

DEGREE _____ SEAT NO

STUDENT NUMBER - -

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Enter here the numbers of questions answered (in the order answered) →

Question Number	Marks internal	Marks external
Total		

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 - (cc) the removal or attempted removal from an examination room of any examination book or writing paper supplied by the University for the purposes of answering an examination;
 - (dd) the communication or attempted communication of any information relating to an examination to any candidate while the examination is in progress;
 - (ee) the use of a false name or identity number in an examination;
 - (ff) the submission for examination as own work any written matter or project which has been copied, reproduced or extracted, in whole or in part, from the work of another student or some other person; or which is substantially the same, in whole or in part, as the work of another student;
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 - (hh) the commission of any other fraudulent, deceitful or dishonest practice whereby any student, while being examined by the University, seeks to mislead or deceive the examiner or the examination officer.
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- (ii) Cancellation or forfeiture of examination results.
- (iii) Deprivation of a degree, diploma or certificate obtained as a result of the offence.

18(a)(A) A student who is convicted of cheating in an examination will be excluded for a minimum of two semesters, unless compelling mitigating factors are found to exist.

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DISCIPLINE OF DIETETICS & HUMAN NUTRITION
EXAMINATION: NOV/DEC 2015
SUBJECT, COURSE AND CODE: DIET 360 P2
DIET 2: DIET THERAPY – SURGICAL

DURATION: 3 HOURS

TOTAL MARKS: 100

External Examiner: Dr Tani Lombard
Internal Examiner: Ms Chara Biggs

NOTE THIS PAPER CONSISTS OF THIRTY THREE (33) PAGES AND A SEVENTEEN (17) PAGE FORMULA HANDOUT.

PLEASE CHECK THAT YOU HAVE THEM ALL.

ANSWER 2 OUT OF 3 QUESTIONS

STUDENT
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QUESTION 1

- 1.1 Ms Liver (25 year old black African female) has been admitted to your ward suffering from nausea, vomiting, fever, severe abdominal pain and moderate ascites. She was diagnosed with advanced liver cirrhosis as a consequence of chronic active hepatitis. Relevant information is listed in the table that follows.

	Measurement	Normal range
Weight (kg)	80	
Height (m)	1.73	
MUAC (cm)	24.0	
TST (mm)	35.0	
Blood sugar (mmol/l)	2.5	3.0 – 6.0
Urea (mmol/l)	2.0	3.3 – 6.5
Creatinine (mmol/l)	78.0	60 – 120
Sodium (mmol/l)	137	133 – 146
Potassium (mmol/l)	4.0	3.5 – 5.3
Cl (mmol/l)	104	96 – 106s
Bicarbonate (mmol/l)	24	20 - 30
Albumin (g/l)	18	35 - 50
Bilirubin total (umol/l)	60.0	0 – 17
Bilirubin unconjugated (umol/l)	50.0	1 - 17

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1.1.1 Assess her nutritional status from all the information that you have been given. (7)

Parameter	Calculations if necessary	Interpretation if necessary
Weight		
BMI		
MUAC (24.0 cm)		
TST (35.0 mm)		
MAMC		

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- 1.1.2 Apart from the information that you have actually been given, what else should you check for when doing a complete nutritional assessment in someone with liver failure? (6)

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- 1.1.3 Interpret each abnormal laboratory reading, discussing whether you would have expected the result as a consequence of her advanced liver cirrhosis. (5)

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1.1.4 Is your patient in compensated or decompensated balance? Is the nutritional care more important than the pharmaceutical care? Explain briefly. (2)

1.2 Cerebral is a black 8 year old girl who fell off a swing which her older brother was pushing too high. She has been admitted to the paediatric ICU with closed brain trauma. Her Glasgow Coma Scale was 5/15 on admission and cannot be reassessed as she is in a medically induced coma. The nature of the head injury requires that she lies flat on her back (supine). Her intracranial pressure is high. She has been prescribed phenytoin to prevent fits. Relevant information is listed in the table that follows including the anthropometry which you expertly measured.

	Measurement	Normal range
Weight (kg)	23	
Height (cm)	120	
MUAC (cm)	19	
TST (mm)	9	
Albumin (g/l)	26	35 - 50

1.2.1 Assess her nutritional status. (8)

Weight for age (kg)

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Height for age (cm)



BMI for age (kg/m²)

MUAC (cm)



TST (mm)

MAMC (cm)



Additional comments:

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1.2.2 Calculate her energy and macronutrient prescription.

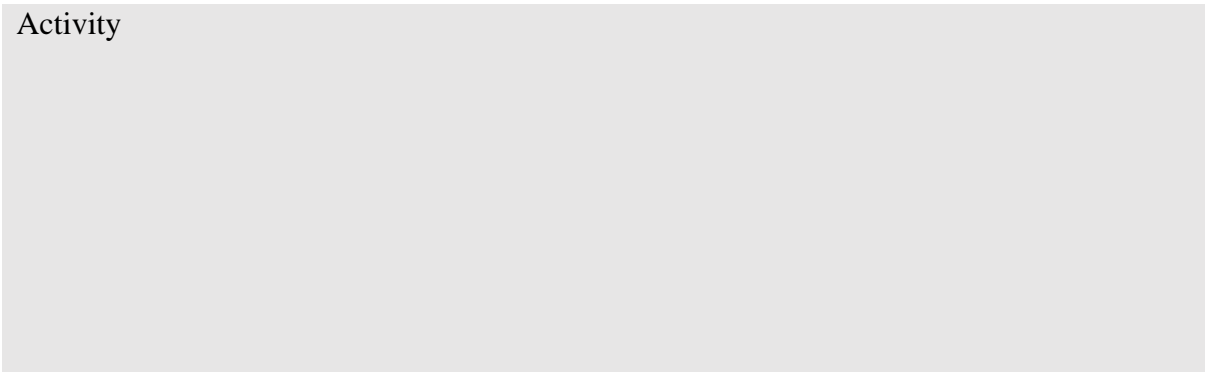
(8)

BMR



Stress factor

Activity



Total E

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Total protein

NPE:N ratio

CHO

mg/kg/min

Fat

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1.2.3 The team's decision is to enterally rather than parenterally feed her. From what you have been told are you anticipating any intolerance to the enteral feed? Elaborate. (6)

1.2.4 What enteral route would you suggest in this case? Briefly state why. (2)

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- 1.3 A friend of yours had a baby a few days ago – initially the baby seemed to be feeding appropriately and doing reasonably well - however the baby suddenly stopped tolerating feeds, bloated abdominally, had bloody stools and increased gastric residuals. Your friend has been told that her baby has necrotizing enterocolitis. Describe this and include the possible causes. (6)

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QUESTION 2

Mr Bangbang (42 year old otherwise healthy male) is in the surgical ICU after having suffered multiple trauma as a consequence of being repeatedly shot in the abdomen three days ago. He has developed sepsis and as a consequence is sweating a lot. Hyperglycaemia has necessitated sliding scale insulin. Relevant findings are included in the table which follows. He has not been fed yet via either the enteral or parenteral route.

