DRUG AND FLUID CALCULATION AND ADMINISTRATION WORKBOOK

FOR NEONATES AND PAEDIATRICS

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Introduction

Safe and effective administration of medicines to children requires a combination of professional competence, best available evidence and partnership with children and their families [Department of Health [DOH] 2004]. All practitioners must be aware of their own accountability when administering medicines to children. This includes knowledge of the legislation and professional regulation and guidance available. This includes the Nursing and Midwifery Council [NMC] Code of Professional Conduct [NMC 2015] and Guidelines for the Administration of Medicines [NMC 2010].

The need for complex drug calculations is due in part to the lack of licensed medicines in suitable formulations for children [Hutton and Gardner 2005]. Most paediatric drug dosages are calculated by weight or body surface area. Paediatric formularies such as the BNF for children are available and these should be consulted to ascertain the correct drug dosage for the child.

These complex calculations increase the risk of paediatric drug miscalculation when compared to adults [Hutton and Gardner 2005]. Evidence suggests that one in six medication errors is due to dose miscalculation [Hutton and Gardner 2005, DOH 2004]. However, as children are less able to compensate physiologically, the potential for harm in them increases threefold [DOH 2004].

General Principles

1. Right drug in the right dose to the right patient at the right time.

2. Don’t allow yourself to be rushed even in emergency situations.

3. If you are not happy to check and administer a drug – say so and don’t do it.

4. Never administer a drug unless you are sure of what you are giving.

5. Be aware of local and national policies and guidelines.

6. Never trust someone else’s calculations, even if that someone is senior to you. Always calculate the dose yourself – you are responsible and accountable for your own actions.
The basic formula that always works for calculating drugs is:

\[
\text{What you want \[Dose\]} \times \text{What it’s in \[Volume\]} \div \text{What you’ve got \[Preparation\]}
\]

This formula works every time providing that the dosage and preparation of the drug are in the same metric units. If they are not, it will be necessary to convert them [e.g. grams to milligrams].

**Conversions Between Units**

1 kilogram [kg] = 1000 grams [g]

1 gram [g] = 1000 milligrams [mg]

1 milligram [mg] = 1000 micrograms [mcg]

1 microgram [mcg] = 1000 nanograms [ng]

**Practice Exercises 1 – Conversions**

1. \(0.75\text{g} = \text{mg}\)
2. \(650\text{mg} = \text{g}\)
3. \(0.25\text{mcg} = \text{ng}\)
4. \(75\text{ng} = \text{mcg}\)
5. \(0.125\text{g} = \text{mg}\)
6. \(1500\text{mcg} = \text{mg}\)
7. \(1750\ \text{ng} = \text{mcg}\)
8. \(55\ \text{mcg} = \text{ng}\)
9. \(0.035\text{mg} = \text{mcg}\)
10. \(5\text{ng} = \text{mcg}\)
Drug Calculations By Weight

Children’s medicines are nearly always prescribed by weight on a dose per kilogram basis. To check the dose of a drug you nearly always need to know the weight of the child [in kg].

16 ounces = 1 pound
2.2 pounds = 1 kilogram
14 pounds = 1 stone

Practice Exercise 2 – Drug Dosages

Calculate the dosage of the following drugs on a neonate weighing 1.5kg.

1. Caffeine Citrate [10mg/kg]
2. Cefotaxime [50mg/kg]
3. Flucloxacillin [25mg/kg]
4. Chlortal Hydrate [30mg/kg]
5. Paracetamol [15mg/kg]

Displacement Values

Some drugs are available only in powdered form and require reconstitution with a diluent before they can be administered as a liquid. The actual amount of powder adds volume which is called the displacement value. The displacement value needs to be taken into consideration when reconstituting these drugs in order to ascertain the correct concentration of the drug. The most common drugs used on the NNU that have displacement values are:

Cefotaxime 1g = 0.5ml
Flucloxacillin 250mg = 0.2mls
Benzylpenicillin 600mg = 0.4mls
Amoxycillin 250mg = 0.2mls
Vancomycin 500mg = 0.3mls
<table>
<thead>
<tr>
<th>Drug</th>
<th>Displacement Value</th>
<th>Reconstitute With</th>
<th>Final Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefotaxime 1g</td>
<td>0.5ml</td>
<td>3.5mls water</td>
<td>1g / 4 mls</td>
</tr>
<tr>
<td>Flucloxacillin 250mg</td>
<td>0.2mls</td>
<td>4.8mls water</td>
<td>250mg / 5mls</td>
</tr>
<tr>
<td>Benzylpenicillin 600mg</td>
<td>0.4mls</td>
<td>3.6mls water</td>
<td>150mg / 1ml</td>
</tr>
<tr>
<td>Amoxycillin 250mg</td>
<td>0.2mls</td>
<td>4.8mls water</td>
<td>250mg / 5mls</td>
</tr>
<tr>
<td>Vancomycin 500mg</td>
<td>0.3mls</td>
<td>9.7mls water</td>
<td>50mg / 1ml</td>
</tr>
</tbody>
</table>

N.B. Due to the strong concentration of the reconstituted drug, vancomycin will need to be diluted further for safe administration. Refer to local guidelines or BNF for children for administration guidance.

Percentages

Solutions used in nursing are sometimes prepared as percentage solutions. Think of 5% glucose for example. In most cases the % is simply a descriptive label indicating, in this case, that there are 5 parts glucose per 100 parts of water. ‘Per cent’ literally means ‘per 100’. Therefore, 1% means 1 in 100.

Some drugs come in different percentage solutions. On the NNU the most common ones are 30% sodium chloride and 20% potassium chloride. How many mg per ml do these drugs contain?

By convention 1ml is equivalent to 1g and so 30% sodium chloride contains 30g in 100mls.

This means $30,000\text{mg} = 100\text{mls}$

1ml of 30% sodium chloride therefore contains:

$\frac{30,000\text{mg of sodium chloride}}{100} = 300\text{mg / ml of sodium chloride.}$
Practice Exercise 3 – Percentages

1. How many mg per ml does 20% potassium chloride contain?

2. Complete the following table for lidocaine preparations:

<table>
<thead>
<tr>
<th>Lidocaine</th>
<th>Mg per ml</th>
<th>Mcg per ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1%</td>
<td>10mg / ml</td>
<td></td>
</tr>
<tr>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Emergency Drugs

Adrenaline 1:10,000  = 0.1ml / kg

Sodium Bicarbonate 4.2%  = 2 - 4 mls / kg

Intubation Drugs

During a controlled intubation procedure in neonates, fentanyl, atropine and suxamethonium are often used to sedate and paralyse the infant. In an emergency situation the baby is intubated without the use of drugs as the baby’s clinical condition over-rides the need for sedation.

Fentanyl, Atropine and Suxamethonium all need to be diluted before administration. For a baby weighing 1.8kg the calculations would be as follows:

Fentanyl  [Dose = 2mcg / kg]

Preparation = 50mcg / 1 ml

Add 1 ml fentanyl to 4 mls 0.9% Sodium Chloride = 50mcg / 5 mls

Dose = 0.2 mls / kg of the diluted solution = 0.36 ml
Atropine  [Dose = 20mcg / kg]
Preparation = 600mcg / 1 ml
Add 1 ml atropine to 9 mls 0.9% Sodium Chloride = 600mcg / 10 mls [or 60mcg / ml]
Dose = 0.33 mls / kg of the diluted solution = 0.59 ml

Suxamethonium  [Dose = 2mg / kg]
Preparation = 100mg / 2 ml
Add 1 ml suxamethonium to 9 mls 0.9% Sodium Chloride = 50mg / 10 mls [or 5mg / ml]
Dose = 0.4 mls / kg of the diluted solution = 0.72 ml

Practice Exercise 4 – Drug Calculations
Calculate how much of the following drugs you would give:

1. 14mg Caffeine Citrate Oral Solution [10mg / 1 ml]

2. 50mg Chlroral Hydrate Oral Solution [500mg / 5 mls]

3. Cefotaxime 75mg IV injection [1g / 4 mls]

4. 2.2mg Spironolactone Oral Solution [50mg / 5 mls]

5. 25mg Chlorothiazide Oral Solution [250mg / 5 mls]

6. Paracetamol 30mg Oral Solution [125mg / 5 mls]

7. 70mg Flucloxacillin IV injection [250mg / 5 mls]

8. Cefotaxime 225mg IV injection [1g / 4 mls]
9. Gentamicin 6mg IV injection [20mg / 2 mls]

10. Ranitidine 3.3mg Oral Solution [150mg / 10 mls]

11. How much adrenaline [1:10,000] would you give to a 1.8kg baby in an emergency situation?

12. The consultant has asked for 4mls / kg of 4.2% Sodium Bicarbonate on a baby weighing 0.83kg. How much will you draw up?

