

ROUTINE CHEMISTRY - BLOOD REFERENCE RANGES					
Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
Acetaminophen (Paracetamol)	mg/L		NO RANGE		Pathology Harmony Jan 2011
Albumin	g/L	0 to 4 days	28 - 44		
		4 days to 14 years	38 - 54		
		Adult	35 - 50		
		60 - 90 years	32 - 46		
		>90 years	29 - 45		
Alpha-fetoprotein (AFP)	kiU/L	All	< 7		
Alkaline Phosphatase (ALP)	U/L	< 4 weeks	70 - 380		Pathology Harmony Jan 2011
		> 4 weeks to 16 years	60 - 425		
		Adult	30 - 130		
Alanine transaminase (ALT)	U/L	All	0 - 55		
Alpha-1-Antitrypsin (a1AT)	g/L	All	0.9 - 2.0		
Amikacin	mg/L	All	4 – 8 (Trough)	Recommended sampling time: pre-dose	
Amylase, total	U/L	0 - 14 days	3 - 10		

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		15 days < 13 weeks	2 - 22		CALIPER study DOI: 10.1515/cclm-2021-0336
		13 weeks - < 1 year	3 - 50		
		1 year - 18 years	25 - 101		
		Adult	28 - 100		
Amylase, pancreatic	U/L	All	8 - 51		Abbott (G90710R02 November 2017)
Angiotensin converting enzyme (ACE)	U/L	All	20 - 70		
Anion gap	mmol/L	All	8 - 17		Internal audit AUD438
Apolipoprotein A1	g/L	<b>0 to 1 year</b>			
		Male	0.61 - 1.64		
		Female	0.59 - 1.69		
		<b>&gt; 1 to 12 years</b>			
		Male	0.93 - 1.72		
		Female	0.86 - 1.79		
		<b>&gt; 12 to 60 years</b>			
		Male	0.95 - 1.86		
		Female	1.01 - 2.23		
		<b>&gt; 60 years</b>			

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		Male	0.73 - 1.86		
		Female	0.91 - 2.24		
Apolipoprotein B	g/L	<b>0 to 1 year</b>			
		Male	0.16 - 1.24		
		Female	0.17 - 1.20		
		<b>&gt; 1 to 12 years</b>			
		Male	0.48 - 1.25		
		Female	0.51 - 1.26		
		<b>&gt; 12 to 60 years</b>			
		Male	0.49 - 1.73		
		Female	0.53 - 1.82		
		<b>&gt; 60 years</b>			
		Male	0.54 - 1.63		
		Female	0.64 - 1.82		
Aspartate transaminase (AST)	U/L	All	5 - 34		
AST:ALT ratio	N/A		NO RANGE	AST:ALT ratio > 1.0 has 49 % sensitivity and 87 % specificity for predicting cirrhosis in	

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				liver disease (NHS HTA 2015)	
AST to platelet ratio Index (APRI)	N/A		NO RANGE	APRI > 0.75 – 1.0 has 75 % sensitivity and 78 % specificity for predicting cirrhosis in liver disease (NHS HTA 2015)	
B-hydroxybutyrate (BOHB)	mmol/L		NO RANGE	Interpreted in light of concurrent glucose result	
Bicarbonate	mmol/L	0 - 16 years	19 - 28		
		Adult	22 - 29		Pathology Harmony Jan 2011
Bile Acids, total	µmol/L	All	1.0 - 6.0 (Fasting)		
Bilirubin, total	µmol/L	>14 days to Adult	< 21		Pathology Harmony Jan 2011
CA 125	kiU/L	All	< 35		NICE CG122 Ovarian cancer: recognition and initial management (2011)
CA 153	kiU/L	All	< 31		
CA 199	kiU/L	All	0 - 37		Steinberg W. The clinical utility of the CA 19-9 tumor-associated antigen. Am J