	Measurement	Normal range
Temperature (°C)	39	
Breathing (breathes per minute)	30	
Heart rate (beats per minute)	110	
Weight (kg)	60	
BMI (kg/m ²)	24	
Blood sugar (mmol/l)	26	3.0 – 6.0
Urea (mmol/l)	5.2	3.3 – 6.5
Creatinine (mmol/l)	80	60 – 120
Sodium (mmol/l)	140	133 – 146
Potassium (mmol/l)	3.0	3.5 – 5.3
Chloride (mmol/l)	100	96 – 106
Bicarbonate (mmol/l)	24	20 – 30
Magnesium (mmol/l)	0.68	0.74 – 0.99
Albumin (g/l)	37	35 – 50
Bilirubin (umol/l)	10	0 – 17
ALP (U/l)	40	30 – 85
ALT(U/l)	25	0 – 53
AST (U/l)	29	0 – 32
GGT (U/l)	22	0 – 32

- 2.1 During the ICU ward round you request that some form of nutrition is initiated. The surgeon offhandedly comments that a little starvation never hurt anyone. You counter this with the argument that Mr Bangbang is not simply starving but is in fact hypermetabolic. You have been asked to explain the difference between these 2 states at the next medical update meeting. Fill in the table below as the basic outline for your talk. Please note the marks allocated to each section as an indication of the detail needed. (28 by ½ marks = 14)

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	Starvation	Metabolic response to injury (catabolic phase)
Energy needs and BMR (marks 2½)		
E source (marks 1)		
Ketones (marks 1)		
Insulin (anabolic) (marks 1 ½)		

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	Starvation	Metabolic response to injury (catabolic phase)
Catabolic hormones (marks 1½)		
Protein breakdown (marks 3)		
Glycogenolysis (marks 1 ½)		

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Starvation	Metabolic response to injury (catabolic phase)
Fat breakdown (marks 1)	
Weight loss (marks 1)	

- 2.2 During the ward round, the consultant asked the registrar to explain the probable causes of the patients low potassium levels. The registrar has suggested that this is a consequence of the hepatorenal syndrome. You have been asked whether you agree and if you don't then to suggest other possible causes for the hypokalemia. (6)

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- 2.3 From what you know, do you think that he is likely to have SIRS? Include a brief explanation of SIRS. (9)

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- 2.4 The hyperglycaemia is concerning. List the most probable cause in Mr Bangbang's case and the general consequences. (10)

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- 2.5 Taking into consideration all you know about this patient, plan an appropriate energy and macronutrient prescription. (8)

BMR

Stress factor

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Activity



Total E

Total protein



NPE:N ratio

CHO



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mg/kg/min

Fat



- 2.6 Would fat or water soluble vitamins be more likely to be needed in higher quantities?
Briefly discuss. (3)

[50]

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QUESTION 3

Mrs Kidknee is a 70 year old lady who has been on conservative management for renal failure for a number of years. She has just been referred to the renal unit as there are indications that she will need dialysis. Apart from the renal failure (caused by the unintentional misuse of Disprin) she is otherwise healthy with no other systemic diseases. However she has been experiencing some angina like pains and has been scheduled for an angiogram within the next 2 weeks. She is a bit concerned as she has noticed that in the last week she has suddenly gained 5 kg and does not think that she has been eating anything out of the ordinary to make her so fat. She is a fit, active individual who lives in a remote cottage on the Transki coast. She loves to watch the whales and dolphins and hike along the beach. She is a wild life photographer for National Geographic and therefore travels a lot. Relevant information is in the table which follows.

	Measurement	Normal range
Body weight (kg)	70	
Height (cm)	162	
Wrist circumference (cm)	12	
Albuminuria (mg/mmol)	15	
GFR (ml/min/1.73m ²)	5	
Urea (mmol/l)	18	3.3 – 6.5
Creatinine (mmol/l)	1500	60 – 120
Sodium (mmol/l)	145	133 – 146
Potassium (mmol/l)	6.1	3.5 – 5.3
Bicarbonate (mmol/l)	13	20 – 30
Chloride (mmol/l)	100	96 – 106
Albumin (g/l)	30	35 – 50
Calcium (mmol/l)	1.8	2.1 – 2.6
Phosphorus (mmol/l)	1.8	0.84 – 1.45
PTH	Detected	High

She diligently takes Centrum Silver 50 plus daily. The nutritional content is listed in the table that follows.

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Amount Per Serving	Amount	% RDA
Vitamin A	2,500 IU	50%
Vitamin C	60 mg	100%
Vitamin D	500 IU	125%
Vitamin E	50 IU	167%
Thiamin	1.5 mg	100%
Riboflavin	1.7 mg	100%
Niacin	20 mg	100%
Vitamin B6	3 mg	150%
Folic Acid	400 mcg	100%
Vitamin B12	25 mcg	417%
Pantothenic Acid	10 mg	100%
Calcium	220 mg	22%
Phosphorus	20 mg	2%
Zinc	11 mg	73%

- 3.1 Like most of us, she passionately hates needles and the hospital environment, and is not keen to start dialysis as she does not want to acknowledge that the renal failure is getting worse. She has asked you in confidence whether you feel that dialysis is absolutely necessary. Support your answer as to whether you feel that she should start dialysis or whether she should continue on conservative management. (6)

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3.2 Your renal unit equally favours the use of either peritoneal or haemodialysis. Taking what you know about her into account, which form of dialysis do you think is the most appropriate should she need dialysis. Substantiate your answer please. (6)

3.3 She does not understand the process of dialysis nor the difference between the two types. Explain to her simply the process. Use diagrams to explain each type of dialysis. (6)

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- 3.4 You are about to take 3 weeks leave. Dialysis of some form may be initiated during this period. As no decision has been made as yet work out her energy and macronutrient requirements for both forms of dialysis. The PD unit uses 3 bags of 1.5% (7.6 g CHO per bag) and 1 bag of 2.5% (27.9 g per bag). (10)

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Frame size



% of standard body weight

Adjusted weight



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CAPD	Haemodialysis
Energy	
Protein	
NPE	