13. You are looking after a 2.5kg baby on the NNU. The baby has been on CPAP but due to a worsening blood gas is now about to be intubated.

   a] Which emergency drugs are you going to prepare for intubation?

   b] Calculate the dose of each drug you will give.

   c] Demonstrate how you will make them up.

   d] Calculate the final volume of drug required for each drug [in mls]

14. The loading dose of IV Caffeine Base is 10mg / kg. The baby weighs 1.3kg.

   a] How much are you going to give?

   b] IV Caffeine Base preparation is 5mg / 1ml. What volume of drug do you need?

   The safest way to administer IV Caffeine Base is to dilute it in an equal volume of 0.9% Sodium Chloride and then administer it over half an hour.

   c] What is the final concentration of the solution you are giving?
d] How much of this solution are you going to give?

e] At what rate [mls per hour] are you going to set your pump to administer the drug over the required period?

15. The baby you are looking after weighs 3.5kg. Following a traumatic delivery by emergency caesarean section for meconium aspiration he has just begun to have seizures. The doctor has written him up for a loading dose of phenobarbitone prescribed at 17.5mg.

a] Is this the correct dose? If not, why not?

b] If not, what should it be?

Phenobarbitone IV solution comes in ampoules containing 30mg / ml.

c] How much are you going to give?

NB: Phenobarbitone must always be diluted with an equal volume of Water for Injections before administration. Phenobarbitone is incompatible with 0.9% sodium chloride and glucose.

d] What is the final concentration of the solution you are going to give?

e] How much of this final solution do you need?

f] What rate [mls per hour] does your pump need to be set at to administer this volume over 20 minutes?
Neonatal Fluid Requirements

Neonates require an enormous amount of energy to maintain adequate weight gain, growth and development. A term baby needs approximately 100-110 cal/kg/day to maintain an adequate intake of nutrition. A preterm baby needs 120-140 cal/kg/day to maintain adequate growth and development. Even then extra calorie supplements may be required. As a result it is imperative that infants receive some form of nutritional intake soon after birth rather than just clear intravenous fluids. As the majority of preterm infants are unable to swallow effectively, Total Parenteral Nutrition [TPN] needs to be commenced within 24 – 48 hours of birth on those infants unable to tolerate nasogastric feeds. Neonatal fluids are calculated on a mls / kg basis.

Fluid Regime for Neonates

Day 1 = 60mls / kg / day  
Day 2 = 90mls / kg / day  
Day 3 = 120mls / kg / day  
Day 4 = 140mls / kg / day  
Day 5 = 150mls / kg / day  
Day 6 = 160mls / kg / day  
Day 7 = 170mls / kg / day  
Day 8 and beyond = 180mls / kg / day

The above regime is for an average preterm infant. However, there may be some slight changes in specific circumstances. For example, fluids on a term baby rarely go above 150 mls / kg / day. If a baby is nil by mouth intravenous fluids do not generally go above 150 mls / kg / day. Babies who are likely to have suffered a hypoxic insult at birth are often restricted to 40mls / kg / day in the first 24 hours. In contrast infants who are growth retarded in utero, or are born to insulin dependent diabetic mothers, may have fluids commenced a day ahead [i.e. 90mls / kg / day on day 1]. Older infants who are suspected of having a patent ductus arteriosus are often fluid restricted to 120mls / kg / day to prevent additional strain on the heart.

As milk feeds increase, intravenous fluids are titrated accordingly, maintaining the same total fluid volume throughout. For example:

A 1.5kg baby is day 5 and has a total fluid requirement of 150mls / kg / day.

The baby’s total fluids therefore are 1.5 x 150 = 225mls in 24 hours.

If the total volume is then divided by 24 it gives you the amount the baby needs to receive every hour:

= 225 ÷ 24 = 9.3mls / hr.
The baby is having 4 mls milk 2 hourly [equivalent to 2mls / hr]. Therefore, intravenous fluids need to run at a total of 7.3mls / hr to maintain total fluid volume.

