

Title: Table of tests for web pages NO sendaways	Q Pulse Identifier:CB-CLIN-PI-015
Version: 17	Copy No: electronic Q-pulse
Date of Issue:February 2021	Author F Ivison
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Manchester University
NHS Foundation Trust

Analyte	Sample Type	Sample Volume	Stability	Reference range	Special Requirements	Turn around time
17 α OH Progesterone	Serum or lithium/heparin plasma	0.5mL	2 weeks	0-6 nmol/L	Neonatal samples should not be taken in the first 48 hours of life.	2 weeks
17 α OH Progesterone (in blood spots)	Blood spot		1 month	For monitoring only	3 spots collected throughout the day	1 month
Acid-Base status	<p>Paediatrics: pre-heparinised syringe, 0.5mL minimum or full heparinised capillary tube. Mix well immediately after collection to prevent clotting.</p> <p>Adults: Blood gas syringe. Remove needle, cap syringe.</p>	0.5mL	30 min	<p>pH: 0-28d: 7.18-7.51 1-5 months: 7.18-7.50 6-11 months: 7.27-7.49 ≥12 months to 17 years: 7.35-7.45</p>	<p>Do not send this specimen by pneumatic tube.</p> <p>Send labelled sample on ice to the laboratory immediately after collection. Inform the laboratory before you send a gas. Capillary samples require proper collection technique to ensure reliable results and are not recommended for the estimation of pO₂.</p>	30 min
				<p>pCO₂: Newborn (0-28d): 3.6-5.3 Infant (1-11 months): 3.6-5.5 ≥12 months to 17 years: 4.3-6.4 >18 years: Male 4.67 – 6.4kPa; Female 4.27 – 6.0kPa</p>		
				<p>pO₂: 1-24h: 7.3-10.6 kPa 24-48h: 7.2-12.6 kPa All other ages: 11.1 – 14.4 kPa arterial 12.0-14.7 kPa capillary 6.7 - 10.7 kPa</p>		
				<p>Actual bicarbonate: 22 - 29 mmol/L</p> <p>Base Excess Newborn-10 to -2 mmol/L Infant -7 to -1 mmol/L Child -4 to +2 mmol/L male -2.3 to + 2.3 mmol/L female -3.0 to + 1.6 mmol/L</p>		

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AFP	Serum	1.0mL	1 week	<p><2 days 0-103990 KU/L 2-7 days 0-60750 KU/L 8-14 days 0-48590 KU/L 15-21days 0-19000 KU/L 22-28days 0-5500 KU/L 29days-6 weeks 0-4750 KU/L 6 weeks-8 weeks 0-1650 KU/L 8 weeks-3 months 0-850 KU/L 3months-4months 0-350 KU/L 3months-5months 0-100 KU/L 6months-9months 0-3 0KU/L 10months-18 years 0-5 KU/L >18 yrs 0-6 KU/L</p> <p>AFP can also be measured in other fluids (not urine) but these reference ranges do NOT apply.</p>	<p>Increased AFP levels can be caused by liver cancer, germ cell tumour of the testis or less commonly other cancers (for example, stomach, bowel, lung, breast, lymphoma). Slightly increased levels of AFP are common in patients who have chronic hepatitis or cirrhosis and do not indicate the presence of cancer.</p>	1 day								
AKI alert	calculated test from U/E (serum or lithium heparin plasma)	1.0mL	1 week	<p>Null: Insufficient data to determine AKI Stage</p> <table border="1"> <thead> <tr> <th>Serum creatinine (SCr) criteria</th> <th>Urine output criteria</th> </tr> </thead> <tbody> <tr> <td>Stage 1. Increase ≥ 26 $\mu\text{mol/L}$ within 48hrs or increase ≥ 1.5 to 1.9 X reference SCr</td> <td><0.5 mL/kg/hr for > 6 consecutive hrs</td> </tr> <tr> <td>Stage 2. Increase ≥ 2 to 2.9 X reference SCr</td> <td><0.5 mL/kg/ hr for >12 hrs</td> </tr> <tr> <td>Stage 3. Increase ≥ 3 X reference SCr or 1.5 fold increase to >354 $\mu\text{mol/L}$</td> <td><0.3 mL/kg/hr for >24hrs or anuria >12h.</td> </tr> </tbody> </table>	Serum creatinine (SCr) criteria	Urine output criteria	Stage 1. Increase ≥ 26 $\mu\text{mol/L}$ within 48hrs or increase ≥ 1.5 to 1.9 X reference SCr	<0.5 mL/kg/hr for > 6 consecutive hrs	Stage 2. Increase ≥ 2 to 2.9 X reference SCr	<0.5 mL/kg/ hr for >12 hrs	Stage 3. Increase ≥ 3 X reference SCr or 1.5 fold increase to >354 $\mu\text{mol/L}$	<0.3 mL/kg/hr for >24hrs or anuria >12h.	<p>https://www.thinkkidneys.nhs.uk/</p>	<p>Urgent: 2 hours Routine: 4 hours</p>
Serum creatinine (SCr) criteria	Urine output criteria													
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Alanine Aminotransferase (ALT)	Serum or lithium/heparin plasma	1.0mL	1 week	<1 month up to 90 U/L Male <50 U/L Female <35 U/L	Included in liver profile	Urgent: 2 hours. Routine: 4 hours
Albumin	Serum or lithium/heparin plasma	1.0mL		up to 1 mth 25 - 35 g/L 1 - 6 mths 28 - 40 g/L 6 mths - 17yrs 30 - 45 g/L >17yrs 34 - 48 g/L Albumin can be measured in a range of other fluids. These reference ranges do NOT apply.	Included in the liver and bone profiles.	Urgent: 2 hours Routine: 4 hours
Albumin/creatinine ratio (ACR)	Random urine sample – preferred first sample on waking	5.0 mL		See NICE guidance for use of ACR in monitoring progression of renal disease. <3.0 mg/mmol creatinine	https://www.nice.org.uk/guidance/cg182/chapter/1-recommendations	Same day
Aldosterone (Paediatrics only)	EDTA plasma	1.0mL		<1 month 139-4856 pmol/L 1-12 months 139-2498 pmol/L 1-2 years 194-1499 pmol/L 2-10 years 83-971 pmol/L 10-18 years 56-611 pmol/L	Important variables affecting interpretation are sodium intake, supine or upright position and drug treatment.	1 month
Alkaline phosphatase (ALP)	Serum or lithium/heparin plasma	1.0mL		0 - 7 days 75 - 300 U/L 8 - 28 days 90 - 477 U/L 29 - 90 days 90 - 540 U/L 91 - 180 days 77 - 540 U/L 181 - 360 days 87 - 382 U/L 361 - 540 days 69 - 434 U/L >540 days-2 y 60 - 370 U/L 2 - 10 y 60 - 320 U/L (300U/L in males) 10-17 y 60 400 U/L >17 y 30-130 U/L	Included in the liver and bone profiles.	Urgent: 2 hours Routine: 4 hours

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Alkaline Phosphatase Isoenzymes	Serum	1.0mL		Qualitative interpretation. Contact relevant duty biochemist	This test is NOT required if the total alkaline phosphatase activity is not raised.	2 weeks
Alpha-1-antitrypsin	Serum or lithium/heparin plasma	1.0mL		0.9 - 2g/L	An A1AT deficiency allele cannot be excluded by concentration alone in the presence of an acute phase response or if blood products have been given in the 6 weeks prior to the sample.	1 week
Amikacin	Serum or lithium/heparin plasma	1.0mL		There are many indications for the use of various antibiotics. It is best practice to contact Pharmacy for advice after reviewing the specific guideline on the intranet: http://microbiology.staffnet.xcmmc.nhs.uk/	Pre dose	Urgent: 2 hours Routine: 4 hours
Ammonia	EDTA plasma	1.0mL	30 min	<14 days 10 to 100 µmol/L >14 days 5 to 50 µmol/L May be higher in prematurity.	The sample should be sent to the laboratory immediately on ice/water.	Urgent: 2 hours Routine: 4 hours
Androstenedione	Serum or lithium/heparin plasma	1.0mL		<6 nmol/L pre-pubertal Children <2 nmol/L		2 weeks
Anion-Gap	Serum or lithium/heparin plasma	1.0mL		Anion Gap = (Sodium + potassium) - (Chloride + total bicarbonate) 10-18 mmol/L	Calculated in cases of unexplained acidosis. Ethanol measurement also required.	Urgent: 2 hours Routine: 4 hours