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					Gastroenterol. 1990 Apr;85(4):350-5.
Caeruloplasmin	g/L	All	0.2 - 0.6		
Adjusted calcium	mmol/L	< 4 weeks	2.00 - 2.70	Adjusted calcium not available if: - Children < 4 weeks – ionised calcium preferred Children >4 weeks and < 1 year with albumin < 30 g/L Adults with albumin < 20 g/L	Pathology Harmony Jan 2011
		> 4 weeks to 16 years	2.20 - 2.70		
		Adult	2.20 - 2.60		
Carbamazepine	mg/L	All	4 – 12 (Trough)	Recommended sampling time: pre-dose	Pathology Harmony Jan 2011 and Patsalos et al 2008
Carcinoembryonic antigen (CEA)	µg/L	> 20 years	< 5		Abbott kit insert
Chloride	mmol/L		95 - 108		Pathology Harmony Jan 2011
Cholesterol, total	mmol/L		NO RANGE		

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Complement C3	g/L	<b>1 to 14 years</b>			
		Male	0.80 - 1.70		
		Female	0.82 - 1.73		
		<b>&gt; 14 to 80 years</b>			
		Male	0.82 - 1.85		
		Female	0.83 - 1.93		
Complement C4	g/L	<b>1 to 14 years</b>			
		Male	0.14 - 0.44		
		Female	0.13 - 0.46		
		<b>&gt; 14 to 80 years</b>			
		Male	0.15 - 0.53		
		Female	0.15 - 0.57		
Conjugated bilirubin	µmol/L	All	0 - 7		WAKO (411-23695 0318D5)
Cortisol	nmol/L		102 – 535 (Before 10 am)		
			80 – 477 (After 5 pm)		
C-Peptide	pmol/L		258 – 1718 (Fasting)		
Creatine Kinase (CK)	U/L	Male	40 - 320		Pathology Harmony Jan 2011
		Female	25 - 200		

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Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
Creatinine (enzymatic)	µmol/L	<b>0 to 15 days</b>	29 - 82		
		<b>15 days to 2 years</b>	9 - 32		
		<b>2 months to 4 years</b>	15 - 42		
		<b>2 to 5 years</b>	18 - 38		
		<b>5 to 12 years</b>	27 - 54		
		<b>12 to 15 years</b>	40 - 72		
		<b>15 to 19 years</b>			
		Male	55 - 96		
		Female	43 - 74		
		> 19 years			
		Male	64 - 104		
Female	49 - 90				
<b>Creatinine clearance</b>	mL/min		70 - 140		
<b>C-Reactive Protein (CRP)</b>	mg/L	All	< 5		

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Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
Digoxin	µg/L	All	0.5 - 2.0	Recommended sampling time: 6 - 8 h pre-dose. Assay must be at least 8 hours after previous dose. We suggest you assay before morning tablet is taken.	Pathology Harmony Jan 2011
Estimated glomerular filtration (eGFR)	mL/min/1.73m <sup>2</sup>	Adult	No range	CKD-EPI (2009) minus ethnicity (NG203)	
Ferritin	µg/L	All	22 – 275		
Folate	µg/L	All	3.1 - 20.5		Nutristasis SOP HT-SOP-VKARC-001
Follicle stimulating hormone (FSH)	IU/L	<b>Male</b>	1.0 - 12.0		Roche (07027346500V2.0 2017-08)
		<b>Female</b>			
			3.0 - 8.1 (Follicular Phase)		
			2.6 - 16.7 (Mid-Cycle Phase)		
			1.4 - 5.5 (Luteal Phase)		
		26.7-133.4 (Postmenopausal)			
Free PSA	µg/L		0.0 - 0.5		



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Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
Free androgen index	%	<b>Male</b>			
		21 to 49 years	24.5 – 113.3		
		> 50 years	19.3 -118.4		
		<b>Female</b>			
		21 to 49 years	0.7 – 8.7		
		> 50 years	0.5 – 4.7		
Free triiodothyronine (FT3)	pmol/L	All	2.4 - 6.0		Abbott kit insert G71299R04 April 2020
Free thyroxine (FT4)	pmol/L	All	9.0 - 19.1		
Fructosamine	µmol/L	Adult	205 - 285		
Gamma-glutamyl transferase (GGT)	U/L	Male	<55		
		Female	<38		
Globulin	g/L	All	20 – 35		KCH range
Glucose	mmol/L		NO RANGE	Fasting glucose > 6.9 or Random glucose > 11 suggests diabetes mellitus.  Fasting glucose 6.1 – 6.9 suggests impaired fasting glycaemia.	