If the baby’s milk feeds were increasing by 1ml 6 hourly, at the time of the increase milk feeds would increase to 5mls / 2 hourly [equivalent to 2.5mls / hr]. At what rate do the intravenous fluids need to run to maintain the total fluid volume?

Total fluid requirement = 9.3mls hr

Milk feeds = 2.5 mls / hr

Therefore the intravenous infusion needs to run at 9.3 – 2.5 = 6.8 mls / hr.

Paediatric Fluid Requirements

Fluid calculations for paediatrics are calculated differently to neonates although they are still based on the weight of the child. Maintenance fluids are calculated using a percentage system. Fluids are calculated initially assuming that the child is receiving 100% maintenance fluids [i.e. the total volume of fluid required in 24 hours].

For a child weighing <10kg, 100% maintenance fluids = 100mls / kg / day.

For example, an infant weighing 7kg receives:

100 x 7 = 700mls in 24 hours

For a child weighing 10 – 20kg, 100% maintenance fluids = 100mls / kg / day for the first 10kg then 50mls / kg / day for every kilogram thereafter.

For example, a 15kg child would receive:

100 x 10kg = 1000mls +
50 x 5kg = 250mls

Total fluid requirement = 1000 + 250 = 1250mls in 24 hours
For a child weighing >20kg, 100% maintenance fluids = 100mls / kg / day for the first 10kg, 50mls / kg / day for the second 10kg, then 20mls / kg / day for every kilogram thereafter.

For example a 35kg child would receive:

\[
100 \times 10kg = 1000mls + \\
50 \times 10kg = 500mls + \\
20 \times 15kg = 300mls
\]

Total fluid requirement = 1000 + 500 + 300 = 1800mls in 24 hours

If a child is fluid restricted for any reason fluids are calculated using a percentage or fraction of the total requirement:

For example if the 35kg child mentioned above was restricted to 75% maintenance [or \(\frac{3}{4}\) maintenance, he would receive:

\[
1800mls \times 75\% = \frac{1800 \times 75}{100} = 1350mls \text{ in 24 hours}
\]

Practice Exercise 5 – Fluid Calculations

1. The baby you are looking after weighs 1.55kg. His fluid requirement is about to increase to 140mls / kg / day. What volume of milk will you give him if he is on 2 hourly feeds?

2. You have just admitted a 37 week infant weighing 4.2kg. His mother is an insulin dependent diabetic. He has a low blood sugar and needs to start an infusion of 10% dextrose at 90mls / kg / day. At what rate will you set your pump to deliver the total volume of fluid required?

3. The 1.2kg baby you are looking after is currently receiving 18mls of feed 2 hourly.
   a] How many mls / kg / day is she receiving?
   b] How much volume would you give her if she were to increase to 3 hourly feeds?
4. The baby you are looking after has a total fluid requirement of 150mls / kg / day and weighs 1.75kg.
   
   a] How many mls should the baby receive in 24 hours?
   
   b] At what rate is your pump set at to deliver continuous intravenous fluids of 10% dextrose?

   The baby is receiving 2mls of milk 2 hourly as extra fluid. His feeds have been tolerated and he is now about to increase his milk intake. To begin with you need to reduce his IVI to include the milk he is receiving.

   c] What is your new rate?

   d] His feeds are increasing 1ml 6 hourly. How will you adjust his fluids to accommodate this increase at that next change?

5. The neonate you are looking after has a total fluid requirement of 120mls / kg / day. He is receiving 90mls / kg / day of intravenous fluids and 30mls / kg / day of feed. He weighs 2.5kg. How much fluid and feed are you giving him if he is on 2 hourly feeds?

6. A 4 month old infant has just been admitted to the paediatric ward with bronchiolitis. He is too breathless to feed and needs 100% maintenance fluids. He weighs 5kg.

   a] What is his total fluid requirement?

   b] At what rate will you set your pump to give him the fluid he needs?