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Antihypertensive Medication Screen	Random urine sample	0.5mL		Reported if detected.	Supply details of prescribed medication	4 weeks
Antimullerian Hormone	Serum or lithium/heparin plasma	1.0mL		<p>AMH < 2.6 pmol/L suggests a very low/undetectable ovarian reserve. If patient undergoing IVF and AMH <2.6pmol/L there is a relatively high risk of retrieving either none or a very low number of oocytes after controlled stimulation</p> <p>AMH >2.6 to 17 pmol/L low ovarian reserve,</p> <p>AMH 17.1 to 34 pmol/L satisfactory ovarian reserve</p> <p>34.1 to 55 pmol/L optimal ovarian reserve</p> <p>(All the above classifications to be considered in context with other fertility factors, both clinical and endocrinological).</p> <p>NB. Risk of OHSS in ART rises with rising AMH.</p> <p>>55 pmol/L very high ovarian reserve/Polycystic ovarian disease – caution higher risk of ovarian hyperstimulation syndrome (OHSS)</p> <p>If AMH very high >100 Suggestive of severe PCOS. Must also consider the possibility of a granulosa cell tumour.</p> <p>See below for paediatric reference ranges</p>	AMH is a marker of ovarian reserve - it does not predict pregnancy outcome.	Same day

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				Female Pediatric AMH Reference Range			
				Age Group	Female AMH (pmol/L)		
				0-28 d	≤ 6.7		
				29-364 d	≤ 31.2		
				1-4.99 y	1.3 – 43.7		
				5-7.99 y	1.4 – 39.5		
				8-11.99 y	2.9 – 52.8		
				12-14.99 y	3.0 – 46.6		
				15-17.99 y	2.1 – 84.1		
				Male Pediatric AMH Reference Range			
				Age Group	Male AMH (pmol/L)		
				0-2 d	68.0 – 523.7		
				3-7 d	138.3 – 1023.7		
				8-10 d	195.2 - 1200.9		
				11-20 d	140.1 - 1130.9		
				21-28 d	212.0 - 951.4		
				29-364 d	203.8 – 971.7		
				1-4.99 y	268.6 - 1229.9		
				5-7.99 y	206.2 – 956.5		
				8-11.99 y	84.0 – 976.4		
				12-14.99 y	8.8 – 286.8		
				15-17.99 y	16.8 – 130.0		
Aspartate Aminotransferase (AST)	Serum or lithium/heparin plasma	1.0mL		Male: 0 to 14d <169; 14d to 1y <78; 1 to 7y <55 7 to 12y <48 >12y <50 Female: 0 to 14d <169 14d to 1y <78 1 to 7y <55 7 to 12y <48 >12y <35		NOT routinely included in any profile	Urgent: 2 hours Routine: 4 hours

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Beta HCG (Pregnancy)	Serum or lithium/heparin plasma	1.0mL		A result of >25 U/L would normally indicate a positive test but, a result of <25 U/L does not exclude early pregnancy.	If used for Ectopic Pregnancy see Clinical Guideline: hCG should be repeated after 48 hours. Policy for pregnancy testing: http://staffnet.cmft.nhs.uk/policies/nursing%20and%20medical%20care/oc7-2594-16-12-2015-12-08-47.pdf	Urgent: 2 hours Non-urgent Same Day
Beta HCG (tumour marker)	Serum or lithium/heparin plasma	1.0mL		<3 months up to 50 IU/L >3 months female: up to 5 IU/L >3 months male: up to 3 IU/L Post-menopausal: up to 8 IU/L hCG, produced in the placenta, partially passes the placental barrier. Newborn serum beta hCG concentrations are approximately 1/400th of the corresponding maternal serum concentrations, resulting in neonate beta hCG levels of 10-50 IU/L at birth. Clearance half-life is approximately 2-3 days. Therefore, by 3 months of age, levels comparable to adults should be reached. hCG can also be measured in other fluids but these reference ranges do NOT apply.	Urine samples from patients with previous molar pregnancies are sent to Sheffield directly by the clinical team	Same day
Beta-hydroxy butyrate (BHB)	Serum or lithium/heparin plasma	1.0mL	Must be received on ice within 20 min of collection	Levels depend on the degree of fasting and hypoglycaemia. A concomitant glucose is required for interpretation. As fasting progresses and glucose levels fall, BHB levels should rise.	If monitoring BHB for children on a ketogenic diet, glucose level and FFA are not required.	2 weeks
Bicarbonate	Serum or lithium/heparin plasma	1.0mL	1 hour	19-28 mmol/L		Urgent: 2 hours Routine: 4 hours

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Bile Acids	Serum or lithium/heparin plasma	1.0mL		< 14 umol/L	This test is for use in cholestasis in pregnancy. Urine bile salts should be requested for investigation of paediatric liver disorders.	Urgent: Call laboratory Routine: next working day
Bilirubin (total)	Serum or lithium/heparin plasma	1.0mL		< 21 µmol/L Levels will rise from birth to approximately 150 µmol/L at 5 to 6 days and then fall to normal childhood levels by day ten.	A prolonged jaundice protocol is available here: https://intranet.mft.nhs.uk/content/hospitals-mcs/rmch/rmch-covid-19-rapid-review-guidelines	Urgent: 2 hours Routine: 4 hours
Bilirubin (Conjugated or direct)	Serum or lithium/heparin plasma	1.0mL		Neonates 1-13 µmol/L Others up to 18y 1-8 µmol/L Adult <5umol/L	A 'normal' level in a very young baby could be an artefact of poor conjugating ability and be falsely reassuring. Please repeat when >10 days old (>14d if preterm).	Urgent: 2 hours Routine: 4 hours
NT pro-BNP	Serum or lithium/heparin plasma	1.0mL		Adults: Up to 400pg/mL 1mo -1 year 37 646 1-1 years 11 months 39 413 2-5 years 11 months 23 289 6-13 years 11 months 22 157 14 - 17 y 11 mo 6 158 Neonates have higher values but ranges are not well defined	Only available routinely for GP samples unless agreement in place. https://link.springer.com/content/pdf/10.1007%2Fs00246-008-9258-4.pdf	Urgent: 2 hours

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Breath hydrogen	Collected by lab staff	<p>Hydrogen breath tests involve the administration of either lactose or sucrose in order to identify malabsorption, or the synthetic sugar lactulose in order to determine gut transit time and/or small bacterial overgrowth. Fructose testing is not provided as a large proportion of the population give positive results.</p> <p>At rest no physiological processes produce hydrogen gas, and so the basal values of a normal patient are low, approx. 0-5 ppm. In health the H₂ in the breath should remain <20ppm throughout the test and no symptoms should be observed. In positive tests (due to primary saccharidase deficiency or secondary cause(s)) basal fasting values should also be <10 ppm.</p> <p>The H₂ levels measured in the breath increase to >20ppm after approximately 60 minutes as the sugar reaches the colon and is metabolised. The value should continue to increase to the end of the test. An early peak (<1hr) may indicate small bowel bacterial overgrowth.</p> <p>Lactulose is not broken down in the small intestine in health, instead progressing through to the colon where it is hydrolysed and fermented by bacteria producing hydrogen. In small intestinal bacterial overgrowth, bacteria from the colon overflow and grow in the small intestine. In a negative test lactulose will produce a hydrogen peak after approximately 120 min as the lactulose load reaches the colon. This timing gives some idea of gut transit time. In a lactulose test positive for small bacterial overgrowth, lactulose is metabolised by the excess anaerobic bacteria in the small intestine resulting in an earlier peak in expired hydrogen with a second peak about 15 min later from the normal colonic lactulose fermentation.</p>		<p>Patients should not have received antibiotics in the preceding 2 weeks. High baselines maybe observed if the patient has failed to fast or not adhered to a low fibre diet before the test.</p>	Same week as patient appointment
Busulfan	Serum	1.0mL	Pharmacokinetic profile is generated from a series of samples.	Only required in specific oncology patients by arrangement. Samples must be received in the lab within 30 min of collection.	48h