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CHO	
mg/kg/min	
Fat	
P (mg/day)	
Na (mg/day)	
K (mg/day)	
Fluid (l/day)	

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3.5 She does not like change and would prefer to keep following the diet prescribed by her previous dietician - the exchanges are below. Can she still follow this diet? Fill in the table below using the renal exchange summary sheet to work out what she is getting in total and comment on whether this is still a suitable diet to follow. (6)

Group	Number of exchanges	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO4 (mg)	Na (mg)	K (mg)
Meat & meat substitutes								
Meat - high P, low Na	2							
Legumes high Na	2							
Milk								
high kJ, fat, CHO	1							
Starch								
Starch low K, low kJ, low fat	6							
Starch low K, high kJ, high fat	2							
Vegetables								
Vegetables low K	1							
Vegetables moderate K	1							
Vegetables high K	1							
Fruit								
Fruit low K	1							
Fruit moderate K	1							
Fruit high K	1							
Beverages								
Beverages high kJ	4							
Sugar	4							
Fat	6							
Totals								
Prescription								

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- 3.6 She has diligently been taking 2 phosphate binders at each meal and 1 at each snack. Looking at her meal plan below would you agree with this? Comment including an example of a commonly used phosphate binder. (3)

Meal Plan

2 peppermints to suck during the day

Breakfast

Egg boiled with 2 slices of bread spread with 2 teaspoons of butter and a banana and a cup of tea with quarter a cup of full cream milk and 2 teaspoons of white sugar

Snack

Apple and an orange

Lunch

Toasted cheese and tomato sandwich (2 slices bread, 30 g cheese, 2 teaspoons butter) with a medium glass of Fanta Orange

Snack

100 g slice of carrot cake plus a glass of Lucozade

Supper

A medium cream sherry before supper
Lentil stew with tomato and onion base served with boiled white rice and lettuce with salad dressing
cup of tea with quarter a cup of full cream milk and 2 teaspoons of white sugar

Late evening

4 large marshmallows

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3.7 Briefly discuss the main cause and health implications of the detected PTH. (5)

3.8 Will Centrum Silver meet her needs on dialysis? Comment next to each vitamin/mineral under the column of either HD or CAPD. (8)

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Micronutrient	HD	CAPD
Vitamin A 2,500 IU RDA 50%		
Vitamin C 60 mg RDA 100%		
Vitamin D 500 IU RDA 125%		
Vitamin E 50 IU RDA 167%		
Thiamin 1.5 mg RDA 100%		

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<p>Riboflavin 1.7 mg RDA 100%</p>		
<p>Niacin 20 mg RDA 100%</p>		
<p>Pyridoxine 3 mg RDA 150%</p>		
<p>Folic Acid 400 mcg RDA 100%</p>		
<p>Vitamin B12 25 mcg RDA 417%</p>		

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Pantothenic Acid 10 mg RDA 100%		
Calcium 220 mg RDA 22%		
Phosphorus 20 mg RDA 2%		
Zinc 11 mg RDA 73%		

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MODEL ANSWER

QUESTION 1

3.1 Ms Liver (25 year old black African female) has been admitted to your ward suffering from nausea, vomiting, fever, severe abdominal pain and moderate ascites. She was diagnosed with advanced liver cirrhosis as a consequence of chronic active hepatitis. Relevant information is listed in the table that follows.

	Measurement	Normal range
Weight (kg)	80	
Height (m)	1.73	
MUAC (cm)	24.0	
TST (mm)	35.0	
Blood sugar (mmol/l)	2.5	3.0 – 6.0
Urea (mmol/l)	2.0	3.3 – 6.5
Creatinine (mmol/l)	78.0	60 - 120
Sodium (mmol/l)	137	133 - 146
Potassium (mmol/l)	4.0	3.5 – 5.3
Cl (mmol/l)	104	96 – 106s
Bicarbonate (mmol/l)	24	20 - 30
Albumin (g/l)	18	35 - 50
Bilirubin total (umol/l)	60.0	0 – 17
Bilirubin unconjugated (umol/l)	50.0	1 – 17

1.1.1 Assess her nutritional status from all the information that you have been given. (7)

Most did not include albumin in the model but put it in later under commenting on the biochemistry ie 1.1.3 so I marked it there and included it in the marks.

INCLUDE FLUID CHART FOR ASCITES, MAC, TST, MAMC, NORMAGRAM, SCHOFIELD

Parameter	Calculations if necessary	Interpretation if necessary
Weight on admission 80kg	80 kg – minus 6 kg for moderate ascites = 80-6 = 74 kg	✓
BMI	$74/1.73 \times 1.73 = 74/2.99 = 24.7 \text{ kgm}^2$	appropriate weight for height and not malnourished acc to this parameter ✓
MUAC (24.0 cm)	MAC = <25 th percentile	thin arms and not nutritionally compromised for the cut off for adults is ≥ 22 cm which is the cut off for malnutrition ✓
TST (35.0 mm)	TST= above 90 th percentile	High body fat stores ✓

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MAMC	About 12.7	Below the 5th therefore low muscle stores ✓
------	------------	---

Her blood albumin levels are severely depleted indicating either malnutrition or severe metabolic stress – they are not very reliable in liver involvement as the liver is involved in the manufacture of albumin so cant really access nutritional status from this ✓

Therefore she has a normal BMI so a normal weight for height but is carrying too little muscle but too much fat and very metabolically stressed. ✓

1.1.2 Apart from the information that you have actually been given, what else should you check for when doing a complete nutritional assessment in someone with liver failure? (6)

Most did badly as they did not learn this section

When doing an assessment check for:

- the existence of nausea, vomiting, steatorrhoea, constipation, diarrhoea and the use of Lactulose (causes D if dose is too large) ✓
- muscle cramps (?magnesium deficiency) ✓
- decreased taste acuity (?zinc deficiency), taste changes ✓
- weight changes ie a series not one weight in isolation ✓
- changes in appetite ✓
- pain on eating or swallowing ✓
- use of herbs, over the counter medicine, vitamins and minerals ✓

1.1.3 Interpret each abnormal laboratory reading, discussing whether you would have expected the result as a consequence of her advanced liver cirrhosis. (5)

Urea low	Would expect the low urea levels as as liver makes urea from ammonia and there is reduced removal of ammonia from the blood by the liver. ✓
Glucose	Glucose is low – would have expected this as there is no room to store glycogen in the badly damaged liver ✓ plus decreasing capacity for gluconeogenesis to support the blood sugar levels. ✓ (Could argue that they would not have expected this because of the insulin resistance and inc glucagon levels but tends to be hypoglycaemic in advanced stages).
Albumin	Albumin levels are low but expected as there is a decreased synthesis of alb by the liver <i>This point should have been referred to in the previous question for a mark.</i>
Bilirubin	Would expect the br to be high as alb is low and br is attached to alb and then carried to the liver to be excreted ✓
Bilirubin unconjugated	unconjugated is high because the liver can not conjugate br in the hepatocytes as they are too damaged from advanced liver disease. ✓

