	25	500
3	50	15	25	
7.5		20	50	400
10	63		50	1250
6	72	12.5		900

Chapter 4

The following questions are from Pharmaceutical Society Sample papers and are Multiple Choice Questions. They were originally Open Book (You may {need to refer} to the BNF, Drug Tariff or MEPG) or Closed Book in which case no additional references should have been needed.

As of 2002 the calculations are all in a separate section of the Open Book Exam.
Open Book calculation questions MAY need referral to the reference source books

These questions should be capable of being answered within the timeframe of the RPSGB Pre-reg exam which allows 1.7 minutes for open book questions and 1.2 minutes for closed book questions .

Original Open Book Questions - Simple Completion

1) Which of the following is the correct recommended dosage for a 18 month old child that weighs 14 Kg of Salbutamol Oral Solution ?

a) 3ml qds
b) 3.5ml qds
c) 4ml qds
d) 4.5ml qds
e) 5ml qds

2) A patient with cardiovascular disease is on a restricted sodium diet. You receive a prescription from the patients GP for Gaviscon Liquid. The prescription dose is 10mls qds pc. The patient advises you that they actually double the dose and take 20mls qds. How many mmols Sodium ions is the patient taking in 24hrs.

a) 36mmols
b) 42 mmols
c) 48 mmols
d) 54mmols
e) 60mmls

3) 75mls of which one of the following solutions would provide 2.25gms of active ingredients

a) Potassium Permanganate Solution BP
b) Hibiscrub cleansing solution
c) Ster-Zac Bath Concentrate
d) Hydrogen Peroxide 20 volume
e) Hydrogen Peroxide 10 volume

4) A Patient needs to receive 60mmols Potassium Chloride intravenously. As part of their TPN. The maximum dose the patient is to receive is 5mmols / hour and they are to receive it by intravenous infusion over a maximum of 24 hours.
30mls of Potassium Chloride Concentrate Sterile are included as part of a 2.5 litre TPN Infusion bag which is to be administered. Which of the following is the nearest maximum drop rate per minute assuming 20 drops per ml

a) 700 drops / minute
b) 420 drops per minute
c) 210 drops per minute
d) 70 drops per minute
e) 35 drops per minute

5) An elderly gentleman is admitted to your ward and the doctors require him to receive Digoxin as he is suffering from atrial fibrillation. He is aged 72 and weighs 76Kg. The ward have Digoxin tablets 0.0625mg. These have a bioavailability of 0.75 and the volume of distribution is 7.5litres / Kg. The Doctors wish to achieve a therapeutic level in the range of 1.5 to 1.75mcg/Litre. How many tablets should be given as a loading dose ? Formula = Loading Dose = (Concentration x Volume of Distribution) / Bioavailability

a) 5-6 x 0.625mg tablets
b) 10-12 x 0.0625mg tablets
c) 15-16 x 0.0625 mg tablets
d) 19-22 x 0.0625mg tablets
e) 25-27 x 0.0625mg tablets

6) Drug A consists of 75mg tablets , The tablets are large oval, enteric coated and orange in colour and weigh approximately 300mg. A Patient is admitted to the casualty unit having taken an overdose. The contents of their stomach reveal a mass of orange tablets weighing approximately 94gms and no other visible tablet / drug debris. How much of the drug is likely to have been taken as an overdose ?

a) 6gms
b) 12gms
c) 18gms
d) 24gms
e) 30gms

7) Which of the following contains approximately 20mmols Potassium (K^+)

a) Kay-Cee-L Syrup 5mls
b) Kloref tablets x 3
c) Slow K tablets x 6
d) Sando-K tablets x 4
e) Potassium Chloride Concentrate Sterile x 5mls

8) You receive a prescription that requires you to supply 150gms of a 1.5% Drug Y in cetomacrogol cream. You have only cetomacrogol cream and a 2.5% Drug Y in cetomacrogol cream preparation. What quantity of the 2.5% cream do you need to dilute to 150gms to prepare a 1.5% Drug X cream ?

a) 30gm
b) 45gm
c) 60gm
d) 75gm
e) 90gm

9) A concentrated antiseptic solution contains Chlorhexidine Gluconate and Cetrimide in the ratio 20:1. If a 25ml sachet contains 0.015% of Chlorhexidine, how many milligrams of Cetrimide will it contain.

a) 187.5mg
b) 75mg
c) 18.75mg
d) 7.5mg
e) 187.5 micrograms

Section 2 Classification

For all the following questions, you are provided with 5 lettered options. For each numbered question select the one lettered option which is closest to the correct answer. Each lettered option may provide the answer once, more than once or not at all in each question set

Questions 1-3 These all concern quantities of Sodium Bicarbonate :-

a) 0.15g
b) 1.5g
c) 15g
d) 150g
e) 1500g

1) is contained in Aromatic Magnesium Carbonate 30mls

2) is contained in 300gms Magnesium Trisilicate oral powder

3) is contained in 3mls Kaolin and Morphine Mixture

Questions 4-6 These all concern the number of millimols of Sodium.

a) 1mmol
b) 10mmol
c) 100mmol
d) 150mmol
e) 1000mmols

4) is or are contained in approximately 60gms Sodium Chloride

5) 100mls of a low sodium antacid must contain less than this quantity of mmols of Sodium

6) Is just at the top of the approximate normal human plasma level of mmols Sodium per Litre

Section 3 - Multiple Completion

For each of the questions in this section ONE or MORE of the responses are correct.
Decide which and then choose :-

A if 1, 2 and 3 are all correct
B if 1 and 2 only are correct
C if 2 and 3 only are correct
D if 1 only is correct
E if 3 only is correct

Directions Summarised				
A	**B**	**C**	**D**	**E**
1,2 and 3	1 and 2 only	2 and 3 only	1 only	3 only

1) A Patient has been advised by his Doctor to take supplemental Iron. He has been recommended to take approximately 200mg Ferrous Iron daily. Which of the following would meet those requirements :-

1) 2 x Feospan Capsules
2) 2 x Ferrograd Tablets
3) 2 x Fersaday Tablets

2) Which of the following statements is or are correct (according to the BNF) :-

1) 100mg oral morphine is equivalent to
30mg Diamorphine subcutaneously

2) 120mg S/R oral Morphine is equivalent to
10mg Diamorphine I.M. x 4 hourly x 4 doses

3) 500mg S/R oral Morphine is equivalent to
30mg oral Diamorphine x 4 hourly

3) A two year old child weighing 13kg is to be treated with intramuscular pethidine hydrochloride to relieve pain. Which of the following doses fall within the BNF recommendations :-

1) 0.8ml of a 10mg in 1ml injection
2) 0.3ml of a 50mg in 1ml injection
3) 0.6ml of a 50mg in 1ml injection

4) Which one of the following would provide a dose of 250mg of Dubutamine

1) 20mls of a 1.25% Injection Solution
2) 0.5mls of a 10gm in 20ml Injection concentrate
3) 1.25mls per minute over 1 hour of a 3gm in 900ml infusion

Section 4 - Assertion / Reason

The following questions consist of two statements. Decide whether the first statement is true or false and then decide whether the second statement is true or false. Then choose as follows :-

	First Statement	Second Statement	**Directions summarised**
A	True	True	2nd statement is a correct explanation of the first
B	True	True	2nd statement is **NOT** a correct explanation of the first
C	True	False	
D	False	True	
E	False	False	

1) **First Statement :-** 2 Litres of 8.4% Sodium Bicarbonate Solution provides 2000 mmols each of Na^+ and HCO_3^-

Second Statement:- 8.4% w/v Sodium Bicarbonate solution contains 1mmol/ml of electrolytes

2) Assume that it is correct that Granicidin for a 50Kg patient should be infused at a rate of 240mg per hour and answer with regard to the correctness of the following statements

First Statement :- 0.2% of Granicidin in a 500ml infusion bag should be infused at a rate of 60mls per 30 minutes

Second Statement :- This represents an infusion rate of 80mcg / Kg / Min

3) An injection contains 25mg of active ingredient in each 12.5ml ampoule

First Statement :- 1ml represents 8% of the volume in each ampoule

Second Statement :- 1ml contains 2mg of active ingredient

ORIGINAL CLOSED BOOK QUESTIONS – should not require reference to source texts

Simple Completion

1) You have been asked to calculate the daily dose for a Child who is 2 years old. The child weighs 16 kg. The recommended dose for a child of this age is 150mcg/kg/ 6hrs It is intended to infuse the drug in 500mls Saline over 24 hours. The injection comes in a strength of 2mg in 5ml. What volume of injection to the nearest 0.5ml needs to be added to the infusion bag.

   a) 22.5mls
   b) 23mls
   c) 23.5mls
   d) 24mls
   e) 24.5mls

2) Potassium permanganate is normally made as a concentrated solution which is then diluted prior to use. The concentrated solution is normally made as a 1 in 800 solution. You are asked to supply a patient with sufficient of this solution to allow them to use 250mls of the diluted solution (1 in 20) four times a day for 28 days. What quantity of Potassium permanganate will be contained in the volume of solution you supply :-

   a) 17.5gm
   b) 15gms
   c) 1.75gms
   d) 1.5gms
   e) 0.175gms

3) You receive a prescription in your pharmacy for peppermint water to provide a dose equivalent to 0.125mls tds for a ten year old child. You are asked to dilute this to provide the dose in 10mls. Assuming you are competent and still allowed to dispense extemporaneously, and assuming you are to supply 300mls of the final solution, what volume of peppermint water will you require ?

   a) 0.75mls
   b) 1.5mls
   c) 3.75mls
   d) 7.5mls
   e) 15mls

4) What weight of a substance is required to manufacture 6.5 litres of a solution such that when 10mls is diluted to 1 litre a 1 in 200,000 solution results ?

   a) 65gms
   b) 32.5gms
   c) 6.5gms
   d) 3.25gms
   e) 0.65gms

5) What volume of a 6.5% solution of Benzalkonium Chloride is required to produce 1.5 Litres of 4.25% Solution ?

a) 980mls
b) 990mls
c) 1,000mls
d) 1,100mls
e) 1,200mls

6) The formula for making Ferrous Sulphate Mixture is as follows :-

Ferrous Sulphate	60mg
Ascorbic Acid	10mg
Orange Syrup	0.5mls
Chloroform Water DS to	5mls

You are asked to prepare 900mls. What quantity of Ferrous Sulphate is required :-

a) 9.4 gms
b) 9.8 gms
c) 10.4 gms
d) 10.8 gms
e) 11.4gms

7) Referring to the above formula, what is the percentage concentration of Orange Syrup in 900mls of final solution ?

a) 0.1% w/v
b) 1.0 % v/v
c) 1.0% w/v
d) 1.0% v/v
e) 10% v/v

8) A 65kg Patient on your Cardiac Unit is to be transferred to intravenous Dopamine infusion. The Patient is to receive a dose of 4micrograms/ kg / minute. The infusion contains 250mg in 20ml of Dopamine which was added to 50ml Infusion Solution The infusion is to be administered via a 100ml volume syringe pump. What rate in mls / hour should the infusion rate be set at.

a) 4.4mls
b) 4.6mls
c) 4.8mls
d) 5.0mls
e) 5.2mls

9) You are asked to calculate the initial dose of a Cardiac Drug to be injected for a 5 year old Child who weighs 16.5 Kg . They are currently experiencing hypertensive difficulties. Each ampoule of drug contains 12.5mg in 10ml. What is the correct volume required if the recommendation is that you administer 7.5mg / kg

a) 1.0ml
b) 5.0ml
c) 10ml
d) 50ml
e) 100ml

10) A Patient is admitted through casualty having taken an overdose of Killeroxin. The patients blood levels are measured and the blood level is found to be 108 micrograms / Litre. It is now over 4 hours since the patient took their overdose so absorption may be considered complete.
The half life of the drug is 8.5 hours and its elimination is 1st order
Assuming that the maximum recommended therapeutic level is 14 micrograms / Litre, how many hours to the nearest complete hour or half hour will it take for levels to reach normal therapeutic levels.

a) 17.0 hours
b) 25.5 hours
c) 34.0 hours
d) 42.5 hours
e) 51.0 hours

11) Mrs Jones is HIV positive and has been admitted for caesarian section.. She weighs 63Kg and is 26 years old. During labour Zidovudine is to be administered IV at a dose of 2mg/kg over 1 hour. What volume of Sodium Chloride 0.9% is needed to produce a 2mg/ml Zidovudine Infusion for this patient. The Zidovudine is available as a 200mg in 20ml Ampoule.

a) 12.6mls
b) 25.2mls
c) 50.4mls
d) 63mls
e) 239.4mls

12) A patient's prescribed Prednisolone 75mg OD with instructions to reduce the dose by 10mg every 7 days until at 5mg and then to continue taking 5mg tablets for a further 14 days and then stop. How many tablets should be supplied ?

a) 255
b) 305
c) 355
d) 405
e) 455

13) A baby girl on your neonatal Unit has been admitted with meningococcal meningitis. The recommended treatment is Benzylpenicillin at a dose of 180mg/Kg/Day given in 4 divided doses. It's intended to use single vials of 600mg reconstituted to a final volume of 2ml for each set of daily doses, reconstituted in your CIVAS unit and four syringes are to be prepared and sent to the ward each day.. You contact the nursing staff and are informed that the girl weighs 6Kg. What volume should each syringe contain..

a) 0.8ml
b) 0.9ml
c) 1.0ml
d) 1.1ml
e) 1.2ml

14) You currently have Phenol 95% v/v . This solution is to be diluted to give a 1 in 10,000 v/v Phenol for swabbing down lab benches and walls . You are required to make 10 Litres of the diluted solution. How much of the Phenol solution will you require ?

a) 0.9ml
b) 0.95ml
c) 1.0ml
d) 1.05ml
e) 1.1ml

15) You are required to send 250mls w/v of a solution of Benzalkonium Chloride Solution such that when diluted 1 in 40 it produces a 1 in 1000 w/v solution. You have Benzalkonium Chloride concentrate 50% w/v. What volume of concentrate is required to produce your initial solution ?

a) 12mls
b) 15mls
c) 20mls
d) 25mls
e) 30mls

16) Paediatric Ferrous Sulphate Mixture contains 1.2% Ferrous Sulphate. The molecular formula of Ferrous Sulphate is $FeSO_4.7H_2O$and the molecular weight is 278. The atomic weight of Iron (Fe) is 56. How many milligrams of Fe are there in a 15ml dose of this mixture ?

a) 36mg
b) 40mg
c) 48mg
d) 60mg
e) 72mg

17) A Consultant requests the following :-
Dithranol 1.5%
Salicylic Acid 1%
in White soft paraffin x 150gms
Which of the following is the correct quantities to use :-

	Dithranol	**Salicylic Acid**	**White Soft Paraffin**
a)	1.5gm	1gm	147.5gm
b)	15gm	10gm	130gm
c)	2.25gm	1.5gm	150gm
d)	2.25gm	1.5gm	146.25gm
e)	20gm	15gm	125g

18) Drug X, a class 1 antiarrythmic is renally excreted. It is administered by intravenous infusion. The data sheet provides the following recommendations :-

Creatinine Clearance	**Dosage**	**Frequency**
>50ml/min	5mg/L kg	12 hrly
25-50ml/min	2.5mg/L kg	12 hourly
10-25ml/min	2.5mg/L kg	24 hrly
0-10ml/L kg	1.25mg/L kg	24 hrly

cont…..