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CA125	Serum	1.0mL		<35U/mL Can also be measured in other fluids (not urine).	https://www.karger.com/Article/FullText/338393 , Duffy M, J, Tumor Markers in Clinical Practice: A Review Focusing on Common Solid Cancers. Med Princ Pract 2013;22:4-11	Same day
Caeruloplasmin	Serum or lithium/heparin plasma	1.0mL		<4 weeks 50 - 200 mg/L 4 weeks – 18 y 200 - 450 mg/L >18yrs 200 - 600 mg/L http://www.eurowilson.org/en/professional/diagnosis/index.phtml	Copper transport protein primarily for use in diagnosis of Wilson's disease.	1 week
Calprotectin	Random faecal collection	5g	Sample should be sent promptly to the lab	Faecal calprotectin concentration <100ug/g wet weight excludes active bowel inflammation with a high degree of confidence. Note that conditions other than IBD (e.g., infection, neoplasia, NSAID treatment) may raise calprotectin. This test should not be used in cases of suspected colorectal cancer. Faecal calprotectin concentration of 100ug/g to 2500ug/g is equivocal. Repeat in 4 weeks and refer to Gastroenterology if the repeat level is equal to, or greater than 50ug/g. Faecal calprotectin concentration >2500ug/g indicates active bowel inflammation. Refer to Gastroenterology.	Samples collected while the patient has diarrhoea may give falsely low results.	10 working days
Carbamazepine	Serum or lithium/heparin plasma	1.0mL		4 to 12mg/L	Pre dose sample required	Urgent: 2h.
Carboxyhaemoglobin	If sent with blood gas; Blood gas syringe. Also lithium heparin plasma.	1.0mL	30 min	<2% non-smokers <10% for smokers (approximate)	Do NOT send this specimen by pneumatic tube Remove needle, cap syringe.	30 min

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Calcium (Adjusted)	Serum or lithium/heparin plasma	1.0mL		0 to 14d 1.9 to 2.8 mmol/L 14days to 18 years 2.2 to 2.7mmol/L All others 2.2 to 2.6 mmol/L Calcium can be measured in other fluids. These reference ranges will NOT apply.	Avoid venous stasis	Urgent: 2 hours Routine: 4 hours
Calcium (urine)	Random sample. Preferably the second morning void. 24 hour collection	5.0mL	Random samples must be sent to the lab <2h from collection	Child < 0.01 to 0.52mmol/mmol creatinine 2.5 - 7.5 mmol/24h		Routine: Next day Mon-Fri Urgent: Same day
Calcium (ionised)	Syringe, balanced heparin	1.0mL	ASAP	1.0- 1.4 mmol/L	Avoid venous stasis. Send to the lab immediately. Do not use the pod system.	Urgent: 2 hours Routine: 4 hours
CEA Carcino-embryonic antigen	Serum or lithium/heparin plasma	1.0mL		<5.0ug/L Non smoker Smoker – levels may be up to 6.5ug/L Can also be measured in other fluids (not urine).		< 2 weeks

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Catechol amines	24h collection (acid containing bottle) or Random urine sample	10mL	Must be sent promptly to the lab for acidification to $pH3$	<p>This profile should be selected when investigating or monitoring neuroblastoma in children. Please choose plasma metadrenalines for adults with hypertension ?cause</p> <p>All umol/mmol creatinine</p> <p>Dopamine : creatinine ratio</p> <p>Up to 3 months <math><2</math></p> <p>3 to 9 months <math><1.9</math></p> <p>9 to 15 months <math><1.75</math></p> <p>15 to 21 months <math><1.6</math></p> <p>21m to 2.5y <math><1.4</math></p> <p>2.5 to 3.5y <math><1.2</math></p> <p>3.5 to 4.5y <math><1.0</math></p> <p>4.5 to 6.5y <math><0.9</math></p> <p>6.5 to 8.5y <math><0.8</math></p> <p>8.5 to 11y <math><0.75</math></p> <p>11 to 13y <math><0.6</math></p> <p>13 to 17y <math><0.55</math></p> <p>HMMA : creatinine ratio</p> <p>Up to 3months <math><18</math></p> <p>3 to 9 months <math><17</math></p> <p>9 to 15 months <math><15</math></p> <p>15 to 21 months <math><12</math></p> <p>21m to 2.5y <math><11</math></p> <p>2.5 to 3.5y <math><9</math></p> <p>3.5 to 4.5y <math><8</math></p> <p>4.5 to 6.5y <math><7</math></p> <p>6.5 to 8.5y <math><6</math></p> <p>8.5 to 11y <math><5.5</math></p> <p>11 to 17y <math><5</math></p>	<p>A 24 hour urine collected into acid, container supplied by laboratory is the preferred specimen, for which reference ranges have been established. In infants in whom it is difficult to obtain 24 hour specimens, shorter collections or random urine may be used. Send sample to laboratory immediately if not collected into acid.</p>	1 week, urgent: by discussion with duty biochemist
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				<p>HVA : creatinine ratio</p> <p>Up to 1y <25</p> <p>1y to 1.5y <22</p> <p>1.5 to 2y <19</p> <p>2 to 3y <16</p> <p>3 to 4 y <13</p> <p>4 to 5y <12</p> <p>5 to 8y <9</p> <p>8 to 10y <7.5</p> <p>10 to 11y <7</p> <p>11 to 12.5y <6.5</p> <p>12.5 to 15y <6</p> <p>15 to 17y <5.5</p> <p>Noradrenaline : creatinine ratio</p> <p>Up to 3months <0.3</p> <p>3 to 9 months <0.27</p> <p>9 to 15 months <0.25</p> <p>15 to 21 months <0.20</p> <p>21m to 2.5y <0.18</p> <p>2.5 to 3.5y <0.16</p> <p>3.5 to 4.5y <0.15</p> <p>4.5 to 5.5y <0.14</p> <p>5.5 to 6.5y <0.13</p> <p>6.5 to 8.5y <0.12</p> <p>8.5 to 11y <0.11</p> <p>11 to 13y <0.1</p> <p>13 to 17y <0.08</p> <p>For adults (age greater than 17 years) the upper limit of the reference ranges are:</p> <p>Noradrenaline < 1.0 µmol/24h</p> <p>Adrenaline < 0.1 µmol/24h</p> <p>Dopamine < 4.0 µmol/24h</p> <p>HMMA < 35 µmol/24h</p> <p>HVA < 40 µmol/24h</p>	
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Chloride	Serum or lithium/heparin plasma	1.0mL		95 - 108 mmol/L Chloride can be measured in a range of fluids. This reference range will NOT apply e.g. see electrolytes (urine).		Urgent: 2 hours Routine: 4 hours
Cholesterol (total)	Serum or lithium/heparin plasma	1.0mL		up to 1 month 1.1 - 2.6 mmol/L 1m - 2yrs 1.2 - 4.7 mmol/L Adults <4.0 mmol/L Upper limits quoted for total cholesterol and LDL-Cholesterol are target levels from the National Cholesterol Education Program (NCEP) Expert Panel on Cholesterol Levels in Children Cholesterol can be measured in other fluids e.g. see lipoprotein electrophoresis. These cut offs will NOT apply.	See Joint British Societies 2 guideline <or = to 4.0 mmol/L is ideal	Routine: 4 hours
HDL Cholesterol	Serum or lithium/heparin plasma	1.0mL		HDL male >1.0 mmol/L HDL female >1.2 mmol/L Adults: HDL target level >1.1 mmol/L	See Joint British Societies 2 guideline	Routine: 4 hours
LDL Cholesterol	Serum or lithium/heparin plasma	1.0mL		<17yrs 1.3-2.9mmol/L >17yrs <2.0mmol/L	See Joint British Societies 2 guideline. LDL will only be calculated if TG <or = to 4.0 mmol/L	Routine: 4 hours
Cholinesterase (Total and Phenotyping)	Serum or lithium/heparin plasma	1.0mL		Total 620 – 1370U/L Qualitative interpretation. Contact relevant duty biochemist	Apnoea investigations should wait until patient is fully recovered.	4 Weeks