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1.1.4 Is your patient in compensated or decompensated balance? Is the nutritional care more important than the pharmaceutical care? Explain briefly. (2)

Decompensated as symptoms are apparent ✓ Nutritional care is very nb in decompensated disease because the use of drugs is limited by the livers ability to metabolize them ie so medication options are limited. ✓

1.2 Cerebral is a black 8 year old girl who fell off a swing which her older brother was pushing too high and has been admitted to the paediatric ICU with closed brain trauma. Her Glasgow Coma Scale was 5/15 on admission and cannot be reassessed as she is in a medically induced coma. The nature of the head injury requires that she lies flat on her back (supine). Her intracranial pressure is high. She has been prescribed phenytoin to prevent fits. Relevant information is listed in the table that follows including the anthropometry which you expertly measured.

	Measurement	Normal range
Weight (kg)	23	
Height (cm)	120	
MUAC (cm)	19	
TST (mm)	9	
Albumin (g/l)	26	35 – 50

1.2.1 Assess her nutritional status. (8)

	Measurement	Normal range	
Weight (kg)	23	<0	Normal weight for age ✓
Height (cm)	120	< -1	Normal height for age ✓
BMI (kg/m ²)	16.0	Above 0	Appropriate weight for actual height ✓
MUAC (cm)	19	Below 50 th	Normal arm circumference – above MAM cut off of 13.5 cm ✓
TST (mm)	9	Below 50 th	Normal fat stores ✓
MAMC (cm)	16	On 50 th	Normal muscles store ✓s

Moderately depleted albumin ✓ which considering her good nutritional status is likely due to be due to the stress response as albumin is an acute phase protein. ✓

1.2.2 Calculate her energy and macronutrient prescription. (8)

Include childrens Schofield

Energy Requirements (accurate weight and height)

Females

Weight

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<3 years	0	3404	0
3 - 10 years	23	4000	4000
10 - 18 years	0	3173	0
Males	Weight		
<3 years	0	5041	0
3 - 10 years	0	2391	0
10 - 18 years	0	2847	0
Basal Metabolic Rate:			4000
Metabolic rate adjustment	30	%	1200
Activity factor	0	%	0
Total Energy			5200
Protein	g/kg BW		Protein (g)
	1.5		35
	% TE		NPE:
	11		836
CHO	% of Tot E		Total (g)
	49		150
	mg/kg/min		
	4.5		
Fat	% of Tot E		Total
	40		55

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Total % of protein, CHO, fat

100

MAXIMAL GLUCOSE OXIDATION RATES that must not be exceeded (Shaw and Lawson 2007, pg 145 , 391 ; Jain 2010)

Age	Glucose (mg/kg/min)
Neonates	12
Infants < 1 year	8 – 9
Toddlers and Children	5 – 7
Adolescents	4

Paediatrics

Nutritional requirements for paediatric neurosurgical patients

Energy	Use <u>childrens schofield</u>
Protein	1.5--3.0g/kg/IBW
Carbohydrate	45--50% of total energy
Fat	40--45% (up to 6 years of age) of total energy

1.2.3 The teams decision is to enterally rather than parenterally feed her. From what you have been told are you anticipating any intolerance to the enteral feed? Elaborate. (6)

Yes as the raised intracranial pressure ✓ can result in delayed gastric emptying ✓, can induce V by pressing on the vomiting centre ✓ and can cause erosive gastritis and ulceration ✓ and she is taking opiates which also results in delayed GE. ✓ She also has to lie flat and head injuries have a depressed gag reflex so this would encourage aspiration. ✓

1.2.4 What enteral route would you suggest in this case? Briefly state why. (2)

Jejunal ✓ as this is post pyloric therefore the delayed GE is not important ✓

1.3 A friend of yours had a baby a few days ago – initially the baby seemed to be feeding appropriately and doing reasonably well - however the baby suddenly stopped tolerating feeds, bloated abdominally, had bloody stools and increased gastric residuals. Your friend has been told that her baby has necrotizing enterocolitis. Describe this and include the possible causes. (6)

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Portions of the bowel die off in premature infants ✓
 Present with increased gastric residuals, abdominal distension, bloody stools and not tolerating feeds. Results in intestinal perforation, peritonitis and systemic hypotension. Approximately 2 weeks or more to recover and before enteral feeding can be resumed – 70 to 80% survive. Cause unknown but probably include intestinal flora ✓, extended use of antibiotics (over 5 days), □ ✓ feeding and changes in mesenteric blood flow. □ ✓ Usually not seen before infant is fed ✓ – it appears that NEC is tens time more likely if formula rather than breast fed. □ ✓

[50]

QUESTION 2

Mr Bangbang (42 year old otherwise healthy male) is in the surgical ICU after having suffered multiple trauma as a consequence of being repeatedly shot in the abdomen three days ago. He has developed sepsis and as a consequence is sweating a lot. Hyperglycaemia has necessitated sliding scale insulin. Relevant findings are included in the table which follows. He has not been fed yet via either the enteral or parenteral route.

	Measurement	Normal range
Temperature (°C)	39	
Breathing (breathes per minute)	30	
Heart rate (beats per minute)	110	
Weight (kg)	60	
BMI (kg/m ²)	24	
Blood sugar (mmol/l)	26	3.0 – 6.0
Urea (mmol/l)	5.2	3.3 – 6.5
Creatinine (mmol/l)	80	60 – 120
Sodium (mmol/l)	140	133 – 146
Potassium (mmol/l)	3.0	3.5 – 5.3
Chloride (mmol/l)	100	96 – 106
Bicarbonate (mmol/l)	24	20 – 30
Magnesium (mmol/l)	0.68	0.74 – 0.99
Albumin (g/l)	37	35 – 50
Bilirubin (umol/l)	10	0 – 17
ALP (U/l)	40	30 – 85
ALT(U/l)	25	0 – 53
AST (U/l)	29	0 – 32
GGT (U/l)	22	0 – 32

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2.1 During the ICU ward round you request that some form of nutrition is initiated. The surgeon offhandedly comments that a little starvation never hurt anyone. You counter this with the argument that Mr Bangbang is not simply starving but is in fact hypermetabolic. You have been asked to explain the difference between these 2 states at the next medical update meeting. Fill in the table below as the basic outline for your talk. Please note the marks allocated to each section as an indication of the detail needed. (28 by ½ marks = 14)