The formula you are given for for Creatinine Clearance (CC) is

CC = (1.2(140 - A) x W)/ SC

A = Age, W = Weight (Kg) SC = Serum Creatinine(mmol/L)

You have a patient who is a 60yr old non obese male. He weighs 50kg and his last plasma creatinine was measured as 300mmol/L. This is remaining steady.
Which of the following doses of Drug X would be appropriate :-

a) 275mg x 12hrs
b) 125mg x 12 hrs
c) 125mg x 24 hrs
d) 75mg x 12 hrs
e) 75mg x 24 hrs

19) A solution of Sodium Acid Phosphate contains 109.2gms in 1 Litre.
This is equivalent to a 0.7 molar solution.
What is the Gram Molecular Weight or Relative Molecular Mass of Sodium Acid Phosphate

a) 3.12 ms
b) 15.6 gms
c) 31.2 gms
d) 156 gms
e) 312gms

20) The formula for Screenistat Ointment is as follows :-

Screenistat	2gm
Beeswax	20gm
White Soft Paraffin	30gm
Light Liquid Paraffin	25mls
Cetosteryl Alcohol	33gms

You are required to manufacture 750gm of the above.
Which of the following is the correct formula:

Ingredient	A	B	C	D	E
Screenistat	14gm	28gm	28gm	14gm	28gm
Beeswax	140gm	140gm	140gm	140gm	140gm
WS Paraffin	210gm	210gm	210gm	210gm	210gm
LL Paraffin	175gm	175gm	175ml	175ml	175gm
Cetosteryl Alc.	231gm	231ml	231ml	231gm	231gm

21) What amount of base is required to manufacture 50 suppositories, each containing 100mg Theophylline if each suppository will weigh 1gm and the displacement value of Theophylline is 0.5

a) 40gms
b) 42.5gms
c) 45gms
d) 47.5gms
e) 50gms

22) How many micromols of an active ingredient is contained in 2ml given that its Gram Molecular weight or RMM is 50gms and the solution is 1 in 10,000

a) 5
b) 4
c) 3
d) 2
e) 1

23) A 11 year old is having a two week stay with his parents in Eastern Transvaal (an Endemic malaria area). Assuming Chloroquine and Proguanil are the required medication, how many Proguanil hydrochloride tablets would be necessary to provide prophylactic cover for the child ?

a) 28
b) 49
c) 74
e) 98
f) 112

25) An infusion pump is used to administer Epinephrine (Adrenaline) to a patient at a rate of 4mls per minute. Adrenaline solution 1 in 10,000 is to be administered. What quantity in milligrams of adrenaline will be supplied per hour.

a) 24
b) 36
c) 48
e) 72
f) 112

26) What is the correct dose volume of Epanutin Syrup for a child weighing 15kg given that the initial daily dose is 5mg/Kg. Phenytoin suspension contains 60mg in 10ml and is recommended to be given at 12 hourly intervals

a) 62.5mls
b) 35mls
c) 25mls
d) 12.5mls
f) 6.25mls

27) A batch of 100,000 tablets containing 100mg of Drug A are about to be spray coated with a coloured enteric coating. This coating will represent 5% of the final tablet weight. Each tablet weighs 1.9gms. The tablets are to be rolled in a copper drum during this process and the coating will be applied at approximately 20 micrograms per second per tablet and dried with the simultaneous passing of hot dry sterile air. How long to the nearest minute will the spray coating take.

a) 20 minutes
b) 41 minutes
c) 62 minutes
d) 83 minutes
e) 104 minutes

28) A patient is being given Timoptol Eye Dops 0.5% for an eye infection.
They are using the drops every six hours and are putting two drops into each eye.
Assuming that 50% of each does is absorbed, what dose of Timoptol is being provided systemically every 24 hours. (Assume 20 drops = 1ml)

a) 1mg
b) 2mg
c) 3mg
d) 4mg
e) 5mg
f) 6mg

29) A Patient needs to be given 120mmols Of Phosphate intravenously, as part of their TPN. The maximum dose the patient is to receive is 2.5 mmols / hour and they are to receive it by intravenous infusion over time. The Phosphate is added as part of a 2.4 litre TPN Infusion bag which is to be administered over a maximum of 2 days. Which of the following is the nearest maximum drop rate per minute that needs to be set on the giving set (assuming 20 drops per ml) to administer the I.V.

a) 22 drops / minute
b) 34 drops per minute
c) 46 drops per minute
d) 58 drops per minute
e) 70 drops per minute

Section 2 Classification

The following 3 questions concern the following quantities :-

a) 70mg
b) 30mg
c) 18.75mg
d) 6.25mg
e) 2.5mg

Select from A to E the quantity that represents

1) 0.25% of 7.5gms

2) The number of mg of Potassium Chloride contained in 5 mls of an original solution which when diluted 1 in 250 provides 2.5mg in 500ml

3) Given the Molecular weight of Sodium Chloride is 60, contains 500 micromols of Sodium Chloride

The following 6 questions concern the following quantities :-

a) 1000millimols
b) 150mmols
c) 100mmols
d) 15mmols
e) 10mmols

4) The approximate number of millimoles per litre of Sodium in serum

5) The number of millimoles in one mole

6) The number of millimoles of Calcium equivalent to 200mEq Calcium

7) The approximate number of millimoles of Chloride in Serum

8) The approximate number of millimoles of Sodium excreted normally in 24 hours

9) The number of millimoles per litre Bicarbonate in a 100mEq per 100ml solution of Sodium Bicarbonate.

Section 3 - Multiple Completion

For each of the questions in this section ONE or MORE of the responses are correct. Decide which and then choose :-

A if 1, 2 and 3 are all correct
B if 1 and 2 only are correct
C if 2 and 3 only are correct
D if 1 only is correct
E if 3 only is correct

Directions Summarised				
A	**B**	**C**	**D**	**E**
1,2 and 3	1 and 2 only	2 and 3 only	1 only	3 only

Referring to the following values :-

1) 1mole
2) Molecular Weight in grams
3) The sum of the individual atomic weights

1) A Solution containing 1mole of active ingredient in 100mls diluted one part in 10 with purified water would contain in one litre ?

2) You are asked to make 2500mls of a Potassium Permanganate Solution such that when diluted 30 times, a 1 in 1800 solution is obtained. Which of the following are correct :-

1) The concentration of the 'mother' solution is approximately 1.7%
2) The concentration of the final solution is approximately 0.05%
3) The 1,800mls of Potassium permanganate will contain 10gms Potassium permanganate

An Exercise with Benorilate

Benorilate Suspension contains 2gm of Benorilate in 5ml
Benorilate tablets contain 750mg Benorilate

1gm of Benorilate is equal to 485mg Paracetamol and 0.525mg Aspirin

What is the maximum total daily dose of Benorilate suspension and tablets given that :-

Maximum dose of Paracetamol in 1 day is 4gm (8 x 500mg tablets)
Maximum dose of Aspirin in 1 day is 4gm (13? x 300mg tablets)

The maximum recommended dose of Benorilate is 6gms daily for the elderly. What dose of Aspirin and Paracetamol does this represent.

An Exercise with Potassium Chloride

1) Potassium Chloride is to be administered to a child weighing 44lbs at a dose of 0.5mEq Potassium per Kg
This is prescribed to be administered over 4 hours in 250mls of 5% Dextrose Saline
The maximum recommended rate of administration for Potassium Chloride is 1.5 Meq/kg/24 Hours for a child

Assume that 2.2lbs = 1 Kg

Questions

1) What is the Patients weight in Kg
2) What is the dose of Potassium to be administered
3) What is the mmol equivalent of Potassium Chloride
4) What is the maximum recommended 24 hour dose for a child of this weight
5) Using Potassium Chloride Concentrated solution (sterile) how much would you add to a 250ml bag
6) Why would you use the concentrate
7) Is the infusion rate within the recommended limits
8) Assuming the dose is within recommended limits what is the flow rate in drops / minute (assume 20 drops/ml)
9) What is the error level if the drop rate is rounded down/up – is this acceptable
10) If the maximum recommended dose rate were 25% of the one recommended above, what would be the maximum flow rate you could use.
11) When made up, what is the concentration of Potassium chloride in 250mls in parts per 1000 as w/v
12) What is the answer to Q9 expressed as a percentage.

Some Useful Maths

Tips

Always keep units the same and the number of significant places (if relevant) and where possible use whole numbers rather than fractions. If asked to calculate a drug dose, don't give an answer like 1.34654mg. Round up as 1.35mg . Limit your answer to practical levels of accuracy. Also be aware of human errors and /or discrepancies. One RPSGB asked "How many milligrams of ...." and then gave a multiple choice answer in which the correct answer was in micrograms.

Some useful values to remember are :-

10mg in 1ml	= 1% w/v or 1gm in 100mls
1mg in 1ml	= 0.1% w/v or 1gm in 1000mls (1 Litre)
1mcg in 1ml	= 0.0001% w/v or 1gm in 1,00,000 mls 1 in a million
1000mls	= 1 Litre
1 ml	= 1 millilitre (This is often forgotten)
1 mol	= 1000 millimols (normally written as 1000 mmol)
1 millimole	= 1,0000 micromoles
1 micromole	= 1,000 nanomoles
1 mol / litre	= 1 mmol / ml, 1 mmol / litre = 1 microlmole / ml
1 Mole	= Molecular Weight in grams or Relative Molecular Mass in grams
1 Molar solution	= Gram Molecular Weight or Relative Molecular Mass in grams in 1 Litre

Displacement Values

To convert weights to volume you may need to use specific gravity / density e.g. if asked to produce a weight in volume of two liquids. (rare). The commonest way you will encounter this is 'Displacement Values' which indicates the relative density of an active ingredient and its diluent base. The displacement value is the number of parts by weight of an ingredient that will displace one part by weight of the diluent base. Displacement values are only required where the quantity of active ingredient is quoted as a quantity rather than as a percentage. This is to ensure an accurate dose is administered ad is usually required for solid dosage forms for internal use e.g. tablets, capsules, suppositories, pessaries etc.