7. A 17kg child has just been admitted through A & E following a road traffic accident. She has a fractured arm and needs to go to theatre to have it set. She is nil by mouth as a result and needs 100% maintenance fluids.

   a] What is her total fluid requirement?

   b] At what rate will you set your pump to give her the fluid he needs?
8. A 42kg child has deteriorated since his overnight admission. He was admitted following a head injury sustained whilst playing football. His consciousness level is reducing and although he is still responsive he is a little confused. The decision has been made to stop oral fluids and commence an IVI.

a] What is his total fluid requirement?

b] At what rate will you set your pump to give him the fluid he needs?

9. The consultant has requested 2/3 maintenance fluids on a child with known cardiac anomalies who he suspects is in heart failure. His weight is 25kg.

a] What is his total fluid requirement?

b] At what rate will you set your pump to give him the fluid he needs?

10. The child you are looking after is fluid restricted to 75%. She weighs 12kg.

a] What is her total fluid requirement?

b] At what rate will you set your pump to give her the fluid she needs?

Continuous Intravenous Infusions

Some drugs in both neonatal and paediatric care are prescribed as a continuous intravenous infusion on a mcg / kg / hour basis. These drugs are diluted before administration in either a dextrose or sodium chloride solution. They can be complex but the following formula may help to ascertain the correct rate of infusion.

\[
\text{Dose [mg]} \div \text{volume [mls]} \div \text{weight [kg]} \times 1000 \text{ [converts mg to mcg]} \times \text{rate [mls / hr]} = \text{mcg / kg / hour}
\]
For example, a 2kg baby has been prescribed 10mg morphine sulphate in 50mls 5% dextrose to run at 0.2mls / hr. How many mcg / kg / hr does this equate to?

Dose = 10mg
\( \div \) volume = 50mls \[ 10 \div 50 = 0.2 \]
\( \div \) weight = 2kg \[ 0.2 \div 2 = 0.1 \]
x 1000 = mg to mcg \[ 0.1 \times 1000 = 100 \]
x rate = 0.2mls / hr \[ 100 \times 0.2 = 20 \]

Therefore the infusion is running at 20mcg / kg / hr

Some drugs such as dopamine and dobutamine are calculated on a mcg / kg / minute basis. These can be calculated in a similar way to the above but the dose also needs to be divided by 60 to convert hours to minutes.

Dose [mg]
\( \div \) volume [mls]
\( \div \) weight [kg]
\( \div \) 60 [convert hours to minutes]
x 1000 [convert mg to mcg]
x rate [mls / hr]

= mcg / kg / minute

For example, a 2kg baby has a low blood pressure and needs to commence a dopamine infusion. He has been prescribed 60mg dopamine in 50mls 5% dextrose to run at 1ml / hr. How many mcg / kg / minute does this equate to?

Dose = 60mg
\( \div \) volume = 50mls \[ 60 \div 50 = 1.2 \]
\( \div \) weight = 2kg \[ 1.2 \div 2 = 0.6 \]
\( \div \) 60 = hours to minutes \[ 0.6 \div 60 = 0.01 \]
x 1000 = mg to mcg \[ 0.01 \times 1000 = 10 \]
x rate = 1ml / hr \[ 10 \times 1 = 10 \]

Therefore the infusion is running at 10mcg / kg / minute
Practice Exercise 6 – Continuous Intravenous Infusions

1. A neonate weighing 1.5kg has been prescribed an infusion of 7.5mg morphine sulphate in 50mls 0.9% sodium chloride to run at a rate of 0.1mls / hour.

How many mcg / kg / hour does this equate to?

2. A preterm infant of 26+6 weeks gestation weighing 900g has been admitted to the neonatal unit. His blood pressure drops during your shift and you need to commence a dopamine infusion. The dosage range for dopamine is 5 – 20 mcg / kg / minute. The doctor has prescribed an infusion of 2.7mg dopamine in 50mls 5% dextrose to run at 1ml / hour.

   a] Is this the correct dose?

   b] If not, what should it be to obtain 10mcg / kg / min on an infusion running at 1ml / hour.

3. A term baby weighing 3.5kg has just been ventilated following an emergency caesarean section for meconium aspiration. You need to commence a morphine infusion of 20mcg / kg / hour. If your infusion is to run at 0.2mls / hr how much morphine sulphate do you need to add to 50mls 5% dextrose to obtain this amount?