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Chromium	Whole blood collected in EDTA	1.0mL		MDA/2012/036: if metal ion levels in whole blood are elevated above 120 nmol/L (cobalt) or 135 nmol/L (chromium) (i.e., seven parts per billion (ppb) for either metal ion), a second test should be performed 3 months after the first in order to identify patients who require closer surveillance, which may include cross sectional imaging.	For monitoring metal on metal joint replacement.	4 Weeks
Ciclosporin (cyclosporin)	Whole blood collected in EDTA	1.0mL		100-300 ug/L Results should be interpreted in accordance with local treatment protocols and appropriate trough therapeutic target ranges applied on an individual basis dependent upon speciality, dosing, period in treatment regime and clinical status.	12 hours post dose - state dose and timings.	In patients same day Mon-Fri (if in lab before 10.30)
CK (creatinine kinase)	Serum or lithium/heparin plasma	1.0mL		up to 90 days <475 up to 1 year <250 Adult levels are reached at about 2 years of age. Male: 40 to 320 U/L Female: 25 to 200 U/L	Isoenzyme analysis may be available. Please discuss with the duty biochemist.	Urgent: 2 hours. Routine: 4 hours
Cobalt	Whole blood collected in EDTA	1.0mL		MDA/2012/036: if metal ion levels in whole blood are elevated above 120 nmol/L (cobalt) or 135 nmol/L (chromium) (i.e., seven parts per billion (ppb) for either metal ion), a second test should be performed 3 months after the first in order to identify patients who require closer surveillance, which may include cross sectional imaging.	For monitoring metal on metal joint replacement.	4 Weeks
Copper	Serum.	1.0mL		up to 1 month 2 - 8 µmol/L > 6 months 13 - 26 µmol/L		1 Week

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Copper (urine)	24h urine collection (no preservative or pretreatment of the container required)			<p>< 0.8 $\mu\text{mol}/24\text{ h}$ Post Penicillamine urine copper > 25$\mu\text{mol}/24\text{h}$ in 92% symptomatic WD patients but only 46% asymptomatic WD patients. J Hepatol 2007 Aug 47(2) 172-3</p> <p>Urinary copper excretion is useful for diagnosis and monitoring of therapy. Elevated urinary copper excretion may also be seen in patients with other forms of chronic active liver disease and in heterozygotes for Wilson's disease. A penicillamine challenge test increases the sensitivity and specificity by greatly increasing the urinary copper excretion in patients with Wilson's disease.</p> <p>See also the EASL Clinical Practice Guidelines, http://www.eurowilson.org/en/professional/diagnosis/index.phtml</p>		4 weeks
Cortisol	Serum or lithium/heparin plasma	1.0mL		<p>All samples taken as part of dynamic function test (see relevant handbook) should be sent to the laboratory in a single batch.</p> <p>9am: 133 to 537 nmol/L</p> <p>Values would be raised when the patient is under stress (hypoglycaemia for example).</p> <p>Values should be lower at midnight.</p>	<p>Diurnal variation established at about 3 months of age; Normal response post-Synacthen 30 minutes > 430 nmol/L</p> <p>Random cortisol is not an effective means of screening for Cushing's syndrome: use 1 mg overnight Dexamethasone suppression or 24 hour urinary free cortisol</p>	<p>Urgent: 2 hours Routine: 4 hours</p>
Cortisol (Salivary)	Kits available from Department	0.5mL		<p>Used when the patient is on metyrapone and a specific method is required to avoid cross reaction with metabolites.</p> <p>Cortisone is also measured.</p> <p>Morning sample = <9.1 nmol/L</p> <p>Late night 23:00-00:00 hr = <2.8 nmol/L</p>		2 weeks

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Cortisol (Urine free)	24 h collection			< 165nmol/24h		2 weeks
C-peptide	Serum or lithium/heparin plasma	0.5mL	2.5 hours	Fasting samples with normal glucose: 350-1800 pmol/L Level depends on glucose concentration.	Must be received by the laboratory within 2.5 hours of collection. A simultaneous fluoride oxalate sample for glucose must be provided if investigating hypoglycaemia.	2 weeks
C-reactive protein (CRP)	Serum or lithium/heparin plasma	1.0mL		< 5 mg/L		Urgent: 2 hours Routine: 4 hours
Creatinine	Serum or lithium/heparin plasma	1.0mL		Units are umol/L 0 - <14days M 27 – 81; f 27 - 81 14d - <1yr M 14 – 34; f 14 - 34 1 - <3yr M 15 – 31; f 15 - 31 3 - <5yr M 23 – 37; f 23 - 37 5 - <7yr M 25 – 42; f 25 - 42 7 - <9yr M 30 – 48; f 30 - 48 9 - <11yr M 28 – 57; f 28 - 57 11yr M 36 – 64; f 36 - 64 12yr M 36 – 67; f 36 - 67 13yr M 38 – 76; f 38 - 74 14yr M 40 – 83; f 43 - 75 15yr M 47 – 98; f 44 - 79 16yr M 54 – 99; f 48 - 81 16-18 years M 55 –104; f 45–84 >18 M 59 - 104; f 45-84	Creatinine in other fluids can also be measured but these reference ranges will NOT apply.	Urgent: 2 hours Routine: 4 hours
Creatinine (urine)	24h or random	24h or 10mL random		Male: 9 to 21mmol/24h Female: 7 to 14mmol/24h Random: <1mmol/L is considered too dilute for reliable calculation of ratios	Generally used to calculate a ratio where a 24h collection is not feasible	

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Creatinine Clearance	24h urine collection and paired blood sample			up to 1 month 29 - 69 ml/min/1.73m ² 1 - 3 months 31 - 91 ml/min/1.73m ² 3 - 6 months 44 - 109 ml/min/1.73m ² 6 - 12 months 51 - 165 ml/min/1.73m ² 12 -18 months 65 - 200 ml/min/1.73m ² 2 - 12 years 90 - 173 ml/min/1.73m ² Adult 71 - 151 ml/min/1.73m ²	This has largely been superceded by eGFR calculation. eGFR can also be calculated for paediatric patients provided the height is supplied at the time of request.	Routine: Next day Mon-Fri Urgent: Same day
Cystatin C	Serum or lithium/heparin plasma	1.0mL		0 – 28d 0.80 - 2.30 mg/L 29d – 12mo 0.70 - 1.50 mg/L 13mo – 17y 0.56 – 1.30 mg/L 18 – 50y 0.56 – 0.98 mg/L >50y 0.61 – 1.40 mg/L	CKD-EPI cystatin C will be calculated for adults	Urgent: 2 hours Routine: 4 hours
DHEA sulphate	Serum or lithium/heparin plasma	2.0mL		Male: 2.2 – 15.2 µmol/L Female :1.0 -12.0 µmol/L Pre-pubertal children <2.0 umol/L		2 weeks
Digoxin	Serum or lithium/heparin plasma	1.0mL		0.6-1.2 ug/L	Pre-dose or 12 hours post dose	Urgent: 2 hours Routine: 4 hours
Disaccharidases	Jejunal mucosa. Wrap biopsy in silver foil, place in 2mL screwcap tube, place on ice immediately	min weight 2mg		Maltase 12 - 45 IU/g wet wt Sucrase 4 - 15 IU/g wet wt Lactase 2 - 12 IU/g wet wt		2 weeks
Drugs of Abuse Screen	Random Urine	5.0mL		Reported as positive or negative: amphetamines benzodiazepines cannabinoids cocaine methadone opiates integrity tests (pH and specific gravity)	Detects only those drug classes indicated. Give full medication details as these are required for interpretation	2 weeks
eGFR (estimated glomerular filtration rate)	Calculated on U/E sample	N/A		>90 mL/min/1.73m ² CKD stage increases with falling eGFR. This is not calculated in patients <18y old and is not valid in pregnancy, amputees and patients with very low muscle mass.	https://kidneyresearchuk.org/kidney-health-information/stages-of-kidney-disease/	Same Day