The formula is $A - (B/C) = D$

Where
A = Final weight required
B = Weight of Active Ingredient
C = Displacement Value
D = Weight of Diluent to use

PARTS AND RATIOS

1 part in 10	= 10%	= 100mg in 1ml w/v
1 part in 100	= 1%	= 10mg in 1ml w/v
1 part in 1,000	= 0.1%	= 1mg in 1ml w/v
1 part in 10,00	= 0.01%	= 1mg in 10mls w/v
1 part in 1,000,000	= 0.0001%	=1 microgram in 1ml w/v
1 part in 8,000	(= 0.1% / 8)	= 0.0125% w/v

In an expression such as 1 in 1000, it will be assumed you know the SI units are equivalent
I.e. it is 1gm in 1000mls and not 1mg in 1000mls

1:3 implies a ratio of 1 part of A to 3 parts of B i.e. 4 parts in total	= 1 in 4
1:5	= 1 in 6 etc
1:10	= 1 in 11

Ratios are usually used where there are two active ingredients in a common base.
e.g. A Solution of Chlorhexidine and Cetrimide solution where the ratio of Chlorhexidine to Cetrimide may be present in the ratio of 1:10 . I.e. the strength of Cetrimide is 10 times stronger than the Chlorhexidine

Some Roman Numerals

These are usually now only encountered in prescribers 'dosage instructions'.

ss = ½	xi = 11	I or L = 50
I or I = 1	xii = 12	XXX = 30
ii = 2	xiii = 13	Xl or XL = 40
iii = 3	xiv = 14	C = 100
iv = 4	xv = 15	D = 500
v = 5	xvi = 16	M = 1000
vi = 6	xvii = 17	
vii = 7	xviii = 18	
viii = 8	xix = 19	
ix = 9	xx = 20	
x = 10	xxi = 21	

Duration of Supply

1/7 = 1 day   1/52 = 1 week   1/12 = 1 month (28 days)
7/7 often means give a full weeks supply

Frequency of Administration

tds or TDS = Three times a day   qds or QDS = Four times a day
stat = immediately   od or OD = daily

Ideal Body Weight

IBW = (0.9xH) - X   H = height in cm
X = 88 for Males, X = 92 for Females

Bioavailability

The Bioavailability of a drug (usually given as F) is the fraction of any dose which reaches the systemic circulation. It is normally given as a number between 0 and 1. This is NOT the same as the amount of base drug where different presentations of a drug may use different salts . The salt value is usually given the letter S

Quantity reaching systemic circulation = Bioavailability (for that route) x Salt fraction x Dose Q=F x S x D

The concept of bioavailability indicates that for any drug, a bioavailability of less than 1 indicates some of the drug is not absorbed. Therefore is it is known what therapeutic drug level is required, two new doses can be identified :-

Loading Dose = initial dose to achieve a particular therapeutic drug level
Maintenance Dose = dosage to maintain a particular therapeutic drug level

So Quantity of Drug in Systemic Circulation = Target concentration x Bioavailability
and by substituting from above
Loading Dose = Quantity of drug in body / F x S

Loading doses are normally calculated on the assumption that no or little elimination occurs while reaching initial therapeutic levels. This is valid if half lives are long and absorption rapid. It is considered unnecessary to account for elimination where the infusion of a drug or its absorption is less than 1/4 of the half life

Maintenance Dose = Quantity of drug removed / F x S

but Amount of drug removed = $V_{D \times C}$

so Maintenance dose (mg/hr) = VD x C / F x S

This would be multiplied by the frequency of dosing

so Maintenance dose (mg / H hrs) = (VD x C / F x S) x H

Volume of Distribution (Apparent)

VD = Amount of drug absorbed / serum concentration = Q/ C

Also	Q = F x S x D	
So	VD = F x S x Q / C	
And by substituting in Loading Dose	= C x VD / F x S	(C x VD = Q)

Vd = (Apparent) Volume of Distribution and its units are always expressed in litres / kg body weight.
For a 50Kg patient with a Vd of 6 litres, the total apparent distribution volume = 6 x 50 = 300 Litres

Creatinine Clearance

Creatinine Clearance (CLCR) = (C (140 - age) x Weight) / Serum Creatinine

C = 1.23 for males and 1.04 for females
Weight is in Kg
Serum Creatinine in micromols/Litre
Creatinine Clearance is in mls / minute

CLCR	= <10mls/min	Severe renal impairment
	= 10-20mls/min	Moderate renal impairment
	= >20mls/min and <50mls/min	Mild renal impairment

<u>These may or may not be of use</u>

100	= 1	= 1/1
50%	= 0.5	= 1/2
25%	= 0.25	= 1/4
12.5%	= 0.125	= 1/8
6.25%	= 0.0625	= 1/16
3.125%	= 0.03125	= 1/32

Can't divide by 5 Then multiply by 2 and divide by 10 = easier

<u>If using a giving set graded in drops</u>

20 drops = 1 ml (adult)	No of drops per minute = No of mls per hour / 3
60 drops = 1 ml (paediatric)	No of drops per minute = No of mls per hour

ALLIGATION – A Brief Introduction

Dilution by Alligation

This is really a simple method of calculating the required quantities of two different concentrates to provide a final solution. Here is a simple example :-

Solution A has a concentration of Ac (and is the stronger solution)
Solution B has a concentration of Bc (and is the weaker solution)

We require some amount (Volume here although it works equally well for weight) of a Solution of concentration Fc

Alligation

Parts of Solution A required = Final Required Concentration – Concentration of Solution B
This can be expressed as Pa = Fc - Bc

Parts of Solution B required = Concentration of Solution A - Finalor Required Concentration
This can be expressed as Pb = Ac – Fc

Also Total parts = Pa + Pb = (Fc - Bc) + (Ac - Fc) = Ac – Bc

These simple formulae can be used for either weights or volumes.
Weights and volumes can be intermixed as long as you ensure you use the right units for the amounts required. (In reality there may be some slight variations due to Specific gravity, density etc.)

Alligation represented diagrammatically

Alligation can be represented as a square where the formulas lie along the diagonals

Concentration Of First solution (Ac)				Parts of First Solution needed (Pa)
	-		=	
		Required Concentration (Fc)		
	-		=	
Concentration of Second Solution (Bc)				Parts of Second Solution Required (Pb)

Example using weights

You have an ointment that contains 55% of ingredient A
You also have an ointment that contains 15% Ingredient A
You are required to dispense a 500 gms of an ointment containing 35% of ingredient A.
You have no alternative but to mix quantities of the ointments above.
What quantity of each of the above would need to be mixed together to provide 500gms of 35% A ?

By Alligation :-
Parts of the 55% ointment required would be 35 - 15 = 20 parts (Pa = Fc – Bc)
Parts of the 15% ointment required would be 55 -35 = 20 parts (Pb = Ac – Fc)

20 + 20 = 40 parts in total and there would be 20 parts of each or simply put there would be 50% of each
So here there would be 50% of each and the total number of parts = 40 = (55-15)

<u>Example 2 – Using Volumes and Weights combined</u>

We have a 6% Solution of Chlorhexidine
We require 1 litre of a 30% solution
This is to be made by adding Chlorhexidine.
How much Chlorhexidine needs to be added ?

(Note - The concentration of Pure Chlorhexidine should be treated as 100%)

<u>By alligation</u> :-

Parts of Chlorhexidine (powder) required = 30 - 6 = 24 parts (Pa = Fc – Bc)
Parts of Chlorhexidine 6% solution required = 100 - 30 = 70 parts (Pb = Ac – Fc)
(remember the Chlorhexidine is 100%)
Total parts = 70 + 24 = 94

Therefore to make 1 litre you would need
(70 / 94) x 1000 parts of 6% Chlorhexidine solution - 744.68 **<u>mls</u>**

And of Chlorhexidine you would need
(24 / 94) x 1000 gms = 255.32**<u>gms</u>** (24 out of 94 parts of the 1000mls <u>BUT in grams</u>)

<u>A quick checksum on calculation</u> above
In 1 litre of 30% solution there must be 300gms Chlorhexidine

744.68mls of 6% Chlorhexidine contain 6 x 7.45gms Chlorhexidine = 44.7gms
(each 100mls contains 6gms so in 744.68mls (745mls approx) there are 6 x 7.45gms)

and 44.7 + 255.32 = 300gms (approx)

- some rounding up and down was done to keep to 2 significant decimal places.
- (and note that Ac - Bc = 100 - 6 = 94 parts)

<u>Example 3 using Volumes only</u>

You have a solution of Potassium Permanganate of 4 %
You also have another Potassium Permanganate Solution containing 50%.
How much of each is needed to produce a 300mls of a solution that is 24%

<u>By alligation</u> :-

Pa = 24 - 4 = 20 parts A is the 50% Solution
Pb = 50 - 24 = 20 parts B is the 4% Solution
Total parts = 20 + 26 = 46 parts (Note that Pa - Pb = 50 – 4 = 46 parts)

Therefore what is needed is 46 parts which equal 300mls :-

Of A
(20/46) x 300mls of Solution A = 130.43 mls (i.e. 20 parts out of 46 will be Solution A)

and of B
(26/46) x 300mls of Solution B = 169.56mls (i.e. 26 parts out of 46 will be Solution B)

(and as a check, note that 169.56 + 130.43 = 300)

A Little More on Alligation

Alligation – Definition

1) The act of tying together or attaching by some bond, or the state of being attached.
2) – *(Arithmetical)* A rule relating to the solution of questions concerning the compounding or mixing of different ingredients, or ingredients of different qualities or values.

Here's a non-pharmaceutical example of the Alligation Process

A zoo has 80 animals.
When counted, the legs of the animals add up to 260.
The Zoo has only 2 legged animals and 4 legged animals.
All the 4 legged animals are alligators,

How many alligators are there ?

1) 30 Alligators
2) 40 Alligators
3) 50 Alligators
4) 60 Alligators

Solution:-

Let the number of 4 legged animals = Pa (They have the biggest concentration of legs)

Then the number of 2 legged animals = Pb (They have the smallest concentration of legs)

Pa + Pb = 80 As there are 80 Animals in total (The animals are the 'Parts')

Pb = 80 – Pa. (Simply re-arranging the equation)

Now the animals are either 2 legged or 4 legged.

Therefore, the total number of legs (Which we know is 260)

= (Pa x 4) + (Pb x 2) (As all the PA animals have 4 legs and all the Pb Animals have two legs) and Pb = (80-Pa)
so:-
4Pa + 2(80-Pa) = 260 (See the re-arranged equation above where Pb = 80-Pa and 260 = total number of legs)
so
260 = 4Pa + 2(80 – Pa) (as there are 260 legs in total and a bit of re-arranging)
260 = 4Pa + 160 – 2Pa
260 = 2Pa + 160
2Pa = 100 (2Pa = 260 – 160)
Pa = 50

So the number of 4 legged animals = 50

And so the number of Alligators = 50

And the number of 2 legged animals = 30 (80-50)

The method used here is simply to substitute animals as each part than mls or gms as in a pharmaceutical calculation.

Calculations - Answers

Chapter 1

1) 30% is 30gms in 100mls. 750mls will therefore contain 30 x 7.5gms of Potassium Citrate = 225gms and will also contain 1 x 7.5 mls of Quillaia Tincture. Although simple check you gave an answer in Gms and Mls

2) 0.2mg in 1ml = 2mg in 10mls = 20mg in 100mls
20mg in 100mls IS NOT 20%
20mg in 100mls = 10mg in 50mls = 100mg in 500mls = 1000mg (1gm) in 5,000mls
1gm in 5,000mls now 1gm in 100mls is a 1% solution
and 1gm in 5,000mls is a dilution of that strength by 50 times
so the percentage strength must be 1/50th of 1% or 1/50% or 0.02%
That's a very long way of getting the answer. An alternative way is to convert to gms
0.2mg in 1ml is 0.0002gms in 1ml Multiply by 100 to convert to percentage
0.0002 x 100 = 0.02gms in 100mls = 0.02%
the first method although longer allows you to see the relationships more clearly and to have a picture of the actual ratios of the materials involved.

3) The dilution required is from 2% to 0.25%. i.e. 1 in 8 or 1 part to 7 parts of diluent
So you will require 200/8 parts of 2% Cream = 25gms
and (200/8) x 7 parts of diluent = 25 x 7 = 175gms

4) This is a little more difficult. You need to find the ratio between the two starting solutions and the final solution. This is done by obtaining the difference between the final 'strength' the initial strength thus :-
50% ~ 10% = 40% and 5% ~10% = 5. Therefore the ratio of parts to use is
to use is 40 : 5 or 8: 1. This means 8 parts to every 1 part NOT 1 in 8 and this method of calculating the relative proportions is known as alligation.
So to make a 750mls of a 10% Solution use 750/9 mls of 50% and (750x8) / 9
or 83.33mls of 50% and 666.66mls of 5%

5) 600 ppm means 600 parts per million or 6 parts in 10,000 or 0.6 parts per 1,000mls.
or 0.006 parts per 100mls or 0.006% (or from above 0.9 parts in 1,500 the total volume)
1gm of crystals contains 159.7 / 249.7 gms $CuSO_4$. Also the purity is 97.5% so the actual quantity is (157.9 x 97.5) / (249.7 x 100) gms in each 1gm crystals = 0.6235gms.
So each 1gm contains 0.6235gms $CuSO_4$. We need 0.9gms so the quantity of crystals needed will be 0.9 / 0.6235 = 1.4434 gms or 1.44gms correct to 2 decimal places.
The full formula is Q = (600 / 1, 000,000) / ((159.7 / 249) * (97.5/100)))* 1500
(I haven't checked the real MW of $CuSO_4$ but it is NOT relevant here. It can be important to know Mws as in at least one exam the MW of Sodium Bicarbonate was misquoted making the calculation impossible with the figures given. However some people who knew the MW were able to identify the error and correctly identify the correct answer from those offered.

6)
a) When diluted 1 in 50 produces a 1 in 10,000 solution
So original strength was 1 in (10,000 / 50) = 200 or 1 in 200
1 in 200 is 0.5 in 100 = 0.5%
or longhand as a single formula ((1/10,000) * 50 * 100) %
= ((50 * 100)/ 10,000) %

b) When diluted 1 in 40 gives a solution containing 15mg in each 1ml
So original strength was (15 x 40)mg in 1ml = 600mg in 1ml
600mg = 0.6gms = 0.6gm in 1ml and 60gms in 100mls = 60%
or as a single formula (((15 x 40) / 1000) * 100)%

c) Contains 1 part per 10,000 of a drug with a molecular weight of 350
The molecular weight is here to throw you. This is not an uncommon practice in exam questions.
1 part in 10,000 = 1 in 10,00 or 0.1 in 1,000 or 0.01 in 100 = 0.01%

7) The weights or volumes for 300gms or mls of the following

a)	12 % w/v	= 300/100 x 12 gms	= 36gms
b)	.3.2 % v/v	= 300/100 x 3.2 mls	= 9.6 mls
c)	5.5% v/w	= 300/100 x 5.5 mls	= 16.5 mls
d)	7.8 % w/w	= 300/100 x 7.8 gms	= 23.4 gms

The important element was to get the units correct

8) The quantities required for the following TPN preparation

	Required	**Quantity to be used**
Ingredient A	50mg/100mls	1.75gms
Ingredient B	0.25% w/v	8.75gms
Ingredient C	100gms/Litre	350gms
Ingredient D	1 ppm w/v	3.5mg
ingredient E	3.2% v/v	112 mls
ingredient F	60gm	60gm
Ingredient G	700 KCals (50kCals/gm)	14gms
Total Volume of TPN		= 3,500mls

D 1 in 1 million is 1mcg/ml so (1 x 3,500) mcg = 3.5mg
G 700KCals = 700/50gms = 14 gms
The rest should be straightforward

9) Each suppository is to contain 25 micrograms of Methylene Blue.
You are to manufacture 20
Your balance is accurate down to 100mcg. (0.1gm)
The suppositories will also contain 50% WSP
The remainder of the Suppositories will be Cocoa Butter.
The suppositories will weigh 5gms each.
An excess of 5% is allowed.