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Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
Haptoglobin	g/L	<b>0 to 1 year</b>			
		Male	0.00 - 3.00		
		Female	0.00 - 2.35		
		<b>&gt; 1 to 12 years</b>			
		Male	0.03 - 2.70		
		Female	0.00 - 2.20		
		<b>&gt; 12 to 60 years</b>			
		Male	0.14 - 2.58		
		Female	0.35 - 2.50		
		<b>&gt; 60 years</b>			
		Male	0.40 - 2.68		
		Female	0.63 - 2.73		
HbA1c	mmol/mol		20 - 41		Local care pathways for Diabetes in South London which are derived from the NHS Diabetes Prevention Programme (NHSDPP) NHS England Publications Gateway Reference 05728 and NICE Type 2 diabetes: prevention in people at high risk

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Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
					(nice.org.uk/guidance/ph38 2012)
HDL Cholesterol	mmol/L		NO RANGE	HDL <1.0 mmol/L associated with increased cardiovascular risk	
Human chorionic gonadotrophin (HCG)	IU/L	Male	<2		Abbott kit insert
		Non-pregnant female	<5		
Immunoglobulin A (IgA)	g/L	<b>0 to 3 months</b>			
		Male	0.01 - 0.34		
		Female	0.01 - 0.34		
		<b>&gt; 3 months to 1 year</b>			
		Male	0.08 - 0.91		
		Female	0.08 - 0.91		
		<b>&gt; 1 to 12 years</b>			
		Male	0.21 - 2.91		
		Female	0.21 - 2.82		
		<b>&gt; 12 to 60 years</b>			

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Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
		Male	0.63 - 4.84		
		Female	0.65 - 4.21		
		<b>&gt; 60 years</b>			
		Male	1.01 - 6.45		
		Female	0.69 - 5.17		
Immunoglobulin G (IgG)	g/L	<b>0 to 1 month</b>			
		Male	3.97 - 17.65		
		Female	3.91 - 17.37		
		<b>&gt; 1 month to 1 year</b>			
		Male	2.05 - 9.48		
		Female	2.03 - 9.34		
		<b>&gt; 1 to 2 years</b>			
		Male	4.75 - 12.10		
		Female	4.83 - 12.26		
		<b>&gt; 2 to 80 years</b>			
		Male	5.40 - 18.22		
		Female	5.52 - 16.31		
Immunoglobulin M (IgM)	g/L	<b>&lt; 3 months</b>			

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Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
		Male	0.06 - 0.21		
		Female	0.06 - 0.21		
		<b>3 months to 1 year</b>			
		Male	0.17 - 1.43		
		Female	0.17 - 1.50		
		<b>&gt; 1 to 12 years</b>			
		Male	0.41 - 1.83		
		Female	0.47 - 2.40		
		<b>&gt; 12 years</b>			
		Male	0.22 - 2.40		
		Female	0.33 - 2.93		
Insulin	pmol/L		NO RANGE		
Iron	µmol/L	Male	11.6 to 31.3		
		Female	9.0 to 30.4		
Lactate dehydrogenase (LDH)	U/L	All	125 - 220		
LDL Cholesterol (Direct)	mmol/L		NO RANGE		