4. The dose range for dobutamine is 2 – 10mcg / kg / minute

   In order to obtain this range the dose is calculated as follows:

   Dose = weight x 30mg in 50mls solution

   a] How many mg of dobutamine do you need to add to your solution if the baby weighs 1.4kg?

   b] At what rate does your infusion need to run to obtain 5mcg / kg / minute?
Practice Exercise 1 – Conversions - Answers

1. 750mg
2. 0.65g
3. 250ng
4. 0.075mcg
5. 125mg
6. 1.5mg
7. 1.75mcg
8. 55,000ng
9. 35mcg
10. 0.005mcg

Practice Exercise 2 – Drug Dosages - Answers

1. Caffeine Citrate = 15mg
2. Cefotaxime = 75mg
3. Flucloxacillin = 37.5mg
4. Chloral Hydrate = 45mg
5. Paracetamol = 22.5mg
Practice Exercise 3 – Percentages – Answers

1. 20% Potassium Chloride contains 200mg / ml

2. 

<table>
<thead>
<tr>
<th>Lidocaine</th>
<th>Mg / ml</th>
<th>Mcg / ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1%</td>
<td>1mg/ml</td>
<td>1000mcg / ml</td>
</tr>
<tr>
<td>0.2%</td>
<td>2mg / 1ml</td>
<td>2000mcg / ml</td>
</tr>
<tr>
<td>0.5%</td>
<td>5mg / ml</td>
<td>5000mcg / ml</td>
</tr>
<tr>
<td>1%</td>
<td>10mg / ml</td>
<td>10,000mcg / ml</td>
</tr>
<tr>
<td>2%</td>
<td>20mg / ml</td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td>50mg / ml</td>
<td></td>
</tr>
</tbody>
</table>

Practice Exercise 4 – Drug Calculations – Answers

1. 14mg Caffeine Citrate Oral Solution = 1.4 ml

2. 50mg Chloral Hydrate Oral Solution = 0.5 ml

3. Cefotaxime 75mg IV injection = 0.3 ml

4. 2.2mg Spironolactone Oral Solution = 0.22 ml

5. 25mg Chlorothiazide Oral Solution = 0.5 ml

6. Paracetamol 30mg Oral Solution = 1.2 ml

7. Flucloxacillin 70mg IV injection = 1.4 ml

8. Cefotaxime 225mg IV injection = 0.9 ml

9. Gentamicin 6mg IV injection = 0.6 ml

10. Ranitidine 3.3mg = 0.22 ml

11. Adrenaline 1:10,000 = 0.18 ml

12. 4.2% Sodium Bicarbonate = 3.3 ml
13. a) Fentanyl, Atropine, Suxamethonium

b] Fentanyl 5mcg

Atropine 50mcg

Suxamethonium 5mg

c] Fentanyl Dilute 1ml Fentanyl with 4 mls 0.9% Sodium Chloride [50mcg/5ml] 
Draw up 0.2 ml / kg

Atropine Dilute 1ml Atropine with 9 mls 0.9% Sodium Chloride [60mcg/1ml] 
Draw up 0.33ml / kg

Suxamethonium Dilute 1ml Suxamethonium with 9 mls 0.9% Sodium Chloride [5mg/ml] 
Draw up 0.4ml / kg]

d] Fentanyl 0.5ml

Atropine 0.8ml

Suxamethonium 1ml

14. a] 13mg

b] 2.6mls

c] 5mg / 2mls or 2.5mg / 1ml

d] 5.2mls

e] 10.4 mls / hr

15. a] No, it is not the correct dose. The phenobarbitone has been prescribed at the maintenance dose of 5 mg / kg and not at the required loading dose.

b] The loading dose of phenobarbitone is 20mg / kg = 70mg

c] 2.3mls
Practice Exercise 5 – Fluid Calculations – Answers

1. \[140 \times 1.55\text{kg} \div 12 = 18\text{mls} \text{ 2 hourly}\]

2. \[90 \times 4.2\text{kg} \div 24 = 15.7\text{mls} / \text{hr}\]

3. a] \[18\text{mls} \times 12 \text{ feeds} = 216\text{mls} / 24 \text{ hours}\]
   \[\div \text{ weight } [1.2\text{kg}] = 180\text{mls} / \text{kg} / \text{day}\]
   b] \[1.2\text{kg} \times 180 \div 8 = 27\text{mls} \text{ 3 hourly}\]