The total weight will be (20 x 5 x 105/100) gms = 105gms i.e. 21 suppositories
The quantity of Methylene Blue required is 21 x 25mcg in 105gms
This equals 510mcg
You cannot weigh out less than 100mcg so you will need to weigh out 1 x 500mcg
and 1 x 100mcg
You will require 52.5gms of WSP (50% of 105gms)
You require 10mcg of Methylene Blue (MB) from the 100mg
If you diluted 100mg of MB in 40gms WSP 4gms would contain 10mcg
Weigh out 40gms WSP, dilute the 100mg MB with this and weigh out 4gms
Add 48.5gms WSP and incorporate the remainder of the Methylene Blue (500mcg)
Make up to a final weight of 105gms with Cocoa Butter
Use to make 20 x 5gm suppositories and discard the remainder
There are other solutions and in practice you would may use alternative methods

10) Sodium Bicarbonate gram MW = 84.01
So 84.01gms contain 1Mole and 84.01/1000 gms contain 1 mmole
= 0.08401gms = 84.01 mg
So 1 Litre would contain 5 x 0.08401gms = 0.42005gms
= 0.0042gms in 100mls
= 0.042% to the nearest milligram
The full equation is (84.01/1000) *5 * (100/1000)
Alternatively using the formula mmols / Litre = 10,000 * C / W (See appendix)
C = 5 x 84.01 / 10000
C = 420.04 / 10000
C = 0.042005
C = 0.042%

11) Calculate the weight in milligrams that would be required to make 3 litres of a a 25 mmol / Litre solution of the following given their molecular weights :-

The formula is		(MW / 1000) * 25 * 3
Calcium Gluconate	MW = 448.4	33, 630mg or 33.63gms
Calcium Lactate	MW = 308.3	23122mg or 23.12gms
Magnesium Chloride	MW = 203.3	15247mg or 15.25gm
Magnesium Sulphate	MW = 246.3	18472mg or 18.47 gms
Potassium Chloride	MW = 74.55	5591mg or 5.59 gms
Sodium Chloride	MW - 58.44	4383mg or 4.38 gms

Note if the Molecular weight is 50 then 50gms contains 1 mole
50mg contains 1mmol etc

12) Express the answers to Q 11 as a percentage
C = mmols/Litre * W / 10000 (See appendix)

The formula is		% = mmols/Litre * MW / 10000
Calcium Gluconate	MW = 448.4	1.12%
Calcium Lactate	MW = 308.3	0.77%
Magnesium Chloride	MW = 203.3	0.51%
Magnesium Sulphate	MW = 246.3	0.62%
Potassium Chloride	MW = 74.55	0.19%
Sodium Chloride	MW - 58.44	0.15%

The purpose behind questions 11 and 12 are to show that equivalent Molar solutions are NOT the same strength (and vice versa).
You could use the weights from Q11 to derive percentages as well
e.g. for Sodium Chloride % = (4.38 / 3)* (100/1000) = 0.145 = 1.5% to 2 decimal places
However each calculation is far longer than the formula given.

13) Sodium Chloride 0.09% MW = 58.44
Using the same formula as above 0.9% = (mmols/Litre) * 58.44 / 10000
or mmols/Litre = (0.9 * 10,000)/ 58.44
= 9,000 / 58.44 = 154
as both Sodium and Chloride are monovalent, there are 154mmols of each
(N.B. This strength is normally quoted as 150mmols / Litre)

14) How many mmols each are there of Sodium and Bicarbonate in 8.4% Sodium Bicarbonate in a 10ml minijet. The molecular weight of Sodium Bicarbonate is 84.1
Using the same formula as above mmol / litre = (8.4 * 10,000)/84.1
= 998 mmols / Litre
but we require the number in 10mls = 998/100 = 9.98mmols
= 10mmols

15) The MW of Magnesium Sulphate is 246.3. Magnesium Sulphate Injection is normally supplied as a 50% solution. How many mEq of magnesium per ml does this contain. Normal blood levels of Magnesium (Mg++) are 2.5mEq / Litre. How many mg of magnesium does this equate to per litre.

part 1) 50% = 50gms in 100mls or 500gms in 1000mls
1mol /1000mls = 246.3gms / 1000mls
No. of mols/ Litre = 500 / 246.3 = 2.03
= 2,030 mmols Litre
= 2.03 mmols /ml
However Magnesium is a divalent ion and mEq = mmol x Valency
= 4.06 mEq

part 2)	1 mEq = 246.3 / 2 mg	= 123.15mg
	2.5mEq	= 123.15 x 2.5 mg
		= 307mg (approx)

16) The 5 Litre solution contains :-

Potassium	1.7 mEq /100ml	= 17mmol / Litre
Sodium	6.3 mEq / 100ml	= 63 mmol / Litre
Chloride	15 mEq / 100ml	= 150 mmol / Litre as all monovalent

17 + 63 = 80 mmols of Chloride will come from KCl and NaCl
therefore 70mmols will come from Ammonium Chloride
gms / 100ml = (mmols x MW)/ 10000))
so gms / 5 Litres = (mmols x MW)/ 10000)) * 5 * 10

For Sodium Chloride	((63 * 58.44)/10000) * 5 * 10	= 19.31gms in 5 litres
For Potassium Chloride	((17 * 74.6)/10000) * 5 * 10	= 6.335 gms in 5 litres
For the Chloride	((70 * 53.5)/10000) * 5 * 10	= 18.75 gms in 5 litres

The mEq of Ammonium ions will be 350 equivalents to the excess 'Chloride' (70 * 5) that cannot be provided by NaCl and KCl
There is almost no need to calculate this.

This is a complicated way of doing this.
In 100mls, there are
1.7 mEq of Potassium and
6.3 mEq of Sodium
Therefore from these, there will be 8 mEq of Chloride
If the total number of mEq of Chloride are 15,
then there are 7mEq that are provided from the NH_3Cl
So in 100mls there are 7 mEq of Ammonia
(Ammonium in Ammonium Chloride is monovalent)
So there are 70mEq in 1 litre
and 350mEq in 5 Litres

17) 100 suppositories each weighing 2gms contain Active Ingredient 200mg each and The displacement value of the Active Ingredient is 2.5

Total weight of Suppositories	= 200gms
Total quantity of Active Ingredient	= 200 x 100 = 20gms
Total quantity of base	= 200 - 20/2.5
	= 200 - 8 = 192gms

In reality you would probably need to make a slight excess.

18) Approximately how many millimols of Sodium are there in a 500ml infusion of Sodium Bicarbonate 1.26% (Relative weights of the Ions Na = 23 Bicarbonate = 61)

Mw = 23+61 = 84
1% = 1gm in 100ml
1.26% = 1.26gm in 100ml or 1.26 x 5 = 6.30gms in 500ml
= 6.3/ 84 mols or (6.3 / 84) * 1000 mmols
= 75 mmols

<u>Section 2 - Quick Questions</u>

19) 450mls of a 7.5% w/v Solution contains 4.5 x 7.5gms = 33.75gms
20) 650mls of a 1 in 15 w/v solution contains 650/15gms = 43.34gms
21) 160mls of a solution containing 250 micrograms in 1ml is equivalent to

a 40mg Capsule (1mg in 4ml)

22) The daily dose of a drug required for a 23Kg teenager if the recommended dose is 7.5mg/kg/QDS is 690mg (23 x 7.5 x 4)

23) 4gms of Drug A are in 100mls if, when diluted 1 in 800 there are 50 micrograms per ml in the final solution (50 x 800mcg/ml) = ((50 x 800 x 100)/1000)gm

24) Express the following quantities as a percentage of 100gms

i)	12gms	= 12% w/w
ii)	240mg	= 0.24% w/w
iii)	750 micrograms	= 0.00075% w/w
iv)	27.5mls	= 27.5% **v**/w
v)	0.01 Litres	= 10% **v**/w (10mls)
vi)	1,000mg	= 1% w/w

25) What quantity of Chlorhexidine is required to make 350mls of solution such that when diluted 100 times, the final solution contains 0.004% Chlorhexidine ?

(0.004 x 100) x 3.5 gms = 1.4gms

26) 0.8% 40mg in 5ml is 80mg in 10ml or 800mg in 100ml

27) 37.5mg are in 25mls of a 0.15% Solution
0.15% = 150mg/100ml or 15mg in 10ml or 37.5mg in 25ml

28) How many grams of a 1 in 400 ointment contain 2gms active ingredient ?
Answer = 800gms. No calculation example - if you can't do this THEN !!!!

29) How many times must you dilute a 5% solution to give a 1 in 10,000 dilution ?
5% = 5 in 100 so to get 1 in 10000 you need to dilute it (5 x 10000)/(100) times
= 500 times
Longhand diluting x 100 gives 5 in 10000 but this is 5 times too strong
Diluting again by 5 give 1 in 10,000 so the answer is 100x5 = 500

30) 8mls You need (50 x 80 x 4)/1000mg for each days dose = 16mg
16mg is contained in 8mls (longhand (16 x 25)/ 50)

What is the daily dose in mls of a 50mg in 25ml injection for a patient weighing 80Kg if the dose is 50mcg/kg/6hrs.

31) 225mls as it is a 1 in 4 dilution
32) (30/10 * 750)mg = 2.25gm
33) 1 in 20
Chloroform Water contains 0.25ml Chloroform in 100mls
DS Chloroform Water contains 0.5ml Chloroform in 100mls
Concentrated Chloroform Water contains 10mls Chloroform in 100mls
34) 0.6 mg is 600 micrograms, 125micrograms in 2mls = 600 micrograms in (600 x 2) /125)mls
= 9.6mls
35) The dose of Duffocillin is 150 x 70 Micrograms = 10.5mg
The strength of Dufocillin injection is 250mg in 5ml,
The volume of the correct dose is therefore (150 x 70 x 5 / 250 x 1000) = 0.21mls
(Check 250mg in 5mls = 25mg in 0.5mls or 2.5mg in 0.05mls
10.5mg is approximately 4 times 2.5mg so the approximate volume is 0.05mls x 4 = 0.2mls)
This low volume may in real life lead you to check or question the recommended dosage ?

Chapter 2

1) 1 in 200,000 is 1gm in 200,000ml or 1000mg in 200,000ml or 1mg in 200ml or 0.1mg in 20ml (or 100 micrograms in 20ml)

2) 1 Litre = 1,000 x 20 drops = 20,000. 20,000 divided by 21 = 952 minutes = 952 divided by 60 hrs = 15.87hrs = 15hrs 52 minutes

3) 0.75mg is 750 micrograms. Digoxin comes in a presentation of 500micrograms in 2ml Ampoules. Therefore 3mls is required from 2 ampoules. 3mls can be added to 50mls. NaCl. You can be accurate and use a 53ml volume or estimate it as a 50ml volume but the infusion is unlikely to be run through totally.
Using 53mls , 53mls x 20 =1060 drops. If these are to be infused over 1 hour, the drop rate is 1020 divided by 60 = 17 drops per minute.
The BNF recommends an emergency loading dose of 750-1000 micrograms over 2 or more hours and a volume of 50mls. Further doses should be administered over two or more hours so this regime does at present appear to be appropriate but the rate of administration could cause problems as it could be too rapid. (see BNF - Nausea and arrythmias)
Lower loading doses are advised where patients have already been exposed to Digoxin so this could explain why a 'lower' end of the dose range is being used here.
Glucose 5% would be an alternative solution to use for dilution .

4) The increase represents 24mm. The current dose the patient is receiving is (150 divided by 48) mg/mm. The new dose will be (150 / 48)* 72 = 225mg / 24hrs
NOTE - with syringe pumps it is easy to increase the rate on the dial ; it is more difficult to increase the dose and then try to calculate the rate.
The problem would be that the syringe pump would now be infusing faster and therefore would not last for 24 hours. You cannot calculate how long it will last unless you know when it was started AND then when the rate was changed..

5) 10% means 10% so for 11,000 boxes with a 10% discount you should pay 90p each i.e £9,900 not £10,000. If you pay £10,000 you are paying 10,000/11,000p each = 90.9p. Over 2 years you would be using 10,000 x 12x 2 boxes = 240,000 boxes. If you paid 90.9p each instead of 90p, then you would overpay by £2,160. Last year we used 2,400 boxes of Ranitidine at £8.63 each. If we had been overcharged by 0.09% this would amount to £180, a small but significant amount. Our drug bill was £20 million. A 0.09% overcharge would represent £18,000 or the salary of 1 member of staff.
Think about this when involved in drug purchasing arrangements.