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Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
Lipase	U/L	All	≤ 60		Sentinel 1761601 - 2.0/02 2020/05/05
Lipoprotein(a)	nmol/L		NO RANGE	Cardiovascular risk increases with Lp(a) > 75 nmol/L	
Lithium	mmol/L		0.4 - 1.0	Recommended sampling time: 12 h post-dose	BNF (accessed 01/09/21), Pathology Harmony Jan 2011 and NPSA (NPSA/2009/PSA005 Dec 2009)
Luteinising hormone (LH)	IU/L	Male	0.6 - 12.1		
		Female	1.8 - 11.8 (Follicular Phase)		
			7.6 - 89.1 (Mid-Cycle Phase)		
			0.6 - 14.0 (Luteal Phase)		
			5.2 - 62.0 (Postmenopausal)		
Macroprolactin	mIU/L	Male	32-309		
		Female	39-422		
Magnesium	mmol/L	< 4 weeks	0.6 - 1.0		
		> 4 weeks to Adult	0.7 - 1.0		

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Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
Methotrexate	µmol/L		NO RANGE	Local procedure	
Neuron specific enolase (NSE)	µg/L	All	< 11.1		
Non-esterified fatty acids (NEFA)	mmol/L		NO RANGE	Results interpreted in light of concurrent glucose result	
Non-HDL cholesterol	mmol/L		NO RANGE	Non-HDL cholesterol > 2.5 mmol/L associated with increased cardiovascular risk	
NT-proBNP	ng/L	All	< 400	<400 ng/L Heart failure unlikely; 400-2000 ng/L Requires review in heart failure clinic within 6 weeks (request ROUTINE appointment on e-referral) >2000 ng/L Requires review in heart failure clinic within 2 weeks (request URGENT appointment on e-referral)	NICE guidelines CG108 Chronic Heart Failure in Adults: Management (2010) and SE and South London CVD therapies group Lambeth CCG guidelines (2018).

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Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
Oestradiol	pmol/L	Male	40 - 162		
		Female	77 – 921 (Follicular Phase)		
			140 – 2383 (Mid-Cycle Phase)		
			77 – 1145 (Luteal Phase)		
			< 103 (Postmenopausal)		
Parathyroid hormone (PTH)	ng/L	All	15.0 - 68.3		
Phenobarbitone	mg/L		10 - 40		Pathology Harmony Jan 2011
Phenytoin	mg/L		5 - 20	Timing of assay not important but we suggest you assay before next dose. Always interpret drug levels according to clinical context. Some patients are well controlled with levels of 3 mg/L while others show no toxic signs with levels of 20 mg/L.	Pathology Harmony Jan 2011
Phosphate	mmol/L	< 4 weeks	1.3 - 2.6		
		> 4 weeks to 1 year	1.3 - 2.4		



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Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
		1 to 16 years	0.9 - 1.8		
		> 16 years	0.8 - 1.5		
Potassium	mmol/L	< 4 weeks	3.4 - 6.0		Pathology Harmony Jan 2011
		> 4 weeks to 1 year	3.5 - 5.7		
		1 to 16 years	3.5 - 5.0		
		Adult	3.5 - 5.3		
Procalcitonin	µg/L	Male	0.0 - 0.08	Probability of bacterial infection (Schuetz et al 2019, Clin Chem Lab Med):  Bacterial infection: UNCERTAIN PCT < 0.25 (< 0.5 in	

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Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
		Female	0.0 - 0.05	<p>ICU) Low; bacterial infection unlikely            PCT <math>\geq 0.25</math> (<math>\geq 0.5</math> in ICU) High; bacterial infection likely</p> <p>Bacterial infection:  <b>HIGHLY SUSPECTED</b>            PCT <math>&lt; 0.25</math> (<math>&lt; 0.5</math> in ICU) Low; bacterial infection possible            PCT <math>\geq 0.25</math> (<math>\geq 0.5</math> in ICU) High; bacterial infection highly likely</p>	
Progesterone	nmol/L	Male	< 1.6		
		Female	< 1.6 (Follicular Phase)		
			3.8 - 50.6 (Luteal Phase)		
			<1.6 (Postmenopausal)		
Prolactin	mIU/L	Male	73 - 407		
		Female	109 - 557		
PSA (Total)	$\mu\text{g/L}$	Male <40 years	NO RANGE		SEL cancer network guidelines, NICE guidance (NG12 Suspected cancer:
		40 - 49 years	< 2.49		
		50 - 59 years	< 3.49		