Table comparing the effects of starvation and hypermetabolism

All table are examinable unless you are specifically told otherwise

(adapted from Zaloga, 1994)

	Starvation	Metabolic response to injury (catabolic phase)
E needs and BMR (marks 2½)	Decreased ✓½	Increased because of release of catecholamines ✓½ Extent depends on: type of injury eg burns ✓½ severity of injury eg 20% vs 50% burns ✓½ presence or absence of infection ✓½
E source (marks 1)	Lipids ✓½	Lipids, carbohydrates, protein ✓½
Ketones (marks 1)	Present ✓½ (less insulin)	Absent ✓½
Insulin (anabolic) (marks 1½)	Decreased ✓½	Normal or increased ✓½ and insulin resistance ✓½ (catecholamines) Often need insulin injections
Catabolic hormones (marks 1½)	Basal ✓½	Increased (insulin resistance and anorexia) ✓½ Results in catabolism of fat, skeletal muscle, connective tissue, glycogen Includes adrenocorticotrophic hormone (ACTH), growth hormone (GH), catecholamines, cortisol, glucagon ✓½

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Protein breakdown (marks 3)	Decreased ✓ ^{1/2}	Accelerated (ACTH, glucagon) ✓ ^{1/2} Supplies precursors for: - increased production of immune cells - plus structural proteins - and acute phase proteins to contain infection and begin wound repair ✓ ^{1/2} ✓ ^{1/2} Initially uses skeletal muscle/connective tissue to supply glutamine an nb fuel source for the immune system and the GIT ✓ ^{1/2} Maintains a supply of glucose ✓ ^{1/2} Long term uses vital structures eg organs and circulating proteins eg albumin
Glycogenolysis (marks 1½)	Increased ✓ ^{1/2}	Accelerated (increased glucagon levels) ✓ ^{1/2} Results in hyperglycaemia to maintain a supply of glucose during hypotension and poor organ perfusion (GIT is also an organ) ✓ ^{1/2}
Fat breakdown (marks 1)	Increased ✓ ^{1/2}	Increased (ACTH) to supply additional E ✓ ^{1/2}
Weight loss (marks 1)	Gradual ✓ ^{1/2}	Accelerated especially if inadequate nutritional support so can lose a life threatening amount of weight quickly ie 20% of body protein can be lost in 2 weeks following major injury ✓ ^{1/2}

2.2 During the ward round, the consultant asked the registrar to explain the probable causes of the patients low potassium levels. The registrar has suggested that this is a consequence of the hepatorenal syndrome. You have been asked whether you agree and if you don't then to suggest other possible causes for the hypokalemia. (6)

The LFT's are normal so no liver involvement so cant be hepatorenal ✓ plus the urea and creatinine normal ✓

Causes include:

- inadequate intake (most std enteral formula contain sufficient) ✓
- overfeeding (refeeding syndrome)
- excessive sweating (fever etc) ✓
- sliding scale insulin ✓
- excessive GI losses eg V, D
- drainage from fistulas and stomas
- hypomagnesemia - if low serum Ca, P and K concs there may be a mg depletion ✓

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2.3 From what you know, do you think that he is likely to have SIRS? Include a brief explanation of SIRS. (9)

Systemic Immune Response Syndrome ✓

This is an excessive inflammation from the activation of the innate immune system and the proinflammatory cascade (Clifford 2004) ✓ with the increased formation of humoral mediators (catecholamines, glucocorticoids), proinflammatory cytokines (TNF, IL-1, IL-6) and chemokines (C5a, LTB₄, PAF) which shifts the T-helper cells to the Th1-type response (Clifford 2004 citing Bones *et al* 1992; citing Levy *et al* 2003). ✓

Yes as in surgical ICU ✓ with multiple trauma ✓ and sepsis (sirs plus infection) ✓

Diagnosis/symptoms of SIRS is 2 or more of the following (Clifford 2004 citing Bones *et al* 1992; citing Levy *et al* 2003):

- Temperature >38⁰C or <36⁰C ✓
- Heart rate of >90 beats per minute ✓
- Respiratory rate of >20 breathes per minute (bpm) or PaCO₂ < 32 mmHg PaCO₂ PaCO₂ is the partial pressure of carbon dioxide in the blood which is essential to regulate breathing levels and to maintain the pH ✓
- White blood cell count >12 000/mm³, <4000/mm³ or >10% bands
- as well as altered cytokine levels (TNF-α, IL-1β, IL-6, IL-8)

2.4 The hyperglycaemia is concerning. List the most probable cause in Mr Bangbang's case and the general consequences. (10)

Not feeding, not diabetic so stress response ✓

Hyperglycaemia *in the ICU* results in:

- Infection ✓
Glucose binds to complement and stops it from attaching to microbial surfaces it impairs phagocyte recognition and impairs leukocyte function (Wright 2000)
BG >12 mmol/l doubled the incidence of nosocomial infection ✓
(Schrezenmeir 1998 citing Rayfield *et al* 1982)
- Fluid imbalance and dehydration (Wright 2000) ✓
Glycosuria increases urinary loss of water, E and electrolytes
- Oxidative stress ✓
Generates oxidants and appears to compromise defence against oxidants
(Schrezenmeir 1998 citing Santini *et al* 1997)
- Increased coagulation (Wright 2000) ✓
Increased coagulation factors (fibrinogen, plasminogen activator inhibitor-1, von Willebrand factor) (Wright 2000) Promotes leukocyte and platelet aggregation

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- Dyslipidemia ✓
 Suppression of LPL (insulin lack or resistance) which increases TG
 High TG increases ‘stickiness’ of leukocytes and impairs response to infection
 ie increases aggregation and coagulability ✓
- Ketoacidosis and coma (Wright 2000) ✓
- Vasoconstriction
 Impairs NO release (vasodilatory) therefore can result in vasoconstriction
 ie reduced perfusion and potential organ damage (Schrezenmeir 1998 citing Giugliano
et al 1995) ✓

2.5 Taking into consideration all you know about this patient, plan an appropriate energy and macronutrient prescription. (8)

The CHO should be lower because of the hyperglycaemia and the protein higher because of the SIRS ie high metabolic response. **In spite of them saying that he had SIRS in the question earlier many did not choose this as the stress factor. I did not make the activity factor clear as they do not have the experience to realise that someone who has SIRS and who has a multiple gunshot abdomen is unlikely to be sitting up so accepted an activity factor of up to 20% ie for sedated, bedbound immobile and bedbound sitting up but not for mobile on ward.**

MACRONUTRIENT REQUIREMENTS Protein: (Thoma

Possible stress factors are multiple trauma 40%, sepsis 20 to 40% but as he has SIRS they should give 50% and therefore also the higher protein.