6) Using the BNF, 2 stone = 12.7kg thus dose will be 12.7kg x 2.4mg/kg = 30.48mg (30.5mg)

7) Recommended total daily dose for Mrs X will be 72kg x 15mg/kg = 1080mg Mrs X is currently taking 1500mg which is an overdose. Contact the prescriber and discuss the dose with him.
In the absence of any other information, an appropriate dosage would be TWO 250mg capsules TWICE daily.

8) a) Dobutamine dose for patient : 10mcg/kg/min x 70kg
= 700mcg/min
= 0.7mg/min
in mg/hr = 0.7mg/min x 60
= 42mg/hr
Dopamine dose : 2.5mcg/kg/min x 70kg
= 175mcg/min
= 0.175mg/min
in mg/hr = 0.175mg/min x 60
= 10.5mg/hr

(b) Dose of Dobutamine = 42mg/hr
Strength of infusion is 250mg in 50ml
thus dose in mls/hr $= \frac{42 \times 50}{250} = 8.4$mls/hr
Dose is dopamine is 10.5mg/hr

Strength of infusion is 200mg in 50ml
thus dose in mls/hr = $\frac{10.5 \times 50}{200}$ = 2.63mls/hr

(c) New dose of Dobutamine = 8mcg/kg/min x 70kg
= 560mcg/min
= 0.56mg/min
in mg/hr = 33.6mg/hr

in mls/hr = $\frac{33.6 \times 50}{250}$ = 6.7mls/hr

9) Concentration of infusion 0.5mg/ml.
Rate in mls/min = $\frac{1000}{720}$ = 1.39mls/min

(a) Solution set (1ml = 20drops)
Rate in drops/min = 1.39 x 20
= 27.8 drops/min

(b) Burette set rate = 1.39 x 60
= 83.4 drops/min

10) Strength of solution is 250mg in 50mls
Thus 3.5mls /hr is $\frac{3.5 \times 250}{50}$ = 17.5 mg/hr

rate in mcg/min = $\frac{17.5 \times 1000}{60}$ = 291.67mcg/min

Patient weighs 70kg, thus dose he is on in mcg/kg/min is $\frac{291.67}{70}$ = 4.16mcg/kg/min

11) Total daily dose for Mr. N is 82kg x 12mg/kg = 984mg rounding up to 1000mg dose would be 4 x 125mg capsules BD

12) Pump was running for 10hrs at 2mls/hr thus 20mls has been infused. Hint : Check chart for initial volume and work out total dose the patient has had e.g If initial volume was 50mls : 50ml contained 25,000 units
20ml contained $\frac{25{,}000 \times 20}{50}$ = 10,000 units.

13) Total daily dose would be 7.5mg/kg x 15kg = 112.5mg
250mg is equivalent to 5mls
112mg is equivalent to $\frac{5 \times 112.5}{250}$ = 2.25 ml daily

The label should state 'Give 0.75mls THREE times daily using the oral syringe provided'
Advice to the mother should be to squirt the drug into the side of the baby's mouth.
Local policies etc. will be variations of the above.

14) 1 in 10,000 means 1g in 10,000ml Thus 2L contains $\frac{2000}{10{,}000}$ = 0.2g of drug

Stock solution is 10g/L
Therefore 0.2g is equivalent to $\frac{0.2}{10}$ = 0.02L = 20mls

15) A simple question. 3 x 1.5 = 4.5gms

16) A lot of waffle here to confuse you. The dosage is 18x5mg = 90mg. 90mg would be contained in 9ml of the injection. However you are not asked for this.

17) i) 25mg . 100mls contains 0.5gm 1 ml contains 0.005gm or 5mg so 5ml contains 5x5 or 25mg
ii) 250 micrograms.

This give you the opportunity to check your calculations.
250 micrograms = 0.25mg
0.25 x 20 = 5mg (i.e. 5mg per ml) x 5 = 25mg in 5ml
25mg in 5ml = 25 x 20 =500mg in 100ml = 0.5%

18) Using the nomogram, the patient's body surface area is 1.99m . Thus dose will be 25 x 1.99 = 49.75mg. I think we would accept 50mg !!

19) 120mg 0.02% is 0.02gms in 100ml 0.02gms equals 20mg
Therefore 600mls contains 20 x 6mg = 120mg

20) D - The batch includes a 5% overage so this is a distractor.
The weight you need is 6/7 of 420Kg = 360Kg

21) C - 8.5mcg/ml. After each 7 hour period, the concentration should halve. Therefore after 7 hours it will be 34mcg/ml, 14 hours it will be 17mcg/ml, 21 hours 8.5mcg/ml and after 28 hours 4.25mcg/ml

22) D - See BNF. You should know Benorilate contains paracetamol. Each tablet is Equivalent to 750 mg Benorilate.
Two tablets equals approximately 1.5gm Benorilate.
2gm Benorilate = 970mg Paracetamol so 1.5gm = ((970 x 1.5) / 2) = 752mg
This equates approximately to 2 standard paracetamol tablets
The maximum dose of paracetamol is 4gm daily (8 tablets)
Therefore an additional 6 tablets are possible..

23) C - 1gm A 1 in 40 dilution produces 1in 800. Therefore the original concentrate is 1 200 (8000/40) 1 in 200 means 1gm in 200ml - SIMPLE !!

24) B - If you dilute 1 in 10 to give a 1in 1000 solution, then your solution must be a 1 in 100 solution. So you have 100mls of 1 in 100 solution.
To make a 1 in 100 solution from a 20% solution (20% = 1 in 5) you would need to dilute it 20 times.
The answer is therefore B

25) C – 39 hours. It would fall to 42 after 13 hours, 21 after 26 hours etc..

26) Please note the amount of product and water in the following preparation:
How much benzalkonium chloride (1:750 solution), will you need to make one litre of a 1:3000 benzalkonium chloride (BAC) solution for use as a wet dressing?

250 ml benzalkonium chloride solution 750 ml water

(1g BAC/3000ml) x (1000ml) = quantity of BAC required
(1g /750ml) = concentration in available solution
so divide quantity by concentration
(1g BAC/3000ml) x (1000ml) x (750ml / 1g) = 250ml BAS2
1000ml of 1:3000 BAC solution - 250ml BAS2 = 750ml water

27) Write down the concentrations and units for the following products:

a) Clotrimazole 1% cream = 1 g clotrimazole/ 100g total product
Each 5g applicatorful contains 50mg or 0.05g
1g clotrimazole/100g = X / 5 = 0.05g clotrimazole

b. Albuterol 0.083% solution = 0.083g Albuterol/ 100ml total product
Each 3ml container contains 2.5mg albuterol (3 x 0.83mg)
Or 0.083g/100ml = X / 3ml = 0.0025 g

c. Timoptol ophth sol 0.25% = 0.25 g Timoptol/ 100ml total product
Each 15ml bottle contains 37.5 mg
0.25g/100ml = X / 15ml = 0.0375 g = 37.5mg
Each drop, assuming 20 drops/ml contains 0.125mg
37.5 mg/15ml x 1ml/20 drops = 0.125 mg/ drop

Benzalkonium chloride, used at 0.1% concentration as a preservative, will equal in each drop 0.05 mg
0.1g/100ml x 1ml/ 20 drops = 0.00005 g/ drop = 0.05 mg/ drop

d. SSKI is short for "saturated solution of potassium iodide." Potassium Iodide becomes saturated at a concentration of 1g/ml. What percent strength is it? 100 %
1 g/1ml = 100 g/100ml 100 g/ml = 100%
In reality it is just less than 100%

e) Patient dilutes 0.3ml in one glass (assume 8oz) of water and drink QID. The Potassium iodide the patient receives each day = 1.2 g
0.3ml / dose x 1 g/ ml x 4 doses / day = 1.2 g / day
(The 8oz is irrelevant)

28) Calculate the normal or therapeutic ranges in SI units of the following drugs or electrolytes from the normal or therapeutic ranges given in commonly-used U.S. units

a. Phenytoin (an anti-seizure medication). Therapeutic serum concentration range in 10-20 mg/L. The serum concentration values in units of µMol/L. Phenytoin MW: 252. Therapeutic Phenytoin SI range: 40-80 µMol/L
10-20 mg/L x 1mMol/252mg x 1000 µMol/ mMol = 39.7-79.4 µMol /L

b. Theophylline (a medication used in patients with lung disease). Therapeutic serum concentration range 10-20 mg/L. The serum concentration values in units of µMol/L. Theophylline MW: 180. therapeutic Theophylline SI range: 55-110 µMol/L 10-20 mg/L x 1mMol/180mg x 1000 µMol/mMol = 55.6-111 µMol/L

c. Chloride. Normal serum concentration range 95-105 mEq/L. The serum concentration values in units of mMol/L. Chloride MW: 35.5.
normal chloride SI range: 95-105 mMol/L
95-105 mEq/L x 1mMol/35.5mg x (35.5 mg/1 valence)/mEq = 95-105 mMol/L

d. Carbon dioxide. Normal serum concentration range 22-28 mEq/L. The serum concentration values in units of mMol/L. CO_2 MW: 44.
normal CO_2 SI range: 22-28 mMol/L
22-28 mEq/L x 1mMol/44mg x (44 mg/1 valence0/mEq = 22-28 mMol/ L

29) Your patient requires (50 x 95) mg per day = 4750mg or 4.75gms
4.75gm is contained in (50 / 4) * 4.75mls = 59.36mls or 60mls to the nearest round quantity
If 4 doses are to be given daily they will require 60 / 4mls / dose = 15mls

30) You are on the ward with a junior doctor and he asks you to calculate the digoxin maintenance dose for a Fred Smith. Fred is 1.75 metres tall and weighs 76Kg and is 85 yrs old. His serum creatinine is currently 125 micromoles / ml. The doctor wants a serum concentration of 1.5mcg/ml. Calculate the daily oral dose to the nearest microgram.

You will need the following formulas and values : -
Ideal Body Weight = (0.9H -88) for males   H = Height in cm
Creatinine Clearance = (1.23 (140 - Age) x wt)/ Serum Creatinine
Digoxin bioavailability = 0.7
Digoxin clearance = (0.8 x Wt) + CL_{CR}
S = 1
C = 1.5 mcg/L
T = 24 hrs

Maintenance dose = Qty drug removed / (F x S)
= (VD x C x T) / (F x S) in time T

Calculate renal function:-

CLCR = (1.23(140-age) x Wt)/ C
= (1.23(140 - 85) x 76) / 125
= 41.13

Digoxin clearance = (0.8 x Wt) + CLCR
= (0.8 X 76) + 41.13
= 101.93 mls / minute or 6.12 litres/ hour

Maintenance Dose = (VD x C x T) / (F x S)
= (6.12 x 1.5 x 24) / (0.7 x 1)
= (220.32 / 0.7)
= 314.74 micrograms
= 1 x 250mcg tablet + 1 x 62.5mcg tablet
or 5 x 62.5mcg tablets to the nearest whole tablet

You could also calculate the patients ideal body weight although this formula is only used if the patient is considered sufficiently obese:-

= (0.9 x 175) - 88
= 157.5 - 88
= 69.5kg

31) Freds height is about 160cm and with a weight of 60kg that give a body surface area of about $1.65m^2$. The correct dose should be 200 x 1.65 = 330mg approx.

32) C You have X gms 10% to which you add Ygms Coal Tar
So X + Y = 120gm
Now 1/10 X + Y = 12% of 120 = 120 x 12/100 = 14.4
Multiplying up X + Y =120 and X + 10Y = 144
So 9Y = 24
Y = 24/9 = 2.667gms
X+ Y = 120
X = 120-3.667 = 117.333 gms

Estimate the amount beforehand . The change is around 2%. 2% of 120gms is 2.4 x 1.2 = 2.88
Note:- a) and b) must be wrong as you are adding around 12% or 7% Coal Tar
e) must be wrong as you are adding less than 2% Coal Tar

33) **B** - Each powder weighs 200mg
A 75mg capsule represents 25mg Acecor so 75/4mg represents 6.25mg Acecor itself
Therefore each powder will contain (200 –75/4) mg Lactose.
You need to supply enough for 30 days = 4 x 30 = 120 (dose is QDS)
So the total weight of Lactose will be :-

(200 – 75/4) x 120 mg = (200 – 18.75) x 120mg
= 181.25 x 120mg
= 21,750mg
= 21.75gm

A simpler method but one that requires you to be able to estimate relatively accurate is as follows.

120 x 200mg powders = 24gms total (120 x 200/1000)
Note that by doing this calculation you should be able to eliminate answers A and E
As E is too large and A represents over 25% of the total weight

Each 200mg powder contains 18.75mg Acecor Tablet = 9% approximately
(9.375 accurately)
The total weight is 24gms and
9% of 20 is 1.8 and 9% of 4 is 3.6 so
9% of 24 is just over 2 approximately (2.16 accurately)
Therefore the weight of lactose is approximately 24gm – 2gm = 22gm minus a little bit more
<u>BUT It will be less than 22</u> rather than more and only just less.
Only answer B is near enough to be correct.