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Test	Units	Age / Gender	Reference Range	Additional information	Range rationale / origin
		60 - 69 years	< 4.49		recognition and referral last updated 15 December 2021).
		70 - 79 years	< 6.49		
		≥ 79 years	NO RANGE		
Salicylate	mg/L		NO RANGE		Pathology Harmony Jan 2011
Sex hormone binding globulin (SHBG)	nmol/L	Male	17.1 - 77.6		
		Female	34.3 - 147.7 (Premenopausal)		
			26.4-118.0 (Postmenopausal)		
Sodium	mmol/L		133 - 146		Pathology Harmony Jan 2011
Testosterone	nmol/L	<b>Male</b>			
		< 12 months	0.4 - 15.1		
		1 - 5 years	0.3 - 1.5		
		6 - 10 years	0.5 - 2.0		
		11 - 14 years	0.7 - 19.3		
		15 - 20 years	4.7 - 41.7		
		20 - 49 years	8.3 - 30.2		
		≥ 50 years	7.7 - 24.8		
		<b>Female</b>			

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		< 49 years	0.5 - 1.9		
		≥ 50 years	0.4 - 1.2		
Theophylline	mg/L		10 - 20		Pathology Harmony Jan 2011
<b>TPO Antibodies</b>	IU/mL	All			
Thyroid stimulating hormone (TSH)	mIU/L		0.35 - 4.94		
TSH receptor antibodies (TRAb)	IU/L		NO RANGE	Negative < 3.10 Positive ≥ 3.10	
Total Cholesterol/HDL ratio	None	All	NO RANGE		
Total Protein	g/L	Premature	36 to 60		
		Newborn	46 to 70		
		Cord	48 to 80		
		1 week	44 to 76		
		7 months to 1 year	51 to 73		
		1 to 3 years	56 to 75		
		> 3 years to Adult	60 to 80		
					Pathology Harmony Jan 2011
Transferrin	g/L	<b>1 to 14 years</b>			
		Male	1.86 - 3.88		

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		Female	1.80 - 3.91		
		<b>&gt; 14 to 60 years</b>			
		Male	1.74 - 3.64		
		Female	1.80 - 3.82		
		<b>&gt; 60 to 80 years</b>			
		Male	1.63 - 3.44		
		Female	1.73 - 3.60		
Transferrin Saturation	%	All	20 - 45		N Engl J Med 2022;387:2159-70 DOI: 10.1056/NEJMra2119758 (upper limit) Am. J. Hematol. 91:31–38, 2016 DOI: 10.1002/ajh.24201 (lower limit)
Triglycerides	mmol/L		NO RANGE	Fasting triglycerides > 1.70 mmol/L are associated with increased cardiovascular risk	
Troponin I (High Sensitivity)	ng/L	0 to <6months	≤ 56		CALIPHER paediatric reference ranges for the
		6 months to <19 years	≤ 6		

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					Abbott Alinity assay. Source: PMID: 37021828
		Male	< 35		
		Female	< 16		
Urea	mmol/L	< 4 weeks	0.8 -5.5		Pathology Harmony Jan 2011
		> 4 weeks to 1 year	1.0 - 5.5		
		1 to 16 years	2.5 -6.5		
		Adult	2.5 - 7.8		
Uric acid (Urate)	µmol/L	Male	200 - 430		Pathology Harmony Jan 2011
		Female	140 - 360		
Valproate	mg/L		50 – 100 (Therapeutic)		Patsalos PN et al. Antiepileptic drugs--best practice guidelines for therapeutic drug monitoring: a position paper by the subcommission on therapeutic drug monitoring, ILAE Commission on Therapeutic Strategies. Epilepsia. 2008 Jul;49(7):1239-76.
Vitamin B12, Active?					