2001, p69)CHO: (Klein *et al* 1998)

Macronutrients	Requirements (g/kg/day)	
Protein	Metabolic Status	Requirement
	Normal	1 (0.87 – 1.25)
	Hypermetabolic: 0-25%	1.25 (1.0 – 1.5) 1.5 (1.25 – 1.87)
	25-50%	1.87 (1.56 – 1.87)
	>50%	
	Depleted	1.87 (1.25 – 2.5)
Carbohydrate	50-60% of total energy	
Lipids	30% of total energy	

Glucose Oxidation:
Non-diabetic: Glucose oxidation reaches a maximum at 5 mg/min/kg/day. (Krause's Food, Nutrition and Diet Therapy, 10th ed. 2000, pg 474)
For diabetic: Glucose oxidation reaches a maximum at 2.5 – 4.0 mg/min/kg/day. Catherine J. Klein, Gena S. Stanek, Charles E. Wiles. American Dietetic Association. Journal of the American Dietetic Association. Chicago: Jul 1998 Vol. 98, Iss 7; pg 807

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Include Schofield equation

Energy Requirements				
Females	Weight			
10 - 17 yrs	0	2897	0	
18 - 29 yrs	0	2039	0	
30 - 59 yrs	0	3541	0	
60 - 74 yrs	0	2876	0	
75+ yrs	0	2612	0	
Males				
	Weight			
10 - 17 yrs	0	2750	0	
18 - 29 yrs	0	2897	0	
30 - 59 yrs	60	6543	6543	
60 - 74 yrs	0	2930	0	
75+ yrs	0	3437	0	
Basal Metabolic Rate:		6543		kJ
Metabolic rate adjustment	50	%	3271	kJ
Activity factor	0	%	0	kJ
Total Energy		9814		kJ

Protein	g/kg BW	Protein (g)
	1.87	112
	% TE	NPE:gN
	19	440

CHO	% of Tot E	Total CHO (g)
	51	294

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<table border="1" style="margin: auto;"> <tr> <td style="padding: 2px 10px;">mg/kg/min</td> </tr> <tr> <td style="padding: 2px 10px;">3.4</td> </tr> </table>	mg/kg/min	3.4
mg/kg/min		
3.4		

Fat	<table border="1" style="margin: auto;"> <tr> <td style="padding: 2px 10px;">% of Tot E</td> </tr> <tr> <td style="padding: 2px 10px;">30</td> </tr> </table>	% of Tot E	30	<table border="1" style="margin: auto;"> <tr> <td style="padding: 2px 10px;">Total Fat (g)</td> </tr> <tr> <td style="padding: 2px 10px;">77</td> </tr> </table>	Total Fat (g)	77
% of Tot E						
30						
Total Fat (g)						
77						

Total % of protein, CHO, fat	100	%
-------------------------------------	------------	----------

2.6 Would fat or water soluble vitamins be more likely to be needed in higher quantities? Briefly discuss. (3)

Water soluble ✓ as biological half life of fat soluble vitamins is usually long ✓ therefore deficiencies of the fat soluble vitamins are less likely to happen
Tissue stores are small of water soluble ✓

[50]

QUESTION 3

Mrs Kidknee is a 70 year old lady who has been on conservative management for renal failure for a number of years. She has just been referred to the renal unit as there are indications that she will need dialysis. Apart from the renal failure (caused by the unintentional misuse of Disprin) she is otherwise healthy with no other systemic diseases. However she has been experiencing some angina like pains and has been scheduled for an angiogram within the next 2 weeks. She is a bit concerned as she has noticed that in the last week she has suddenly gained 5 kg and does not think that she has been eating anything out of the ordinary to make her so fat. She is a fit, active individual who lives in a remote cottage on the Transki coast. She loves to watch the whales and dolphins and hike along the beach. She is a wild life photographer for National Geographic and therefore travels a lot. Relevant information is in the table which follows.

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	Measurement	Normal range
Body weight (kg)	70	
Height (cm)	162	
Wrist circumference (cm)	12	
Albuminuria (mg/mmol)	15	
GFR (ml/min/1.73m ²)	5	
Urea (mmol/l)	18	3.3 – 6.5
Creatinine (mmol/l)	1500	60 – 120
Sodium (mmol/l)	145	133 – 146
Potassium (mmol/l)	6.1	3.5 – 5.3
Bicarbonate (mmol/l)	13	20 – 30
Chloride (mmol/l)	100	96 – 106
Albumin (g/l)	30	35 – 50
Calcium (mmol/l)	1.8	2.1 – 2.6
Phosphorus (mmol/l)	1.8	0.84 – 1.45
PTH	Detected	High

She diligently takes Centrum Silver 50 plus daily. The nutritional content is listed in the table that follows.

Amount Per Serving	Amount	% RDA
Vitamin A	2,500 IU	50%
Vitamin C	60 mg	100%
Vitamin D	500 IU	125%
Vitamin E	50 IU	167%
Thiamin	1.5 mg	100%
Riboflavin	1.7 mg	100%
Niacin	20 mg	100%
Vitamin B6	3 mg	150%
Folic Acid	400 mcg	100%
Vitamin B12	25 mcg	417%
Pantothenic Acid	10 mg	100%
Calcium	220 mg	22%
Phosphorus	20 mg	2%
Zinc	11 mg	73%

3.1 Like most of us, she passionately hates needles and the hospital environment, and is not keen to start dialysis as she does not want to acknowledge that the renal failure is getting worse. She has asked you in confidence whether you feel that dialysis is absolutely

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necessary. Support your answer as to whether you feel that she should start dialysis or whether she should continue on conservative management. (6)

Definitely needs dialysis ✓ Her potassium is very high ✓, she is acidotic (bicarb 15) ✓, her GFR is below 10 ✓, there is uremia (high urea/creatinine) ✓, and she is fluid overloaded as she has rapidly gained 5 kg. ✓