34) **C** - The total weight of the tablets will be (250mg x 1,000,000) / 1000 gms
= 250 x 1000 gms
= 250Kg
Methylcellulose will represent 5% of this = (250/100) x 5 12.5Kg
However it will be a 25% w/v solution. The volume will be 4x as great
So the total volume will be = 12.5 x 4 Litres
= 50 Litres

(a double check is that 50 Litres is 20% (as volume) of 250Kg)

34) Heres the long answer :-
Let the Addict take Xmls a day
Then 5,000 / X = 14
X= 5000/14 = 357.14mls
Let the partner take Ymls a day
Now (5000/14)*10 +10Y = 5000
Or 3571.4 +10Y = 5000
10Y = 1428.6
Y = 142.86
Alternatively 10Y = (5000/14)* 4
So Y = (5000 * 4)/ 14 * 10
Y = 357.14 * 4 = 142.86
And the number of days this will last for is
(Volume) / (Volume of Y)
5000 / ((5000 * 4)/ (14 * 10)) *****
simplifying through what we have calculated about Y = 5000/ 142.86
= 35 days (34.99999)

Now what is odd about this – Look at the starred formula
That can be simplified (by dividing by 500)) to = 1 /((1 * 4) / 14 * 10))
This then becomes = (14*10) / 4
= 140 / 4 = 35
In other words you did not need to calculate or know the volume taken by either addict

Here it is done as algebra
Fred consumes xmls over 14 days = 14Xmls
Fred and Jane (Just or the sake of argument) consume = (10X + 10Y)mls
These are however the same

$$14X = 10X + 10Y$$
$$10Y = 4X$$
$$Y = 4/10\ X$$
Or $$X = 10/4\ Y$$

So if 14 X lasts for 14 days , substituting Y
(10/4 Y) x 14 will last for 10/4 * 14 days = 35

There are other ways. This is a slight variation.

$$14X = 14 \text{ days}$$
$$10X + 10Y = 10 \text{ days}$$
but $$10X + 10Y = 14X$$
$$10Y = 4X$$
$$Y = (4/10)X$$
$$X = (10/4)Y$$
$$14 \times (10/4)Y = 14X$$
$$140/4Y = 14X$$
$$35Y = 14X$$

(This calculation is taken from a calculation book of Elizabeth 1^{st})

Chapter 3 - ANSWERS

1) 13mg in 5ml = 26mg in 10ml = 260mg in 100ml
= 0.26% Morphine Sulphate
= ((285.4 x 2) / 758.8) x 0.26) % Morphine (Anhyd)
= 0.196 %

This is below 0.2% so the solution is a CD invoice POM

2)

	5mg only	**25mg + 5mg**	
1st 2 days	24 x 5mg	4 x 25mg	4 x 5mg
2nd 2 days	20 x 5mg	4 x 25mg	
3rd 2 days	16 x 5mg	2 x 25mg	6 x 5mg
4th 2 days	12 x 5mg	2 x 25mg	2 x 5mg
5th 2 days	8 x 5mg		8 x 5mg
7 days at 10mg	14 x 5mg		14 x 5mg
7 days at 5mg	7 x 5mg		7 x 5mg
TOTALS	101 x 5mg	12 x 25mg	41 x 5mg
Total Dose	= 505mg total	300mg	+ 205mg = 505mg

3) Several of the values given seem to be there to obscure the question. The dose is given as Xmg / m^2
The child has a BSA of 0.6m^2
So the dose is 500 x 0.6 = 300mg tds
This is the dose recommended in the BNF for children aged between 3 months and 12 years

4) This should be easy 0.3% is 0.3gm in 100gm or 300mg in 100gm
= 150mg in 50gm
= 75mg in 25gm
= 225mg in 75gm
or (0.3/100) * 75 * 1000mg

5) B - Try it this way. Dobutrex 20ml contains 12.5mg/ml or 250mg in 20ml. We add this to 1 Litre and get 250mg in 1 Litre (1000ml) or 1mg in 4ml. . The dose we need is 5mcg/min/kg or 75x5mcg/min = 375micrograms per minute.
1mg in 4ml = 250mcg in 1ml or 125mcg in 0.5ml so the answer is 1.5ml as 250 + 125 = 375. That way does not use long formulas.
An alternative is this.
We are going to dilute the solution from 20 to 1000 or a 1 in 50 dilution.
We need 375 micrograms
20 mls contains 250mg so 2mls contains 25mg and 0.2mls contains 2.5mg and 0..02mls contains 250micrograms (0.25mg). So 0.3mls contains 375 micrograms. Now the dilution is 1 to 50 so there will be 50 times the volume in the final bag so the volume we will have is 0.03mls x 50 = 1.5ml
This again avoids using complicated formulas.
To put it all in a mathematical formula the quantity required is :-
(5 x 75) / ((250 x 1000) / 1000) = 375 / 250 = 1.5mls
(dose per Kg times number of kg) divided by ((number of mg converted to micrograms) divided by (final volume) to give micrograms per ml)
With all calculations TRY and guess at the rough value of an answer before calculating as usually only one answer will be in the right 'ball park area' . This one is not that typical but to a mathematician only B has the right numbers for a correct answer.

Both methods assume that the final volume is 1000mls. If you calculate using a final volume of 1020mls, the answer will be effectively the same. In real life you would ignore the effect of adding just 20mls to a litre, probably think about adding20mls to 500mls (It would probably depend on potency) and definitly would not ignore the effect of adding 20mls to 100mls. Its a question of how significant (i.e. accurate) your dosing system is

6) **1st method :-**

1mole = 298gms , 1mmol = 298mg, 1 micromol = 298mcg,
1nanomol = 298 nanograms
therefore 4.4nanomoles /kg/minute = 298 x 4.4nanograms / kg / minute
= 1311.4 nanograms/kg/minute
= 1.3 mcg/kg/min

2nd method :-

1mole = 298gms, 1mmol = 298mg
therefore (50mg/298mg) = 0.168mmols in 5ml injection
= 0.168/5 = 0.03356mmols/ml
= 33,557 nanomols / ml
1 nanomol = 1,000,000 millimols (multiply by 1 million)
4.4 nanomols are therefore in 4.4 /33557mls = 0.00013mls
Drug concentration is 10mg in 1ml or 10,000micirograms in 11ml
or (10,000,000 nanograms in 1ml)
so 0.0013mls contains (0.0013 / 1) x 10,000 micrograms
= 1,3micrograms/kg/min

1.3mcg/kg/min
Per day =(rate per kg per minute) x weight x 60 x 24
= 1.3 x 76 x 60 x 24 micrograms in 24 hrs
= 142,272 micrograms in 24 hours
= 142 mg in 24 hours
= 14.2mls (50mg in 5ml)

cont..

7) The half life of a drug is the time that it takes for the body concentration to approximately Halve. Values are approximate but complete the following table using the values given.

Drug	**Half Life in Hrs**	**Initial Conc**	**Time to reach :-**	**Concentration after**
Digoxin	48	1.5mcg/L	0.375mcg/l = 96hrs (2 half lives)	1 day = 1.125 (1/2 of a half life)
Theophylline	8	24mg/l	1.5mg/l = 32 hrs (4 half lives)	1 day = 6mg/L (3 half lives)
Phenytoin	24	20mg/L	7.5mg/l = 36 hrs (1.5 half lives)	1 day 10mg/l (1 Half life)
Carbamazepine	35	14mg/l	7mg/l = 35 hrs (1 half life)	3 days = 5.6mg/l approx (1 2/3 half lives approx)
Thyroxine	72	4mcg/L	1mcg/L = 144hrs (2 half lives)	3 days = 2mcg / l (1 half live)
Amiodarone	360	18mcg/L	1.25mcg/L = 1440 hrs (4 half lives) note that this is 60 days	3 days = 15.8 mcg / l approx (1/4 of a half life approx)

The aim of this question is to highlight the variation in half lives amongst common drugs.

8) 21 1,500mls contains 1,500 x 20 drops
30,000 / (12 x 60) = drop rate per minute
= 41.6 or 42

9) 112.5 Q = 120 x 1 - ((100 x 120)/ 1.6 x 1000)
(remember to change the quantity of drug to grams

10) This is a simple ratio (with a difference) A/B = C/D
10% is 25gms in 250gms
20% will be (25+ X)gms in (250+ X)gms
X is the amount of coal tar to add and
20 / 10 = 2 (The ratio of the two)
so
((25 + X) / (250 + X)) / (25/250) (i.e. A/B) = 20 /10 (i.e. C/D)
or
(25 + X) / (250 + X) / (1/10) = 2
dividing by 1/10 is the same as multiplying by 10 so
(25 + X) x 10 / (250 + X) = 2
or
250 + 10X = 2 x (250 + X)
= 500 + 2X
so
10X - 2X = 500 - 250
or
8X = 250
X = 250 / 8
= 31.2gms
So 31.2gms coal tar are added to 250gns of 10% coal tar
This gives (25+31.2)gms or 58.2gms in (250=31.2)gms or 281.2gms
58.2 / 281.2 x 100 = 19.99%
You can use this formula / process for any strength or quantity and to either increase or Decrease strengths. To decrease strengths , negative values will need to be introduced.

11) Calculate the missing values

Patient Sex	Patient Age	Patient Weight	Serum Creatinine	Creatinine Clearance
F	65	55	280	**15.32**
M	60	50	300	16.4
M	57	72	185	**26.25**
F	85	55	350	**8.98 or 9**
M	**15**	40	240	175

Example 1 is a straightforward substitution into the formula given
Example 2 requires you to calculate whether the value 1.04 or 1.23 was used in the formula and is a little more tricky than the other examples. It is also unusual in that you would not usually look at using the equation in this way.
Example 3 uses values that do not give nice easy numbers when multiplied out
Example 4 gives a very low value. When you got this value did you double check. In real life you **WOULD** double check
Example 5 should also make you double check as it is a young adult.

12) In the following table, the approximate equivalence of Diamorphine to Morphine BY POTENCY is given for each route. Fill in the missing equivalent doses. In each case you need to multiply or divide by the potency factor. Providing you thought about this correctly, the answer is easy. For the first example, Diamorphine is 3 times as potent as Morphine, so a does of Morphine 3 times that of Diamorphine would be needed for the same analgesic effect
If you did not think, you probably divided rather than multiplied.

Route	equivalence	Diamorphine dose	Morphine dose
I.V.	3:1	30mg	**90mg**
I.M.	2.5:1	60mg	**150mg**
S.C.	2.1	**25mg**	50mg
P.R	2:1	30mg	**60mg**
P.O.	1.5:1	10mg	**15mg**

Similar questions may involve potencies by different routs or form e.g.how many mg of oral morphine would be equivalent to a 100mg SR tablet.
3mg Morphine is equivalent to 2mg SR Morphine
so a dose of 60mg oral QDS equates to 240mg Morphine = 160mg SR Morphine
= 80mg 12 hrly

13) Dextromoramide is twice as potent as Morphine but is shorter acting and hence needs to be given every three hours. Calculate the dose of Dextromoramide that would be equivalent to 60mg Morphine Sulphate QDS

Total dose Morphine = 60mg x 4 = 240mg
Dextromoramide is twice as potent so
240mg Morphine = 240/2mg Dextromoramide= 120mg
This needs to be divided into 8 daily doses = 120 / 8 = 15mg
So 15mg Dextromoramide are needed every 3 hours = 3 x 5mg tabs
Or= 1.5 x 10mg tabs

Note :- recommendations on equivalences do vary between sources. These are here purely to assist with your mathematical skills).
The BNF currently gives Morphine 10mg oral = 3mg Diamorphine IM = 1.3mg Hydromorphone = 5mg Oxycodone.as a guide. It also provides an Oral / parenteral equivalence chart.

14 According to the BNF (Pge 12 , Ed 43) The approximate dose of a drug for a child patient can be calculated from their Body Surface Area (BSA) in M2 according to the following formula :-

(BSA / 1.8) x AD = calculated dose AD = Adult Dose

This is based on an ideal BDSA of 1.8 for a 70Kg adult

Fill in the missing values on the following chart
(You may need to refer to the BNF for one or two to calculate the BSA) :-

Body Weight	Age	Calculated BSA	Adult Dose	Calculated does
		1.4	6gm/day x 6hrly	**4.6gm/day x 6hrly**
		2.1	250mg	291mg (290mg)
		1.7	**158.8mg (160mg)**	150mg
		2.7	**13.3mg QDS (13mg)**	20mg QDS
23	7	**0.88**	200micrograms	**97.7mg (100mg)**
@39kg	11	1.25	120mg TDS	**83.3mg (80mg)**

For the first 4 examples you cannot calculate age or body weight.
Some values have been rounded up to possible practical (starting) doses

For the first 4 examples you cannot calculate age or body weight.
Some values have been rounded up to possible practical (starting) doses
1) 12mg daily x 6hrly = 3mgs 6 hourly
2) 145.5mg - this is above the adult dose - is this an obese child or an error
3) The 200mg would in real life have been a rounding to a nearest possible dose and is in fact probably the adult dose
4) The calculated dose would probably be rounded down to 10mg or 15mg if 5mg strength was available.
5) The BSA value is derived from the BNF data inside the back cover
6) The BNF nomogram shows an ideal 12 year old has a body weight of 39kg and a surface area of 1.25. The child here is therefore likely to weigh approximately the same.

The table is also designed to show that real life calculations rarely give nice neat answers. It will be necessary to round up or down such calculated doses to one which will be practical to administer. A 10% variation in a dose is unlikely in most instances to have any significant difference in effect so to round up or down by less than 10% is likely to be safe and acceptable.