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Vitamin D	nmol/L	All	>50	<25 nmol/L – Deficient, 25 – 50 /L nmol/L – Insufficient >50 nmol/L – Adequate	Nutristasis SOP HT-SOP-VKARC-001

ROUTINE CHEMISTRY - URINE REFERENCE RANGES					
Test	Units	Age / Gender / Random or 24h	Reference Range	Additional information	Range rationale / origin
Urine albumin	mg/L	Random	NO RANGE	Results should be interpreted with urine creatinine (i.e. urine ACR)	
	mg/24h	24h Urine	< 30		
Urine albumin:creatinine ratio (ACR)	mg/mmol	Calculated	< 3		NICE CG182 Chronic kidney disease in adults: assessment and management (2014)
Urine amylase	U/L	<b>Random</b>			
		Male	16 - 491		
		Female	21 - 447		

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		<b>24h Urine</b>	170 - 2000		
Urine calcium	mmol/L	Random	NO RANGE	Results should be interpreted with urine creatinine (i.e. urine calcium:creatinine ratio CACR; urine calcium/creatinine clearance ratio for FHH)	
	mmol/24h	24h Urine	2.5 - 7.5		Pathology Harmony Jan 2011
Urine calcium:creatinine ratio	mmol/mmol	0 – 1 years	0.05 – 1.50	Calcium creatinine ratio reported in mmol/mmol creatinine. In the presence of hypocalcaemia a value greater than 0.3 is considered inappropriate.	
		1 – 2 years	0.05 – 1.25		
		2 – 5 years	0.05 – 1.00		
		5 – 10 years	0.05 – 0.70		
		10 – 18 years	0.05 – 0.60		
		18 – 150 years	0.20 – 0.60		
Urine calcium/creatinine clearance ratio for FHH	No units		UCCR is often <0.01 in familial hypocalciuric hypercalcaemia (FHH); a UCCR >0.02 is typical of primary hyperparathyroidism	UCCR calculated as (urine calcium X serum creatinine) / (serum calcium X urine creatinine).	



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Test	Units	Age / Gender / Random or 24h	Reference Range	Additional information	Range rationale / origin
Urine chloride	mmol/L		NO RANGE	Results should be interpreted with serum chloride	
Urine creatinine (enzymatic)	mmol/L	<b>Random</b>			
		Male	5.1 - 14.2		
		Female	3.9 - 9.4		
	mmol/24h	<b>24h Urine</b>			
		Male	7.7 - 21.3		
		Female	5.9 - 14.1		
Urine magnesium	mmol/L	Random	NO RANGE	Results should be interpreted with serum magnesium	
	mmol/24h	24h Urine	2.4 - 6.5		
Urine phosphate	mmol/L	Random	NO RANGE		
	mmol/24h	24h Urine	15 - 60		
Urine potassium	mmol/L	Random	NO RANGE	Results should be interpreted with serum potassium	
		24h Urine	25 - 125		
Urine protein	mg/L	Random	NO RANGE		

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Test	Units	Age / Gender / Random or 24h	Reference Range	Additional information	Range rationale / origin
	mg/24h	24h Urine	< 150	Results should be interpreted with urine creatinine (i.e. urine PCR)	
Urine protein:creatinine ratio (PCR)	mg/mmol	Random	< 15		KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease
Urine sodium	mmol/L	<b>Random</b>	NO RANGE	Results should be interpreted with serum sodium	
	mmol/24h	<b>24h Urine</b>			
		Male	40 - 220		
		Female	27 - 287		
Urine uric acid (urate)	mmol/24h		NO RANGE		
Urine urea	mmol/L	Random	NO RANGE	Random urine urea measurements have limited clinical value.	
	mmol/24h	24h Urine	428 - 714		