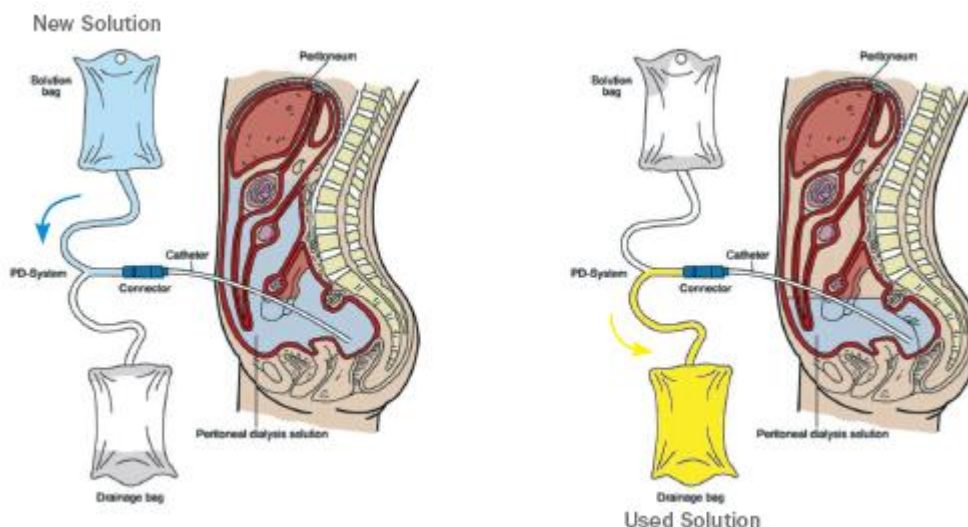
3.2 Your renal unit equally favours the use of either peritoneal or haemodialysis. Taking what you know about her into account, which form of dialysis do you think is the most appropriate should she need dialysis. Substantiate your answer please. (6)

PD ✓ is preferable in:

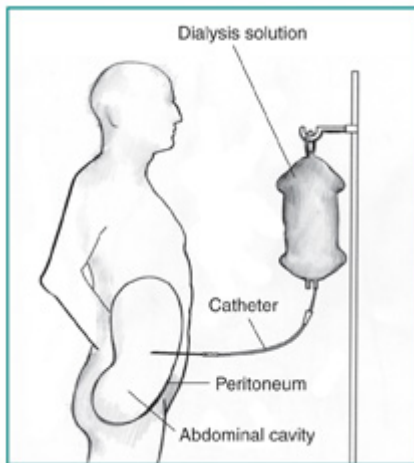
- elderly patients ✓
- cardiovascular disease – suspected as being sent for an angiogram ✓
- independent lifestyle, travel a lot ✓
- live a distance away from a HD centre ✓
- hates needles ✓

3.3 She does not understand the process of dialysis nor the difference between the two types. Explain to her simply the process. Use diagrams to explain each type of dialysis. (6)

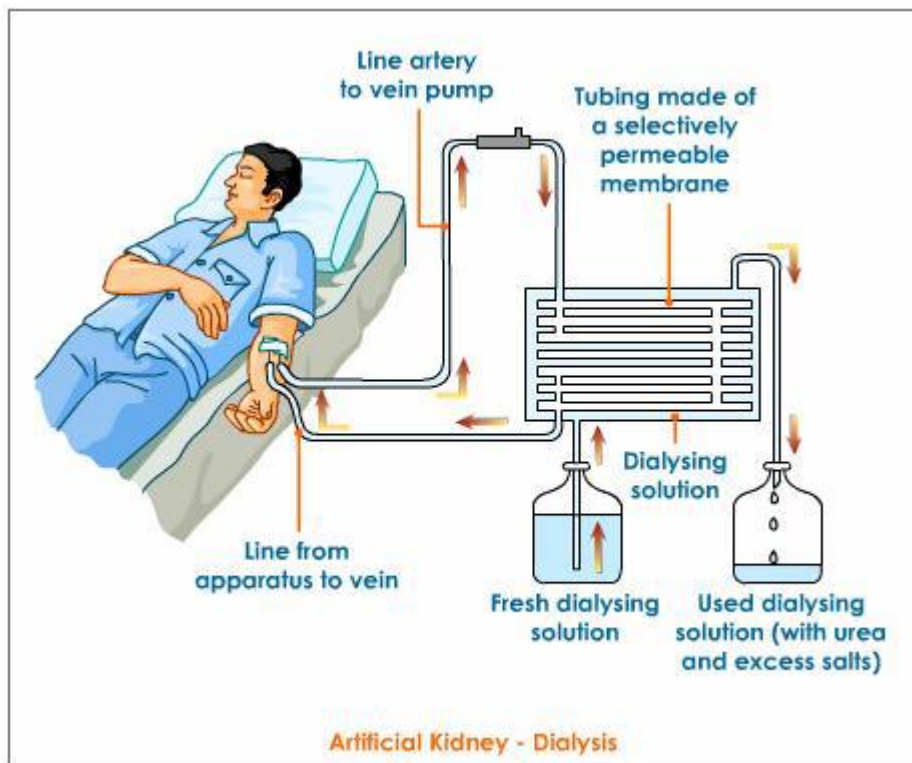
In either form of dialysis a dialysate (a concentrated solution) is used to transfer/remove/clean the blood as the waste passes from a more concentrated to less concentrated solution. ✓ In peritoneal dialysis the dialysate is put into the abdomen and allowed to stand for 4 to 6 hours – in this period of time the waste moves out the blood/organs and into the dialysate. The dialysate is then drained out. ✓ See diagram – can use either diagram ✓



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In haemodialysis a needle is inserted into the vein and the blood is taken out the blood into a machine and then run through a dialysis filter to clean it and then put back into the body. This happens over 4 hours. ✓ and ✓✓ for diagram



3.4 You are about to take 3 weeks leave. Dialysis of some form may be initiated during this period. As no decision has been made as yet work out her energy and macronutrient requirements for both forms of dialysis. The PD unit uses 3 bags of 1.5% (7.6 g CHO per bag) and 1 bag of 2.5% (27.9 g per bag). (10)

The prescription does not need to change so can get full marks for only doing one prescription

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Frame size	162/12 = 13.5	Small frame ✓
% of standard body weight	70/60 kg = 117% the body weight could have been 58 to 60 kg so accepted any of these.	So overweight so use adjusted weight ✓
Adjusted weight	$70 + [60-70] * 0.25 = 62.5$ or thereabouts	✓

Protein in g/kg IBW	1.2
Protein	90 ✓
Ng	14.4
Protein %	14
Protein energy	1530
Non protein energy	9720
NPE:Ng2	675.0 ✓
Energy	11250 ✓
Carbohydrate %	55
Carbohydrate Kj	6187.5
Carbohydrate g	364 ✓
mg/kg/min	3.2 ✓
Fat %	31
Fat g	93.0 ✓

CAPD		
No of 1.5% bags	3	22.7
No of 2.5% bags	1	27.9
No of 4.25% bags	0	0.0
Total CHO from bags		50.7 ✓
Total energy from bags		861
Therefore CHO to be planned on meal plan		313.3