15) The standard formula for calculating the rate of administration using a syringe pump is as follows :-

R = (D x W x 60 x V) / (1000 x T) Where :-
R = Rate in mls/hrD = Dose in mcg/Kg/Min
W = Weight in KgV = Volume in Syringe in mls
T = Total amount of drug in syringe in mg
Fill in the missing values :-

R	**W**	**D**	**V**	**T**
5.25mls	70	25	25	500
3mls	50	5	25	**125mg**
7.5	**50kg**	20	50	400
10	63	**66kg**	50	1250
6	72	12.5	**100mls**	900

Note in real life you would probably have to calculate a value such as D from a drugs recommendations. Also any real life calculations are unlikely to produce nice round figures. The tendency in examples such as mine and the RPSGB is to give values that do work out nicely. Do not be surprised to undertake real life calculations that give values such as 4.33333333mls. You will then need to decide on the level of acceptable accuracy.
The above formula is also one of many possible

CHAPTER 4

OPEN BOOK

Section 1 Simple Completion

1) **B** - The recommended dosage is = 100mcg/kg/qds
dose required is =14 x 100mcg qds
= 1.4mg qds
Volume required = (1.4 x 5) / 2
= 3.5mls qds

2) **C** - 5mls contains 3mmol so the patient would be taking (3 x 4) x 4 mmols/ 24hrs = 48

3) **E** = Hydrogen Peroxide 10 Vol = 3%
First convert quantities to percentage (2.25gm x 100) / 75 = 3%
NB Hydrogen Peroxide 20 vol is 6%
Potassium Permangananate BP = 2%
Sterzac = 2%
Hibiscrub = 4%

With this question looking up Hydrogen peroxide deals with 2 answers together. Once you have a correct answer, it is unlikely that any other answer will be 'correct' in RPSGB calculations so unless you have time or doubt your skills do not waste time eliminating all the others.

4) **D** - First you need to check the Pot. Chlor Conc. Sterile. This does contain 2mmol in each 1ml of Potassium so there are 60mmols in 2.5litres.
The maximum rate is 5mmol / hour so the maximum rate
= (2,500/60) x 5 mls per hour
= (2,500/60) x (5/60) mls / minute
= (2,500/60) x (5/60) x 20 drops per minute
= 41.6 x 0.83 x 20
= 69 drops / minute = 207mls / hours
or 70 to the nearest 10 drops
You can quickly check this. 69 drops = 3.5mls approx
= 210mls / hour
Here is a quick way of checking the answer for this question
There are 60mmols in 2,500mls or 6mmol in 250ml
So there will be less than 6mmol in 210mls i.e. The answer is around 5mmols
If they receive 70 drops per minute the actual maximum dose will be
70/20 x 60mls / hour = 210mls. The error is 3mls or around 1.5%. This is not significant.
Here is another way of looking at this question because the answers differ significantly in magnitude :-
Look at the options and remember 20 drops = 1ml so start low and quickly **estimate** that :-
35 drops / minute = less than 2ml / minute - could be right - D is twice this = 4ml/min
210 drops per minute = 10mls / minute = 600mls / hour = can’t be right and so eliminates A,B,C so only D and E can provide the correct answer.
Going back to D , 2ml / min = 120ml/hour = 240ml in 2hrs
But 250mls contains 6mmol so the answer must be roughly twice this value so must be D
Remember this is designed to find the correct ANSWER from a choice and NOT to provide an answer in actual practice

5) **D** -His volume of distribution is 76 x 7.5 Litres = 570 litres
you require between (570 x 1.5) and (570 x 1.75) micrograms = 855 to 997.5mcg
but Ld = (C x V)/ F F = Bioavailability
Therefore you will need between (570 x 1.5) /0.75 mcg = 1140mcg
= 1140 / 62.5 -= 18.24 tablets (19)
(570 x 1.75) / 0.75 mcg
=1330 mcg = 1130 / 62.5 = 21.28 or 22 tablets
= 19 – 22 tablets
LD = ((76 x 7.5) x (1.5 to 1.75mcg/L)) / 0.75 = 20 - 22

6) **D** - 94 gms will be equivalent to 94 / 0.3 tablets = approx 314 tablets. Each tablet contains 75mg drug = 314 x 75mg = 23,550mg = 24gms to the nearest gm.
Alternatively the formula for calculating the answer is (94 x 75)/300gms
Such calculation requests are rare but do happen, especially when on-call

7) **B** - see below
The following contain XXmmols Potassium

.a)	Kay-Cee-L Syrup 5mls	5mmols
.b)	Kloref tablets x 3	20mmols (approx)
.c)	Slow K tablets x 6	48mmols (approx)
.d)	Sando-K tablets x 4	48mmols
.e)	Potassium Chloride Concentrate Sterile x 5mls	10mmols

8) **E** Think of it this way 2.5% diluted to 1.5% is roughly just under a 1 in 2 dilution
1 in 2 would give a 1.25% dilution
For 150gms you would need **just over** half that quantity of 2.5%
i.e. just over 75gm BUT NOT 75gm
Only E fits that criteria. That way there is no need to calculate
If you wish to calculate the formula is : -

xgm x 2.5% = 150gm x 1.5%
xgm = (1.5%x 150 / 2.5%)
x = (1.5 x 150)/2.5 = 90

9) E There are two ways of calculating this (among many)

1) The strength of Cetrimide is (0.015 / 20)% = 0.00075%
i.e. 0.00075gms in 100ml
0r 0.75mg in 100ml
or 0.0075mg in 1ml
and (0.0075 x 25)mg in 25ml = 0.1875mg or 187.5micrograms

2) 0.015% is 0.015gm in 100ml or 15mg in 100ml
or 0.15mg in 1ml
so there are 0.0075mg in 1ml of Cetrimide if the ratio is 1:20
or (0.0075 x 25)mg in 25ml = 0.1875mg or 187.5 micrograms

There are other maybe simpler ways of doing this. The one problem is that the answer was asked for in milligrams but the correct answer is actually provided as micrograms. This is the way the RPSGB posed this question !!

Section 2 Classification

1) **B** - 1.5gms (5% Sodium Bicarb)
2) **D** - 15gms (5% sodium Bicarb) (3 x 5gms)
3) **A** - 0.15g ((5% Sodium Bicarb)
4) **E** - The gram molecular weight of sodium = approx 60gms and contains 1Mol
1Mol = 1000mmol.
5) **B** - 1mmol or less per 10ml = 10mmol or less in 100ml
6) **D** -150 although different labs have slightly different values all are around 135-147 and this should be core knowledge.

Section 3 - Multiple Completion

1) **C** - 2 and 3 only see BNF40 pge 416
2) **A** - check BNF These values do change – use current BNF Values

100mg oral Morphine is equivalent to 30mg Diamorphine subcutaneously
The BNF States that 10mg Morphine oral is equivalent to 3mg Diamorphine IM
Under Diamorphine the BNF states that IM and subcutaneous are equivalent dose wise.

120mg S/R oral Morphine is equivalent to 10mg Diamorphine I.M. x 4 hourly x 4 doses
i.e. 120mg Morphine oral = 40mg Diamorphine IM

500mg S/R oral Morphine is equivalent to 30mg oral Diamorphine x 4 hourly
500mg S/R Morphine oral = 180mg Diamorphine oral
This requires a little thought.
1/3 of 500mg is 166.667mg – i.e almost 180mg
The oral and IM doses of Diamorphine are the same (unlike Morphine)

Do check the current BNF as these values (which are really approximate guides) have changed regularly.
Earlier versions of this document had different values

3) **B** - 1 and 2 only. Calculate the dose of Pethidine in each example 1) = 8mg
2) = 15mg and 3) = 30mg. The BNF recommends 0.5 to 2mg /kg or for
this child a dose of 7 to 26mg
4) **A** - 20mls of a 1.25% Injection Solution 1.25% = 12.5mg/ml = 250mg in 20ml
0.5mls of a 10gm in 20ml Injection concentrate
= 1g in 2ml = 0.5g in 1ml =0.25g in 0.5ml
1.25mls per minute over 1 hour of a 3gm in 900ml infusion
3gm in 900ml = 1gm in 300ml
= 250mg in 75ml
1.25ml/min = 1.25 x 60mls / hr = 75mls/hr

Section 4 - Assertion / Reason

1) **A** - Both statements are true and the second is an explanation of the first
(If you look carefully at this question only answers A or E could apply)

2) A - Assume it's correct that Granicidin for a 50Kg patient should be infused at a rate of 240mg per hour and answer with regard to the correctness of the following statements

First Statement :- 0.2% of Granicidin in a 500ml infusion bag should be infused at a rate of 60mls per 30 minutes

Second Statement :- This represents an infusion rate of 80mcg / Kg / Min

It is doubtful you will get one this tricky in the exam
240mg / hour = 4mg / minute 240/60
= 4/50mg minute = 0.8mg/kg
= 800mcg / kg/ minute. The dose is therefore 800mcg/kg/min/
Statement 2 is therefore correct.
0.2% represents 2mg in 1ml (1% is 10mg/ml)
60mls = 60 x 2 = 120mg
120mg in 30 minutes = 240mg in 1 hour = 4mg / minute
Statement 1 is also correct
Statement 1 and 2 are complimentary so the correct answer is A

3) **B –** 1ml is (1/12.5) x 100% of 12.5mls = 100/12.5 = 8

An easier way to calculate is to multiply up 12.5 x 8 = 100

1ml contains 2mg because 12.5mg contains 25mg
However the Statement 2 is not dependant on Statement 1
Some argue for A because 2mg is 8% of 25mg

CLOSED BOOK

Section 1 Simple Completion

1) **D** - 24 mls This is essentially the same question as open book 1 but with the Dosage/kg given. Have a look and see.
The dose is 150mcg 6hrly or 600mcg daily / kg = 600 x 16mcg = 9.6mg
9.6mg is contained in (9.6 x 5) / 2 mls = 24mls (as bag wil run over 24 hrs)
What you could also be asked is the infusion rate
This equals 500 / 24mls / hour or (500 / (24 x 60))mls / minute = 0.347mls / min
Note :- This assumes that 24mls have been removed from the IV bag.
You could use a volume of 524ml and this gives 524/(24x60) = 0.36mls min

2) **C** - In Detail, each day the patient will use (250 x 4) / 20 mls
= 50mls concentrate
= 50 x 28mls total supply
= 1,400mls
Since the solution is 1 in 800, 1,400mls contains 1,400 / 800 = 1.75g

3) **C** - 3.75mls. If you look at this it is simple.
You require 0.125mls in each 10mls of final solution
Therefore in 300mls you require (0.125 x 300) / 10
= 37.5 / 10 = 3.75

4) **D** - 3.25gms - 1 in 200,000 x 100 (The dilution) = 1 in 2,000
= 3.25 in 6,500

5) **A** - 980mls (Conc Soln A x Vol Soln A = Conc Soln B x Vol Soln B)
= (4.25 x 1.5) / 6.5 = Vol Soln B
= (6.375 / 6.5) = 0.98
Now dividing 6.375 by 6.5 is not easy in your head. But if you have any idea of the answer, it can only be less than one. Since you are working in litres, the answer is less than one litre. Only Answer A meets that criterium.

6) **D** - 10.8gms (60/5) x (900/1000) gms or (60 x 20 x 9) / 1000 gms
(Mg/ml x volume) / 1000 (mg/ dose x doses)/1000 gms

7) **E** - You should instantly eliminate A and C as they are w/v. The final volume is irrelevant.
The concentration is 0.5ml in 5ml or 5ml in 50ml or 10ml in 100ml = 10% V/V

8) **A** - The dose required is 65 x 4 mcg / min
= 65 x 4 x 60mcg / hour
= 15,600mcg or 15.6mg
In this question you cannot ignore the original dopamine volume so 250mg Dopamine is contained in 50 + 20mls or 70mls.
So if 70mls contains 250mls
1mg is contained in 70/250mls
And 15.6mg are contained in (15.6 x 70) / 250mls
= 4.36mls
=4.4mls approx

9) **E** - 7.5 x 16.5 = 123.5mg dose 123.5 / 1.25 = 98.5mls = approx 100mls
In real life values rarely work out to exact amounts and it should be possible to appreciate that 1.5mls is within the tolerance for dose accuracy. When administering 100ml from 2x 50 vials, normal human error is around 2-5%
On the wards. In a lab it reduces to around 0.5-1% or less.
The RPSGB exam questions have sometimes used rounded values but are more commonly designed to actually produce 'rounded values' in the first place

10) **B –** 25.5 hours. The concentration will halve every 8.5 hours so will be 54 after 8.5 hours, 27 after 17 hours and 13.8 after 25.5.hours

11) **C** - 50.4mls. First calculate your dose this is 63 x 2mg = 126mg
200mg in 20ml = 126mg in 12.6ml
The dose 2mg/ml so the final volume will be 126/2mls = 63mls
12.6mls is added to X mls Sodium Chloride to make 63mls so....
63 -12.6 = 50.4mls

12) **E** longhand this becomes :-

75mg = 15 tablets daily for 7 days =	105	then
65mg = 13 tablets daily for 7 days =	91	then
55mg	77	
45mg	63	
35mg	49	
25mg	35	
15mg	21	
5mg for 14 days	14	
Total =	455 tablets	
Or (15+13+11+9+7+5+3) * 7 = 14		
= (63 * 7) + 14 =	455 tablets	

13) **B** - The daily dose for the baby girl is 180 x 6 = 1080mg
This means a dose of 270mg four times a day
If 2ml contains 600mg then 270mg is contained in (2 x 270) / 600
= 0.9mls

14) **D** - This is easy. The obvious but wrong answer is 1ml. What you need is how much Phenol 95% contains 1ml of Phenol. This is 1 / 0.95 = 1.05

15) **C** - 20mls. Your solution will be 1 in (1000/40) = 1 in 25
The solution you have is 50% = 1 in 2
Therefore the dilution will be a 1 in (25/2) or 12.5 dilution
You need 250mls . 1 in 12.5 is 20 in 250 so you need 20mls

16) **A** - 100mls contains 1.2gms salt. Therefore 1ml contains 12mg salt
15mls contains 180mg of salt. The quantity of Iron represented by 180mg salt is (180 x (56/ 278) = 36mg

17) D This is a simple question but the table of values often throws people.
A simple approach is the combine ingredients as these represent 2.5%
2.5% is 3.75gm in 150gm or 3.75gm + 146.25gm diluent
only D has this value.
An alternative to confuse often gives a set of correct numerical values but gets the units wrong i.e. w/w instead of w/v etc.