4. a] \[1.75\text{kg} \times 150 = 262.5 \text{ mls in 24 hours [total requirement]}\]
   b] \[\text{Rate} = 262.5 \div 24 = 10.9 \text{ mls} / \text{hr}\]
   c] \[9.9 \text{ mls} / \text{hr}\]
   d] \[\text{milk increases to 3 mls 2 hourly}\]
   \[\text{IV fluids decrease to 9.4mls / hr}\]

5. \[\text{Total fluids} = 120 \times 2.5 \div 24 = 12.5 \text{ mls} / \text{hr}\]
   \[\text{Feeds} = 30 \times 2.5 \div 24 = 6 \text{ mls 2 hourly [3mls / hr]}\]
   \[\text{Therefore IV fluids} = 12.5 - 3 = 9.5 \text{ mls} / \text{hr}\]
6. a] Total requirement is: 100 x 5kg = 500mls in 24 hours  
b] rate =  500 ÷ 24 = 20.8 mls / hr

7. a] Total requirement is: 100 x 10kg = 1000mls +  
    50 x 7kg = 350mls  
    1000 + 350 = 1350mls in 24 hours  
b] rate =  1350 ÷ 24 = 56 mls / hr

8. a] Total requirement is: 100 x 10kg = 1000mls +  
    50 x 10kg = 500mls +  
    20 x 22kg = 440mls  
    1000 + 500 + 440 = 1940mls in 24 hours  
b] rate =  1940 ÷ 24 = 80mls / hr

9. a] Total requirement is: 100 x 10kg = 1000mls +  
    50 x 10kg = 500mls +  
    20 x 5kg = 100mls  
    1000 + 500 + 100 = 1600mls in 24 hours [100% maintenance]  
    2/3 maintenance = 1600 x 66% = 1056mls in 24 hours  
b] rate =  1056 ÷ 24 = 44 mls / hr

10. a] Total requirement is: 100 x 10kg = 1000mls +  
    50 x 2kg = 100mls  
    1000 + 100 = 1100mls in 24 hours [100% maintenance]  
    75% maintenance = 1100 x 75% = 825mls in 24 hours  
b] rate =  34mls / hr
Practice Exercise 6 – Continuous Infusions – Answers

1. Dose = 7.5mg
   \[\frac{7.5}{50} = 0.15\]
   \[\frac{0.15}{1.5} = 0.1\]
   \[0.1 \times 1000 = 100\]
   \[0.1 \times 0.1 = 10\]

   Therefore infusion runs at 10mcg / kg / hr

2. a] Dose = 2.7mg
   \[\frac{2.7}{50} = 0.054\]
   \[\frac{0.054}{0.9} = 0.06\]
   \[\frac{0.06}{60} = 0.001\]
   \[0.001 \times 1000 = 1\]
   \[1 \times 1 = 1\]

   Therefore the infusion would be running at 1mcg / kg / minute which is below the dosage range so this dose is not correct.

   b] If 2.7mg in 50mls running at 1ml / hr = 1 mcg / kg / minute then

   \[27 \times 10 = 27\]

3. a] In order to calculate the dose you need to work backwards through the given formula, substituting x for ÷ and ÷ for x

   i.e. 20mcg / kg / hour
   \[\frac{20}{0.2} = 100\]
   \[\frac{100}{1000} = 0.1\]
   \[0.1 \times 3.5 = 0.35\]
   \[0.35 \times 50 = 17.5\]

   Therefore the dose required is 17.5mg in 50mls solution
4. a] 1.4kg x 30 = 42mg

    b] First calculate how many mcg / kg / minute 1ml / hr gives

    Dose = 42mg
    ÷ volume = 50mls [42 ÷ 50 = 0.84]
    ÷ weight = 1.4kg [0.84 ÷ 1.4 = 0.6]
    ÷ 60 = hours to minutes [0.6 ÷ 60 = 0.01]
    x 1000 = mg to mcg [0.01 x 1000 = 10]
    x rate = mls / hr [10 x 1 = 10]

    Therefore 10mcg / kg / minute = 1 ml / hr

    We want 5 mcg / kg / minute, therefore the infusion needs to run at 0.5 mls / hr

References


Nursing and Midwifery Council [2010], *Guidelines for the Administration of Medicines*, London: NMC.