3.5 She does not like change and would prefer to keep following the diet prescribed by her previous dietician - the exchanges are below. Can she still follow this diet? Fill in the table below using the renal exchange summary sheet to work out what she is getting in total and comment on whether this is still a suitable diet to follow. (6)

Quarter mark for each row and then a mark for each comment – they should have commented on that the CHO would be too high for her if she starts CAPD

Group	Number of exchanges	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO4 (mg)	Na (mg)	K (mg)
Meat & meat substitutes								

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Meat - high P, low Na	2							
Legumes high Na	2							

Milk

high kJ, fat, CHO	1							
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Starch

Starch low K, low kJ, low fat	6							
Starch low K, high kJ, high fat	2							

Vegetables

Vegetables low K	1							
Vegetables moderate K	1							
Vegetables high K	1							

Fruit

Fruit low K	1							
Fruit moderate K	1							
Fruit high K	1							

Beverages

Beverages high kJ	4							
Sugar	4							
Fat	6							

Totals
Percentages

Group	Number of exchanges	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO4 (mg)	Na (mg)	K (mg)
Meat & meat substitutes								
Meat - high P, low Na	2	700	14	10	0	240	110	180
Meat - high P, high Na	0	0	0	0	0	0	0	0
Meat - low P, low Na	0	0	0	0	0	0	0	0
Meat - low P, high Na	0	0	0	0	0	0	0	0
Legumes low Na	0	0	0	0	0	0	0	0
Legumes high Na	2	700	14	10	30	240	860	490

Milk

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low kJ, fat, CHO	0	0	0	0	0	0	0	0
high kJ, fat, CHO	1	835	4	10	20	110	65	185

Starch

Starch low K, low kJ, low fat	6	2100	12	0	120	240	420	300
Starch low K, high kJ, high fat	2	1670	4	20	40	80	140	100
Starch high K, low kJ, low fat	0	0	0	0	0	0	0	0
Starch high K, high kJ, high fat	0	0	0	0	0	0	0	0

Vegetables

Vegetables low K	1	90	1	0	2	20	20	75
Vegetables moderate K	1	90	1	0	2	20	20	150
Vegetables high K	1	90	1	0	2	20	20	270

Fruit

Fruit low K	1	250	0.5	0	10	15	5	95
Fruit moderate K	1	250	0.5	0	10	15	5	170
Fruit high K	1	250	0.5	0	10	15	5	240

Beverages

Beverages low kJ	0	0	0	0	0	0	0	0
Beverages high kJ	4	1200	0	0	40	20	40	80
Sugar	4	620	0	0	40	0	0	40
Fat	6	960	0	30	0	0	270	0

Totals		9805	52.5	80	326	1035	1980	2375
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Percent energy	9	31	57
	Protein	Fat	CHO

Not suitable as mainly the protein is now too low and the phosphate is too high unless they used the 17 mg per kg under HD

- 3.6 She has been diligently taking 2 phosphate binders at each meal and 1 at each snack. Looking at her meal plan below would you agree with this? Comment including an example of a commonly used phosphate binder. (3)

Meal Plan
2 peppermints to suck during the day
<u>Breakfast</u>

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Egg boiled with 2 slices of bread spread with 2 teaspoons of butter and a banana and a cup of tea with quarter a cup of full cream milk and 2 teaspoons of white sugar

Snack

Apple and an orange

Lunch

Toasted cheese and tomato sandwich (2 slices bread, 30 g cheese, 2 teaspoons butter) with a medium glass of Fanta Orange

Snack

100 g slice of carrot cake plus a glass of Lucozade

Supper

A medium cream sherry before supper
 Lentil stew with tomato and onion base served with boiled white rice and lettuce with salad dressing
 cup of tea with quarter a cup of full cream milk and 2 teaspoons of white sugar

Late evening

4 large marshmallows

No as breakfast (egg and milk), lunch (cheese) and supper(lentils) are high in phosphate so the phosphate binders should be taken with these meals ✓ and not with the snacks as they do not contain phosphates. ✓ Tums or Titalac ✓

3.7 Briefly discuss the main cause and health implications of the detected PTH. (5)

The PTH is detectable which means that the para thyroid hormone levels are raised ✓. This is because the kidney cant excrete P so phosphate levels rise. ✓ Ca binds to P to form $CaPO_4$ ✓ – drops P levels to normal but calcium levels to low. ✓ Low calcium stimulates release of PTH – PTH takes Ca out the bone leads to metabolic bone disease ✓

3.8 Will Centrum Silver meet her needs on dialysis? Comment next to each vitamin/mineral under the column of either HD or CAPD. (8)

Amount Per Serving	Amount	% RDA	HD	CAPD
Vitamin A	2,500 IU	50%	Would allow this although nb not to supplement above DRI in renal disease but not lots of vit A	Would allow this although nb not to supplement above DRI in renal disease but not lots of vit A

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			in diet history – you probably would also have to accept no supplementation	in diet history – you probably would also have to accept no supplementation
Vitamin C	60 mg	100%	Fine as below the max of 100 mg	Fine as below the max of 100 mg
Vitamin D	500 IU	125%	Fine as individualize sup with the active form – this is the inactive form	Fine as individualize sup with the active form – this is the inactive form
Vitamin E	50 IU	167%	Not routinely supplemented but otherwise to the RDA so this is too high	Not routinely supplemented but otherwise to the RDA so this is too high
Thiamin	1.5 mg	100%	Correct as sup to RDA	need 1.5 to 2 mg per day so correct
Riboflavin	1.7 mg	100%	Correct as both are to the RDA	Correct as both are to the RDA
Niacin	20 mg	100%	Correct as both are to the RDA	Correct as both are to the RDA
Pyridoxine	3 mg	150%	RDA in HD so too high	2 mg per day in CAPD so too high
Folic Acid	400 mcg	100%	Too low 800 to 1000	Too low 800 to 5000
Vitamin B12	25 mcg	417%	Very high RDA	3 ug ie very high
Pantothenic Acid	10 mg	100%	RDA	RDA
Calcium	220 mg	22%	Fine – it is in addition to the phosphate binder	Fine – it is in addition to the phosphate binder
Phosphorus	20 mg	2%	Fine ie very low	Fine ie very low
Zinc	11 mg	73%	Fine as 8 to 11	little low as 15

Summary comment: Little high in vitamin E, too high in pyridoxine and too low in folic acid – might be a little low in zinc for CAPD

Half mark for each line ie quarter mark for HD and quarter mark for CAPD and then one mark for the comment.

[50]