18) C This is a genuine question from a RPSGB sample paper !!
The trick is to avoid/ cut out the lengthy waffle and just calculate.

CC = (1.2(140-60)x 50)/300 = 16
therefore the dosage should be
2.5mg/L kg x 24 hrs = 2.5 x 50 = 125mg

If you get to a SC of 16, this gives only options C and E as being correct
As the dose is above minimal, then C would be logical as a choice if you get stuck on the rest of the calculation

(The value of 1.2 is normally given as 1.23 for males and 1.04 for females)

19) **D** 156gms - This is a simple calculation.
The RMM or GMW = Weight / MMOLS = 109.2 / 0.7

20 **D** Look at the formula. Only LLP is in **MLs**. This eliminates A, B, C, E
There is no need to calculate

Ingredient	A	B	C	D	E
Screenistat	14gm	28gm	28gm	14gm	28gm
Beeswax	140gm	140gm	140gm	140gm	140gm
WS Paraffin	210gm	210gm	210gm	210gm	210gm
LL Paraffin	175gm	175gm	175ml	175ml	175gm
Cetosteryl Alc.	231gm	231ml	231ml	231gm	231gm

21) **D** You require 50 x 100mg Theophylline = 5gms
The displacement value is 0.5 so 5gms will displace 5 / 0.5gms base
Or 10gms
Therefore you will need (50x1gm) - 10gm base
= 40gms

22) **B** 1 in 10,000 is 1gm in 10,000 or 1,000mg in 10,000mls
Or 1mg in 10mls or 0.2mg in 2mls or 200micrograms in 2mls
1micromol is equivalent to 50mcg
200 micrograms is therefore (200/50) micromols
= 4 micromols
If you look clearly only 3 ‘digits’ are involved 1, 2 and 5
3 would be difficult to produce as an answer by division or multiplication so is easily eliminated

23) **C** Check this in current BNF as again recommendation change.
In the current BNF (42) the recommendations on Pge 310 is a dose of 150mg daily for a child between 8-12. Page 309 recommends that prophylaxis should start 1 week before travel and continue for 4 weeks after returning. That gives 7 weeks treatment at 150mg a day or

49 x 150mg Or 49 x 1.5 tablets = 74 to the nearest whole tablet
Malaria prophylaxis in some form is a regular exam topic

25) **A** 4mls per minute = 240mls per hour (4 x 60)
1 in 10,000 is 1gm in 10,000 mls
or 0.1gm (100mg) in 1000mls
or 0.01gm (10mg) in 100mls
or 0.02gm (24mg) in 240mls (100 x 2.4)
or ((4 x 60)/10,000)gms
or ((4 x 60)/10,000) * 1000 mg

24) **A** 4mls per minute = 4 x 60 or 240mls per hour
NOW if the solution is a 1 in 1xxxxxxxx solution, the answer **MUST** Contain the digits 24 - no further calculation is necessary
However the final bit is 1 in 10,000 = (1/10,000) x 240 gms
= 0.024gms = (0.024 x 1000)mg = 24

26) **E** 12.5mls. The daily dose is (5 x15)mg = 75mg
75mg is contained in 75/6mls = 12.5mls
A dose will therefore be half that amount = 6.25mls given twice daily

27) **D** Here is the method I have used for this :-
1.9gms represents 95% of the final mass.

So 1.9 / 95 x 5	= 5% of the final mass
	= 0.02 x 5
	= 0.1gm
	= 100mg
Alternatively 1.9gms	= 1,900mg
so 1,900 / 95 x5	=20 x 5
	= 100mg

Now 100mg is 100,000 micrograms

so the time taken will be	= 100,000 / 20 seconds
	= 100,000 / 20 x 60
	= 1,000 / 12
	= 83.33333 minutes
	= 83 minutes approx.

Here is a second method :-
Look at the question again
1.9gms is 2 x 0.95gms
So if 1.9gms is 95%, then 0.1gms (2 x 50mg or 100mg) is 5%
20 mg is 1000 x 20mcg
if 20mcg takes 1 second then 20mg will take 1000 seconds
and 100mg will take 5,000 seconds (1,0000 x 5)
or 5000 / 60 minutes in minutes (60 seconds to a minute)
= 83.333 minutes

28) **B** 2 drops every 6 hours in both eyes x 50% = 8 drops
20 drops = 1ml
8 drops = 8/20th of 1ml
0.5% = 500mg in 100ml
= 5mg in 1ml
= 5 x 8/20mg in 8 drops
= 2mg
Note that this is a significant doe of Timoptol and explains why the long acting Gel formulation was introduced.

29) **B** 1 in 1800 is 1gm in 1800. – so it can’t be 10 can it.
You will need to calculate the others but both are approximately correct.

30) **B** 2.5mmols / hour means 2.5 x 24 mmols in 24 hours = 60mmols in 24 hours.
I.e. the infusion must run for 48 hours.
Alternatively the rate is 120 / 2.5 hours = 48.
2.4l litres over 24 hours = 2,400 / 24 mls per hour
= 100 mls / hour
= 100/60mls per minute
= 1.67mls per minute
= 1.67 x 20 drops per minute
= 34 approximately
This calculation needs you to have the ability to gesstimate some values.

Section 2 Classification

1) **C** - 0.25% of 7.5gms = (7.5 x 1000) / (100 * 4)mg (note 7.5 / 4 is the only real Calculation involving values other than 10s etc..)
2) **D** - (2.5 / 500) * 250 * 5
3) **B** - 1mmol = 60mg, 1/2mmol = 500 micromols.
These are simple calculations. The ‘odd’ values are designed to make them appear More difficult than they are.
4) **B** - 150 is the approximate number of millimoles per litre of Sodium in serum values vary between 140-155 depending on hospital
5) **A** - 1000 is the number of millimoles in one mole
6) **C** - Calcium is divalent so 100mmols of Calcium equal 200mEq Calcium

7) **C** 100 is the approximate number of millimoles of Chloride in Serum. See Q4 if you Hospital quotes somewhere between 95-105
8) **C** - 100 is the approximate number of millimoles of Sodium excreted normally in any 24 hour period
9) A - 1000 is the number of millimoles per litre Bicarbonate in a 100mEq per 100ml solution of Sodium Bicarbonate. Bicarbonate is monovalent

Section 3 Multiple Completion

1) **B** - 1 Litre would now contain 1 Mole and 1Mole also equals the molecular weight in grams - this is also termed the Relative Molecular Mass
2) **B** - This looks a tricky calculation. However it is simple
Look at statements 1 and 2 1.7% and 0.05%.
Multiply 0.5% by 30 = 1.5%
so statements 1 and 2 are essentially a match for a 30x dilution.
Therefore if 1 is correct, so must be 2
Statement 3 is obviously incorrect 1 in 1,800 is 1gm in 1,800 not 10
Therefore B is the only possible answer as no other options apply
If you must calculate form the values provided :-
The mother solution is 1 in 60 (1/1800) x 30)
1 in 60 = 1gm in 60mls and 0.33 in 20 mls
so this equals 1.66gms in 100mls = 1.66 % so statement 1 is correct
1 in 1800 = 0.05% (I leave you to calculate this)
also 1.66/30 = 0.05 (approx)

An exercise with Benorilate - Answer

1gm = 485mg Paracetamol
1mg Paracetamol = 1000/485mg benorilate
4,000mg Paracetamol = (1000 x 4000)/ 485mg Benorilate
= 8.25gms benorilate
Now there are 2gm of Benorilate in every 5ml of suspension so
8.25gms benorilate = (8.25 x 5) / 2 mls Benorilate Suspension
= 20.6mls Benorilate Suspension

= 8250 / 750 tablets
(converting to milligrams and there are 750mg benorilate per tablet)
= 11 tablets for a maximum Paracetamol dose

1gm = 525mg Aspirin
1mg Aspirin = 1000/525mg benorilate
4,000mg Paracetamol = (1000 x 4000)/ 525 mg Benorilate
= 7.62gms benorilate
Now there are 2gm of Benorilate in every 5ml of suspension so
7.62gms benorilate = (7.62 x 5) / 2 mls Benorilate Suspension
= 19mls Benorilate Suspension

= 7620 / 750 tablets
(converting to milligrams and there are 750mg benorilate per tablet)
= 10 tablets for a maximum Aspirin dose

The maximum recommended dose of Benorilate is 6gms for the elderly so :-
6gms Benorilate is equal to 485 x 6 gms Paracetamol = 2.91gms Paracetamol
0.525 x 6 gms Aspirin = 3.15gms Aspirin

<u>An Exercise with Potassium Chloride - Answers</u>

1) 44 divided by 2.2. = 20kg – this is a simple calculation
2) The dose is 0.5mEq per Kg so the answer is 20 x 0.5 = 10mEq
3) Potassium is monovalent. Therefore 1 mmol KCl contains 1Meq Potassium
4) 3 x 10 = 30Meq
5) KCL Concentrate contains 2mmol (Meq) Potassium in each 1ml Therefore you would add 10/2 = 5mls
6) Using the concentrate does not significantly affect the volume and therefore the calculation of flow rates. Thorough mixing would be essential.
7) Yes / No max daily dose is 1.5 x 20 = 30mEq / 24 hours

10mmols over 4 hours MAY be excessive as such a rate would equate to 60mmols/day – twice the maximum recommended. In a reasonably healthy child, this is unlikely to be a problem. In a severely ill child, a slower rate of infusion may be appropriate.

8) 250mls over 4 hours

= 250/4 x 60 mls/ minute
= 250 / 240 = 1 and 10/240 remainder = 1/24
now ½ =0 .5 so 1/20 = 0.05 so 1/24 is just under 0.05
= 1.05mls / minute (Actually 1.0466666666666)
1 drop = 1/20 ml
= 0.05mls !!!!

so the drop rate is 21 drops / minute
actually the drop rate would be set to 20 drops / minute

9 the error rate is 1 drop per minute

1 drop / minute = 60 drops / hour = 3mls
over 4 hours you would give 250mls (approximately)
or 250 – (3x4)mls accurately
= 238mls
so 238 = 238/250 x 100% = % of required dose given =95.2% = 95%
or 12/250 x 100 = error or % of required dose not given = 4.8% = 5%

However You would be giving 20 drops instead of 21
This represents an error of (approximately 1 in 20 = 5 in 100 = 5%)
This is probably an acceptable error – why ??????

10 The maximum daily dose is 25% of that recommended
that is 30mg /4Eq = 7.5mEq
You are giving 10mEq
This would then need to be given at a rate of

7.5mEq over 24 hours = 2.5mEq every 8 hours
and so the final 2.5mEq would be given over 8hours
so the total time would be 32 hours

So the flow rate would be 250 /32 x 60 mls / minute
= 250 /1920 = approximately 250 / 1800
=25/192
=(approx) 4/30 = 0.1333 (actual value of 25/192 is 0.1302)
= 0.15 to the nearest whole number
i.e. a bit of averaging doesn't affect the number of drops in that 0.1302 and 0.333 still produce 0.15 or 3 as the nearest drop rate
= 3 drops
because 1 drop = 0.05mls

3 drops / minute = (3 x 60 x 32)/20 mls over 30 hours
= (3 x 3 x 32) = 9 x 32 = 288mls over 32 hours
error rate = 288/250 x 100%
= 115% = 11.5% excess

This error rate is again probably acceptable – why – because it is borderline.
If you used 2 drops per minute the rate would be
(2 x 60 x 32)/20 mls over 32 hours
= 2 x 3 x 32 = 192 mls per hour
Error rate = 192/250 x 100% = 76.8%
= 23.2% too little

If the drip were taken down after 32 hours, 2 drops / hour would represent a significant underdosage. Therefore 3 drops / hour is the better rate. As the whole dose will be administered perhaps a little quickly whereas with 2 drops / hour the bag will be taken down before the full dose is given.

11) You will be adding 5mls of KCl concentrate
The concentrate is 15% solution
It contains 15gms in 100mls
= 1.5gms in 10mls
=0.15gms in 1ml
=0.75gms in 5mls (0.15 x 5)

you will be diluting this to 250ml
= 0.75gms in 250mls (255 to be accurate)
= 1gm in 250 x (4/3) = 1000/3
= 1gm in 333.33333mls
= 1gm in 333 mls or a 1 in 333 solution
= 1/333 x 1000 in 1000
= 3.003 in 1000
= 3 in 1000
(to two significant figures – why have I only introduced this now)

12 1gm in 333 expressed as a percentage
1gm in 333
= 1/333 in 1
= 1/333 x 100%
now 1/3 = 33%
so 1/30 = 3%
and 1/300 = 0.3%
so the answer is going to be just over 0.3% (actually 0.3003003)
but 0.3% would be an acceptable answer.

Note that in all the above, there is very little need to actually calculate anything difficult. Any anser given in the RPSGB exam for such questions would be unambiguous enough for you to easily identify it. (I.e for Q12 you will get a choice of percentages but only one would be around 0.3%.

The reason for rounding to two significant figures is that no value given in the question has more than two significant figures)

It is inevitable that there will be errors in this kind of booklet.
It would be appreciated if all errors or areas that are confusing are detailed to :-

Roy Sinclair
e-mail the info to :-
roy.sinclair@virgin.net **or post to the Yahoo Group preregpharms**