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Electrolytes (urine)	24 hour collection or random. Plain bottle	5.0mL		Sodium (urine) Potassium (urine) Chloride (urine) The levels of each of these are related to intake but will give an indication of whether losses are via a renal route.	Also see entries for creatinine, potassium and sodium in urine	Next day Mon-Fri Urgent: Same day
Elastase	Random faecal collection	5g	Sample should be sent promptly to the lab	>200 ug/g stool	Samples collected while the patient has diarrhoea may give falsely low results.	3 weeks
Ethanol	Serum	1.0mL		as antidote (e.g. methanol poisoning) 800-1200 mg/L Legal limit for driving 800 mg/L		Urgent: 2 hours Routine: 4 hours
Faecal Immunochemical Testing (FIT)	For primary care users and colorectal secondary care triage only: Faeces MUST be collected into the PICKER device.		Must be received in the lab <14 days from collection	Positive if >10ug/g faeces. Refer to lower GI pathway	Samples collected while the patient has diarrhoea may give falsely low results.	7 working days from receipt of sample
Follicle stimulating Hormone(FSH)	Serum or lithium/heparin plasma	1.0mL		Pre-pubertal: varies with age and Tanner stage. See DFT Protocol book Post pubertal Males: 1.5 – 12.4 IU/L Post pubertal Females: Follicular: 3.5-12.5 IU/L Mid cycle: 4.7-21.5 IU/L Luteal: 1.7-7.7 IU/L Menopausal: >30 IU/L		Next day Mon-Fri.
Free fatty acids (FFA)	Serum or lithium/heparin plasma	1.0mL	Must be received on ice <30 min after collection	Levels depend on the degree of fasting and hypoglycaemia. A concomitant glucose is required for interpretation. As fasting progresses and glucose levels fall, FFA levels should rise.		2 weeks

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Gamma-Glutamyl transferase (GGT)	Serum or lithium/heparin plasma	1.0mL		<p>0-4wks 10 – 270 IU/L 1 - 2 mths 10 - 155 IU/L 3 – 4 mths 10 - 93 IU/L >5 mths - Male 10 - 71 IU/L >5 mths – Female 6 - 42 IU/L</p>	Mainly used to distinguish between liver and other causes of a raised alkaline phosphatase. Should not form part of a routine assessment of liver function	Urgent: 2 hours Routine: 4 hours
Gentamicin	Serum or lithium/heparin plasma. May be required in CSF (plain bottle).	1.0mL		<p>There are many indications for the use of various antibiotics. It is best practice to contact Pharmacy for advice after reviewing the specific guideline on the intranet:</p> <p>http://microbiology.staffnet.xmmc.nhs.uk/</p>	Pre dose	Urgent: 2 hours Routine: 4 hours
Glucose	Fluoride/oxalate tube.	1.0mL		<p>0 to1d 2.0-6.1 mmol/L 1 to 7d 2.6-6.1 mmol/L >7d 3.0-6.5 mmol/L Fasting samples are recommended, and ranges given are for fasting specimens. Glucose is NOT routinely measured in urine but may be in other fluids. The reference ranges will not apply.</p>	https://www.diabetes.org.uk/About_us/What_we_say/Diagnosis_ongoing_management_monitoring/New_diagnostic_criteria_for_diabetes/	Urgent: 2 hours Routine: 4 hours
Glucose (CSF)	Fluoride/oxalate tube. Blood sample in fluoride oxalate tube also required.	1.0mL of each		40% - 80% plasma level, generally 3.0 to 6.0mmol/L		Routine: Next day Mon-Fri Urgent: Same day
Glycated Haemoglobin, (HbA1c)	Whole blood in EDTA tube	1.0mL		<p>Tight Glycaemic Control * HbA1c < 48* mmol/mol Good Glycaemic Control HbA1c < 59 mmol/mol Review Glycaemic Control</p>	The presence of a variant haemoglobin will be reported. Further investigation of these requires patient consent for further	3 working days

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				<p>HbA1c \geq 59 mmol/mol * Increased risk of significant hypoglycaemia with tight control</p> <p>HbA1c can also be used for diagnosis. Please see https://www.diabetes.org.uk/resources-s3/2017-09/hba1c_diagnosis.1111.pdf</p> <p>HbA1c is not advised for diagnosis of diabetes mellitus in pregnancy. Target of 43mmol/mol is advised in patients already diagnosed.</p>	analysis, which is performed in haematology.	
Growth Hormone	Serum	1.0mL		<p>Level >7 ug/L in at least one sample on stimulation in a dynamic function test. See age-appropriate DFT Protocol handbook for further information. Level dependant on age, gender and clinical circumstance</p>	Random measurements are of little use	2 weeks
Insulin	Serum or lithium/heparin plasma	0.5mL	2.5h	<p>Fasting samples with normal glucose: Insulin 12 to 150 pmol/L To convert back to mU/L divide by 6.</p>	Must be received by the laboratory within 2.5 hours. A simultaneous fluoride oxalate sample for glucose must be provided if investigating hypoglycaemia.	2 weeks

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Insulin Like Growth Factor 1 (IGF-1)	Serum	1.0mL	Age (in years unless specified)	IGF-1 (µg/L)		Preferred test for screening for acromegaly.	2 weeks	
				Male Reference Range	Female Reference Range			
				0-3 mths	27 - 157			18 - 126
				4-6 mths	28 - 159			18 - 127
				7-9 mths	28 - 161			19 - 128
				10-12 mths	29 - 164			19 - 130
				1	30 - 167			20 - 132
				1.5	32 - 175			21 - 138
				2	34 - 184			22 - 145
				2.5	36 - 194			24 - 154
				3	39 - 205			26 - 164
				3.5	42 - 215			28 - 175
				4	44 - 225			31 - 188
				4.5	47 - 235			33 - 201
				5	50 - 246			36 - 214
				5.5	53 - 256			39 - 227
				6	56 - 267			42 - 240
				6.5	60 - 279			45 - 254
				7	63 - 292			49 - 270
				7.5	68 - 307			53 - 286
				8	72 - 323			57 - 305
				8.5	78 - 341			62 - 326
				9	84 - 362			67 - 349
				9.5	90 - 384			73 - 374
				10	97 - 407			80 - 400
				10.5	104 - 431			86 - 427
				11	112 - 454			93 - 453
				11.5	119 - 477			99 - 477
				12	126 - 499			105 - 499
				12.5	133 - 517			111 - 518
				13	139 - 533			116 - 533
				13.5	144 - 544			120 - 545
				14	148 - 551			123 - 552
14.5	150 - 554	126 - 555						
15	152 - 554	127 - 554						
15.5	153 - 549	128 - 550						
16	153 - 542	128 - 542						
16.5	152 - 532	127 - 531						
17	151 - 521	125 - 517						
17.5	149 - 508	123 - 502						
18-20	129 - 494	105 - 486						
21 - 25	103 - 398	82 - 383						
26 - 30	93 - 297	75 - 284						
31 - 35	86 - 254	72 - 249						
36 - 40	79 - 236	65 - 233						
41 - 45	71 - 221	59 - 210						
46 - 50	63 - 208	55 - 197						
51 - 60	52 - 201	44 - 191						
61 - 70	43 - 190	38 - 171						
71 - 80	35 - 182	35 - 168						
> 80	32 - 172	32 - 178						

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IGF- binding protein 3 (IGFBP3)	Serum or lithium/heparin plasma	1.0mL		Units are mg/L	3 weeks	
				<1 M 1.11 to 3.52 F 1.05 to 3.61		
				1 M 1.29 to 3.86 F 1.22 to 3.94		
				2 M 1.47 to 4.29 F 1.39 to 4.36		
				3 M 1.64 to 4.69 F 1.55 to 4.75		
				4 M 1.80 to 5.05 F 1.71 to 5.10		
				5 M 1.94 to 5.31 F 1.85 to 5.34		
				6 M 2.04 to 5.43 F 1.95 to 5.46		
				7 M 2.10 to 5.51 F 2.02 to 5.57		
				8 M 2.15 to 5.60 F 2.10 to 5.69		
				9 M 2.22 to 5.73 F 2.18 to 5.83		
				10 M 2.30 to 5.88 F 2.27 to 5.98		
				11 M 2.39 to 6.03 F 2.36 to 6.12		
				12 M 2.46 to 6.15 F 2.44 to 6.24		
				13 M 2.53 to 6.24 F 2.52 to 6.33		
				14 M 2.58 to 6.29 F 2.58 to 6.40		
				15 M 2.61 to 6.31 F 2.64 to 6.45		
				16 M 2.64 to 6.32 F 2.68 to 6.48		
				17 M 2.66 to 6.32 F 2.72 to 6.50		
				18 M 2.68 to 6.33 F 2.75 to 6.52		
19 M 2.70 to 6.35 F 2.78 to 6.54						
20-54 M 2.22 to 6.37 F 2.29 to 6.57						
55-80 M 1.65 to 5.77 F 1.93 to 5.73						
>80 M 1.63 to 5.46 F 1.93 to 5.85						
Iron	Serum or lithium/heparin plasma	1.0mL		<1 month: 10 to 30µmol/L Up to 1 year: 5 to 25µmol/L 1 to 10 years: 10 to 25µmol/L >10 years : 5.8 to 34.5µmol/L	Ferritin is a better marker of iron deficiency. Measurement of iron is not necessary	Urgent: 2 hours Routine: 4 hours
Lactate	Fluoride oxalate plasma.	1.0mL	Sample must be < 2hrs old	0.6 – 2.5 mmol/L	Specimen to be sent to laboratory immediately within an hour but must be separated immediately so lab staff must be alerted	2 hours

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Lactate (CSF)	Fluoride oxalate tube. Blood sample in fluoride oxalate tube also required.	1.0mL		Should be 40 to 80% of concomitant plasma lactate: Broadly in the range 1.1 - 2.4 mmol/L		Routine: Next day Mon-Fri Urgent: Same day
Lactate Dehydrogenase LDH	Serum or lithium/heparin plasma	1.0mL		0 to 14 day 303-1143 IU/L 15d to <1 yr 169-435 IU/L 1yr to <10 yr 196-314 IU/L 10 to <15 yr 163 - 269 (F), 175 - 279 (M) 15 to <18 yr 139 - 249 18 years and above 20 to 220 IU/L	LDH can be measured in other fluids e.g. pleural fluid, but these reference ranges will not apply.	Urgent: 2 hours Routine: 4 hours
Lamotrigine	Serum or lithium/heparin plasma	1.0mL		3.0 -15.0 mg/L	Pre-dose	1 week
Lipase	Serum or lithium/heparin plasma	1.0mL		13-60 U/L	Lipase can be measured in a range of other fluids. This reference range does NOT apply.	Urgent: 2 hours Routine: 4 hours
Lithium	Serum	1.0mL		0.4-1.0 mmol/L	12+/-0.5 hours post dose	Routine: next day (Mon-Fri) Urgent: 2h
Luteinising hormone (LH)	Serum or lithium/heparin plasma	1.0mL		Pre-pubertal: varies with age and Tanner stage. See DFT Protocol book Post pubertal Male 1.7 – 8.6 IU/L Post pubertal Female Follicular phase: 2.4-12.6 IU/L Mid cycle: 14 – 95.6 IU/L Luteal phase: 1.0-11.4 IU/L		Next day Mon-Fri

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Magnesium	Serum or lithium/heparin plasma	1.0mL		0.7 – 1.0 mmol/L		Urgent: 2 hours Routine: 4 hours
Magnesium (urine)	Acid bottle required for 24h collection.		Avoid metal capped MSU container because of the danger of contamination	3.3 – 5.0 mmol/24h		Routine: Next day Mon-Fri Urgent: Same day
Met-haemoglobin	If sent in a blood gas syringe, for additional measurement of acid base parameters, remove needle and cap syringe. If separate sample; lithium heparin tube.	1.0mL	30 min	< 1.5%	DO NOT send this specimen by pneumatic tube	Urgent: 2 hours Routine: 4 hours
Methotrexate	Serum	1.0mL		There are many protocols in oncology, rheumatology and dermatology for using methotrexate. Best practice is to consult with Pharmacy before starting treatment if you are unable to locate the current protocol for your area.	Collect as protocol. Urgent by arrangement	Routine: 2 working days Urgent: same day Mon-Fri Urgent analysis out of hours can be arranged

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				Female (pmol/L)		Male (pmol/L)			
				Age	RI	Age	RI		
Oestradiol	Serum or lithium/heparin plasma	1.0mL		15 days - < 1y	up to 78	15 days - < 1y	up to 78		Next day, Mon-Fri
				1 - < 9y	up to 19	1 - < 11y	up to 28		
				9 - < 11y	up to 170	11 - < 13y	up to 82		
				11 - < 12y	up to 354	13 - < 15y	up to 89		
				12 - < 14y	21 - 664	15 - < 19y	up to 132		
				14 - < 19y	up to 996				
				Tanner	RI	Tanner	RI		
				I	up to 59	I	up to 52		
				II	up to 83	II	up to 51		
				III	up to 323	III	up to 61		
				IV	32 - 541	IV	up to 118		
				V	53 - 807	V	48 - 115		
Optical Density Difference (ODD)	Amniotic fluid in a plain container	5.0mL	Must be protected from light and lab needs prior warning.	Pregnancies affected by Rhesus incompatibility lead to the destruction of foetal red cells <i>in utero</i> . The bilirubin produced in this process passes into the amniotic fluid where it can be measured by determining the optical density difference (ODD) at 450nm. Results require specialist interpretation.				There are many potential confounding factors. Please discuss with the lab before proceeding.	Same day
Orosomuroid	Serum or lithium/heparin plasma	1.0mL		300 – 1200 mg/L					1 week
Osmolality	Serum + random urine (plain bottle)	1.0mL		275 – 295 mmol/kg A paired random urine sample is required, preferably after an overnight fast/thirst, to enable interpretation. The lab requires prior notification if a water deprivation test is planned.				Can be calculated as (2 x Na) + glucose + urea	same day
Osmolar Gap	Serum	1.0mL		<10 mmol/L (measured Osmolality – Calculated Osmolality)				For use in suspected ingestion of osmotic substances.	

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Paracetamol	Serum or lithium/heparin plasma	1.0mL		In overdose refer to treatment graph (http://pharmacy.staffnet.cmft.nhs.uk/medica/140722/paracetamol_overdose_guidance_on_the_use_of_iv_acetylcysteine_mhra_september_2012.pdf)	At least 4 hours after overdose. Record times of ingestion and sample collection	Urgent: 2 hours Routine: 4 hours
pH (urine)	Random sample, collected and then preserved under a layer of liquid paraffin.	10mL		A wide range of urine pH can be measured, usually to confirm the sample has been sufficiently acidified or not adulterated. This investigation can be useful in the diagnosis of renal tubular acidosis.	Please contact the lab for specific indications where a ward urine dipstick test is not suitable.	same day
Phenobarbitone	Serum or lithium/heparin plasma			10-40 mg/L	Pre dose	Urgent: 2 hours Routine: 4 hours
Phenytoin	Serum or lithium/heparin plasma	1.0mL		Total: 5-20 mg/L Free: 1-2mg/L – not routinely available	Pre dose	Urgent: 2 hours Routine: 4 hours
P1NP	Serum or lithium/heparin plasma	1.0mL		27-128ug/L	Low P1NP - decreased collagen formation Elevated P1NP - increased collagen formation	2 weeks

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P3NP	Serum	0.5mL	<p>All ug/L</p> <p>13wk M 46.5-77.6 F 42.4-64.1 26wk M 24.6-43.3 F 24.7-37.8 39wk M 14.9-21.4 F 16.2-23.2 1yr M 11.5-18.9 F 13.7-26.0 2yr M 7.4-16.0 F 11.2-15.7 3yr M 5.9-11.0 F 7.2-12.5 10yr M 5.6-9.9 F 5.6-9.9 11yr M 6.2-9.4 F 5.5-10.6 12yr M 5.1-9.4 F 8.2-14.2 13yr M 6.0-11.9 F 7.1-14.6 14yr M 7.7-18.8 F 3.0-8.7 15yr M 8.8-17.0 F 6.5-9.7 16yr M 11.4-19.7 F 7.2-7.5 17yr M 7.4-18.0 F 3.0-5.0 18yr M 3.8-5.9 F 3.0-5.2 >18yr M 1.7-4.2 F 1.7-4.2</p> <p>Serum P3NP levels in children may reflect both hepatic fibrinogenesis and also general growth. No guidelines for further investigations are currently available in children.</p>	<p>Consider biopsy in psoriatics on Methotrexate if Pre-treatment >8.0ug/L or three samples > 4.2ug/L in twelve month period or two samples > 8.0ug/L consecutively.</p> <p>Consider withdrawing Methotrexate if three samples > 10.0ug/L in a twelve month period. Active erosive arthritis or fractures may raise P3NP.</p>	4 weeks
Phosphate	Serum or lithium/heparin plasma	1.0mL	<p>1 month 1.4 - 2.8 mmol/L 1 month - 1 year 1.2 - 2.2 mmol/L 2 - 3 years 1.1 - 2.0 mmol/L 4 - 12 years 1.0 - 1.8 mmol/L 13 - 15 years 0.95 - 1.5 mmol/L 16 -18 years 0.8 - 1.4 mmol/L >18 years 0.8 - 1.5 mmol/L</p>		<p>Urgent: 2 hours Routine: 4 hours</p>
Phosphate (urine)	24h urine collection (plain bottle)		15 – 50 mmol/24h	<p>Also see DFT handbook for tubular reabsorption of phosphate</p>	<p>Routine: Next day Mon-Fri Urgent: Same day</p>

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Placental Growth Factor and ratio to Soluble FMS Tyrosine Kinase-1 (PLGF; sFlt; sFlt:PLGF ratio)	Serum	1.0mL		No reference range quoted as ratio is interpreted as part of clinical pathway in conjunction with clinical assessment (NICE DG23)	For use in assessing pre-eclampsia	Routine Mon to Fri.
Potassium	Serum or lithium/heparin plasma	1.0mL		Neonate (up to 28d): 3.4 - 6.0 mmol/L 1 mth – 17 yrs 3.5 - 5.0 mmol/L >18 yrs 3.5 – 5.3 mmol/L	Potassium can be measured in a range of other fluids. These reference ranges will not apply.	Urgent: 2 hours Routine: 4 hours
Potassium (urine)	24h collection or random	24h collection or 10mL random		25-125mmol/24h	Highly variable depending on fluid and potassium intake	Same day
Procalcitonin	Serum or lithium/heparin plasma	1.0mL	Freeze serum/plasma if sending through the post.	Consider stopping antibiotics if Procalcitonin concentration has decreased by more than or equal to 80% from the PEAK concentration or is less than 0.5 ug/L.		Same day
Progesterone	Serum or lithium/heparin plasma	1.0mL		Progesterone level >30 nmol/L on day 21/mid-luteal phase sample is consistent with ovulation		Next day, Mon-Fri
Prostate Specific Antigen (PSA)	Serum or lithium/heparin plasma	1.0mL		50-59 yrs <3.0 ng/mL 60-69 yrs <4.0 ng/mL 70 and over <5.0 ng/mL (Department of Health Referral Guidelines 2002) Interpretation is by close scrutiny of latest evidence	For use in men only	Same day

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Prolactin (Total)	Serum or lithium/heparin plasma	1.0mL		<p style="text-align: center;">All mU/L</p> <p>30d M 900-6751 F 900-6751 60d M 689-4208 F 689-4208 90d M 151-2820 F 151-2820 5m M 113-2813 F 113-2813 8m M 121-2213 F 121-2213 12m M 148-1105 F 148-1105 2yr M 93-1063 F 96-1165 4yr M 82-967 F 81-864 8yr M 69-593 F 66-630 18yr M 60-324 F 65-496 >18yr M 86-324 F 102-496</p>		Same day
Prolactin (Free or monomeric)	Serum or lithium/heparin plasma	1.0mL		<p style="text-align: center;">All mU/L</p> <p>Infants (both sexes) 0 - 30 days 693 - 5198 31 - 60 days 531 - 3240 61 - 90 days 116 - 2171 3 - 5 months 87 - 2166 6 - 8 months 93 - 1704 9 - 12 months 114 - 851</p> <p>Females 1 year 74 - 897 2 - 4 years 62 - 665 5 - 8 years 51 - 485 9 - 18 years 50 - 382 >18y 79 - 384</p> <p>Males 1 year 72 - 819 2 - 4 years 63 - 745 5 - 8 years 53 - 457 9 - 18 years 46 - 249 >18y 67-251</p>		2 weeks

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Protein (total)	Serum or lithium/heparin plasma	1.0mL		0 to 14d 55 – 83 g/L 15 d to <1 yr 46 - 72 g/L >1y 60 – 80 g/L	Total protein can be measured in other fluids. These reference ranges will NOT apply.	Urgent: 2 hours Routine: 4 hours
Protein (urine)	24 hour urine collection or random, early morning sample			<140 mg/24h < 20 mg/mmol Creatinine A positive test for proteinuria is > 30 mg/mmol creatinine.		Routine: Next day Mon-Fri Urgent: Same day
Protein (total, CSF)	1.2mL Fluoride-EDTA tube acceptable 2.7 mL Fluoride-EDTA tube acceptable provided minimum volume of 0.5 mL.	1.0mL		Up to 7 days 0.4 to 1.1 g/L 1 to 4 weeks 0.2 - 0.8 g/L 1 to 3 months 0.2 – 0.7 g/L 3 months to adult 0.05 - 0.45 g/L		Routine: Next day Mon-Fri Urgent: Same day
Parathyroid Hormone (PTH)	EDTA plasma	1.0mL		Normocalcaemic patients 1.6-6.9 pmol/L		Same day
Renin Concentration (paediatrics only)	EDTA plasma	1.0mL	Send to the lab ASAP but NOT on ice	All mIU/L up to 1 week 0 to 312 1 week to 1 year 31.2 to 109.2 1 to 2 years 32.4 to 93.6 2 to 10 years 22.8 to 62.4 Over 10 years 12 to 31.2	Important variables affecting interpretation are sodium intake, supine or upright position and drug treatment.	3 weeks
Reducing Substances and sugar chromatography (faeces)	Random faecal collection	5g		The following sugars are reported as positive or negative: glucose, galactose, lactose, maltose, fructose, sucrose, oligosaccharides (complex sugars) along with a non-specific test for reducing substances.	Specimen must be less than 2 hours old or frozen while fresh. Urine reducing substances are analysed in the Willink lab.	2 weeks
Salicylate	Serum or lithium/heparin plasma	1.0mL		Overdose: see Toxbase or BNF	Repeated measurement may be required. Record times of ingestion and sample collection	Urgent: 2 hours Routine: 4 hours

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Selenium	Serum	1.0mL		2yr 0.2-0.6umol/L 16yr 0.44-1.4umol/L >16yr 0.8-1.5umol/L		1 week
SHBG	Serum	1.0mL		All nmol/L 4 days to 1 month 14 - 120 1 month to 1 year 36 - 229 1 to 8 years 42 - 189 8 to 11 years 26 - 162 11 to 13 years 15 - 108 13 to 15 years 11 - 98 Females 15 to 17 years: 10 – 84 Females 17 to 18 years: 11 – 155 Males 15 to 18 years: 10 – 50 Female 19 to 49y: 32-128 nmol/L ≥50y: 27 to 128 nmol/L Male 19 to 49y: 18-54 nmol/L ≥50y: 21-77 nmol/L		2 weeks
Sirolimus	EDTA plasma	1.0mL		5-10ug/L Overdose: see Toxbase or BNF	12 hours post dose - state dose and timings.	In patients same day Mon-Fri (if in lab before 10.30am
Sodium	Serum or lithium/heparin plasma	1.0mL		0 to 7d 131-144 mmol/L 7 to 31d 132-142 mmol/L >31d 133 - 146 mmol/L	Sodium can be measured in a range of other fluids but these reference ranges will NOT apply.	Urgent: 2 hours Routine: 4 hours
Sodium (urine)	24h collection or random	24h collecti on or 10mL random		40 to 220mmol/24h	Highly variable depending on fluid and sodium intake	Same day
Sweat Test	Samples collected by lab staff			This test is carried out as a diagnostic investigation for cystic fibrosis. http://www.cysticfibrosis.org.uk/about-		Same week as patient

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				cf/publications/factsheets Sweat chloride is the analyte on which the diagnosis is made: A sweat chloride concentration of >60 mmol/L supports the diagnosis of CF. A chloride concentration of 30-60 mmol/L is an intermediate result which requires further CF assessment, including genetic and clinical correlation. A sweat chloride of <30 mmol/L makes CF unlikely but requires genetic and clinical correlation if clinical concerns continue.		appointment
Tacrolimus (Prograf, FK506)	Whole blood (EDTA tube)	1.0mL		3-15 ug/L	12 hours post dose - state dose and timings.	In patients same day Mon-Fri (if in lab before 10.30am)
Testosterone	Serum or lithium/heparin plasma	1.0mL		Male <50y: 8.6 – 29 nmol/L >50y: 6.7 to 25.7 nmol/L Female: < 1.8 nmol/L (by immunoassay) Paediatric Male up to 3 Months 0.5 to 12.6nmol/L 3 to 6 months 0.1 to 3.1nmol/L 6 months to 10 y (pre-pubertal) 0.1 to 1.0nmol/L >13 years (post pubertal) 12.0 to 31.0nmol/L Female Up to 10 years (prepubertal) <0.5nmol/L >10 years (post pubertal) <1.5nmol/L	SHBG and FAI will be reported with all adult female testosterone results. Adult samples are routinely analysed by immunoassay. Paediatric samples and raised results on adult females are analysed by mass spectrometry.	2 weeks

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Thiopental	Serum or lithium/heparin plasma	1.0mL	.	Levels above 28mg/L can cause anaesthesia, levels between 10 – 15mg/L cause depression of respiration and blood pressure. A level of 5mg/L is generally accepted as sufficiently low to have no influence on brain stem cell tests and is adopted by ICU with regard to clinical life support decision making.	We must be informed if the patient is also taking lamotrigine.	Only available on request.
Theophylline	Serum	1.0mL		10 - 20 mg/L		Urgent: 2 hours Routine: 4 hours
Thiopurine Methyl Transferase	EDTA Whole blood	1.0mL		Deficient - <10mU/L Low – 20-85mU/L Normal – 86-185mU/L High - >185mU/L	Recent blood transfusion may mask a deficient TPMT result. Reflex requesting of genotype for low activity.	10 days
Tobramycin	Serum or lithium/heparin plasma	1.0mL		There are many indications for the use of various antibiotics. It is best practice to contact Pharmacy for advice after reviewing the specific guideline on the intranet: http://microbiology.staffnet.xcmmc.nhs.uk/	pre-dose	Urgent: 2 hours Routine: 4 hours
Tri-iodothyronine – Free (free T3)	Serum or lithium/heparin plasma	1.0mL		Units are pmol/L 4d 2.3-8.1 1m 2.4-7.9 2m 2.5-7.8 12m 2.7-7.3 6y 3.0-6.9 11y 3.3-6.8 17y 3.5-6.7 18y 3.5-6.7 >18y 3.6-6.4	Not standard part of Thyroid Function Test	2 weeks

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Thyroxine – Free (free T4)	Serum or lithium/heparin plasma	1.0mL		<1 month 15-34 pmol/L >1 month 9 - 24 pmol/L	Low levels of binding protein usually reflected by a low albumin cause low results. High levels of TBG, as occur in pregnancy or HRT, have no effect	same day
Transferrin	Serum or lithium/heparin plasma	1.0mL		Up to 9 weeks 1.04-2.24g/L 9 weeks to 1year 1.07-3.24g/L 1 to 17 years 2.20-3.37g/L >17yr 2.0-3.60g/L	Provided as part of iron profile and used as the denominator to calculate iron saturation	same day
% Transferrin saturation	Serum or lithium/heparin plasma	1.0mL		15%-45% >50% is consistent with hereditary haemochromatosis https://bestpractice.bmj.com/topics/en-gb/134	Iron saturation of transferrin is a more sensitive marker than ferritin for detecting iron overload	Urgent: 2 hours. Routine same day.
Triglycerides	Serum or lithium/heparin plasma	1.0mL		Up to 1 month 0.1 - 0.9 mmol/L 2 months - 1 year 0.4 - 1.4 mmol/L >2 years 0 - 1.7 mmol/L >18years Fasting guideline; JBS 2 Dec 2005 treatment target an optimal level <1.7 mmol/L	Triglycerides can be measured in other fluids. These reference ranges will NOT apply.	Same day
Troponin T	Serum or lithium/heparin plasma	1.0mL		< 14.0ng/L (99th centile of reference range and limit of detection)	NICE has recommended a testing protocol at admission and 6 hours later for hs-cTnT	Urgent: 1 hour Routine: 4 hours
Thyroid Stimulating Hormone (TSH)	Serum or lithium/heparin plasma	1.0mL		<1 month up to 10 mU/L >1 month 0.2 - 5.0 mU/L	See TFT guideline.	Same day

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Urate	Serum or lithium/heparin plasma	1.0mL		<p>Female & Males 0 to14 days 158 - 748 µmol/L 15 days to <1 yr 88 - 370 µmol/L 1 - <12 yrs 100 – 282</p> <p>FEMALES ONLY: 12 to 18 yrs 147 - 342µmol/L >18 y 140 to 360µmol/L</p> <p>MALES ONLY: 12 to 18 yrs 150 - 446 µmol/L >18y: 200 to 430µmol/L</p>	Urate can be measured in other fluids. These reference ranges will NOT apply.	Routine: 4 hours
Urate (urine)	24 hour collection			1.5 – 4.5 mmol/24h		Routine: Next day Mon-Fri Urgent: Same day
Urea	Serum or lithium/heparin plasma	1.0mL		Up to 1 month 2.0 - 5.0 mmol/L 2mo - 1 year 2.5 - 6.0 mmol/L 2 – 12 years 2.5 - 6.5 mmol/L 13 - 17 years 3.0 - 7.5 mmol/L >18 yrs 2.5 – 7.8 mmol/L	Urea can be measured in other fluids. These reference ranges will NOT apply.	Urgent: 2 hours Routine: 4 hours
Urea (urine)	24 hour collection Plain bottle			428 to 714mmol/24h		Routine: Next day Mon-Fri Urgent: Same day
Valproate	Serum or lithium/heparin plasma	1.0mL		Total: 50 - 100 mg/L Free: 5 – 10mg/L(not routinely available)	Pre dose	Urgent: 2 hours Routine: 4 hours
Vancomycin	Serum or lithium/heparin plasma May be required in CSF (plain bottle)	1.0mL		There are many indications for the use of various antibiotics. It is best practice to contact Pharmacy for advice after reviewing the specific guideline on the intranet: http://microbiology.staffnet.xcmmc.nhs.uk/	Post dose monitoring is no longer recommended	Urgent: 2 hours Routine: 4 hours

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Vitamin A (Retinol)	Serum or lithium/heparin plasma	1.0mL		0.7 - 2.8 µmol/L	Protect from Light	2 weeks
Vitamin D (total 25OH)	Serum or lithium/heparin plasma	1.0mL		Vitamin D < 25 nmol/l Deficient - treatment required Vitamin D 25-50 nmol/l Associated with an increased disease risk and treatment is usually required Vitamin D 51-75 nmol/l Adequate – treatment may be required if clinically indicated Vitamin D >75 nmol/l Optimal Vitamin D status	25OHD2 and 25OHD3 are measured separately and added together to give total 25OHD	2 weeks
1,25-di hydroxyVitamin D (DHVD)	Serum	2.0mL		43-144 pmol/L Usually higher in children up to 3 years old		4 weeks
Vitamin E (Tocopherol)	Serum or lithium/heparin plasma	1.0mL		11.6 – 34.8 µmol/L lower in neonates Ratio to total cholesterol: 3.85 to 7.56	Protect from light	2 weeks
Xanthochromia Screen	Collection Kit from Biochemistry. http://staffnet/resources/medguide/xantho%20ward%20requesting%20guidelines.pdf	1.0mL		Qualitative interpretation to indicate whether a subarachnoid haemorrhage is the likely diagnosis.		Same day, Mon to Fri.
Zinc	Serum	1.0mL		1 month 10 - 22 µmol/L Up to 12 years 10 - 18 µmol/L >12 years 10 - 22µmol/L	Serum levels decrease shortly after birth and regain childhood levels at a few months. Hypoalbuminaemia can result in apparently low circulating zinc levels.	1 week