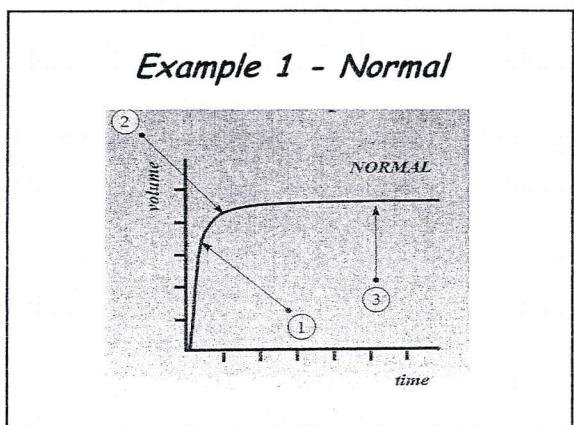
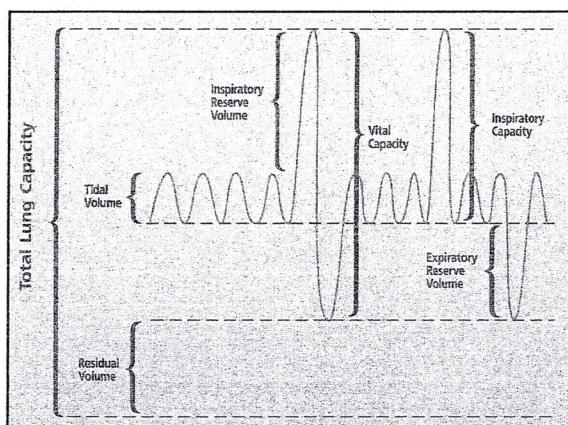
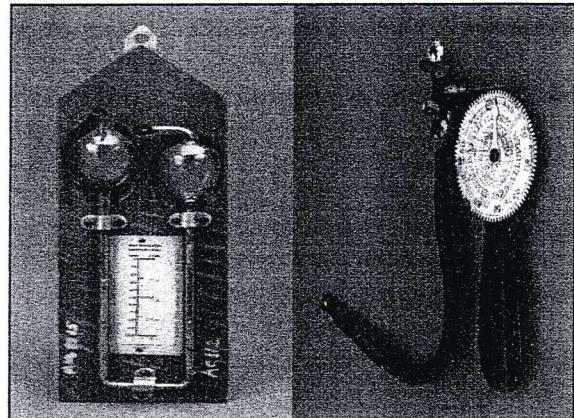
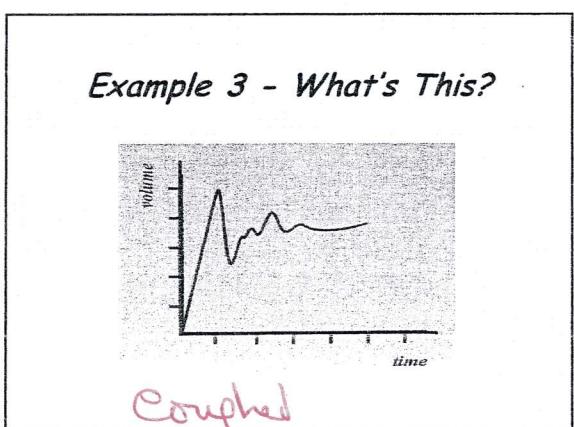
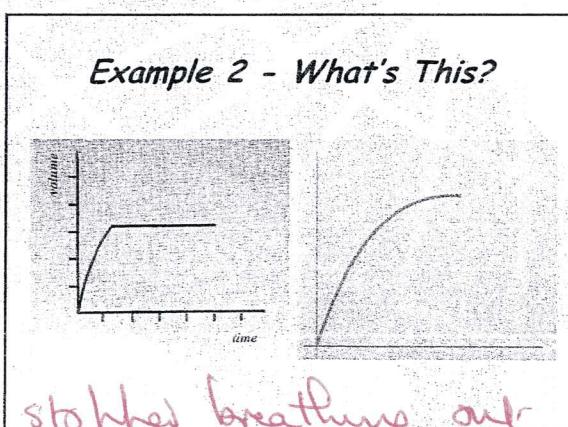


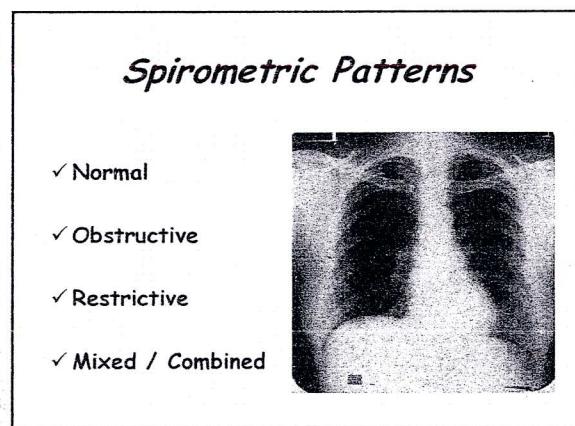
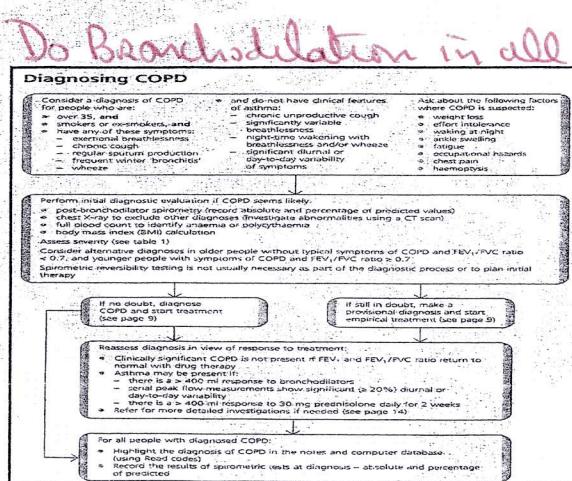
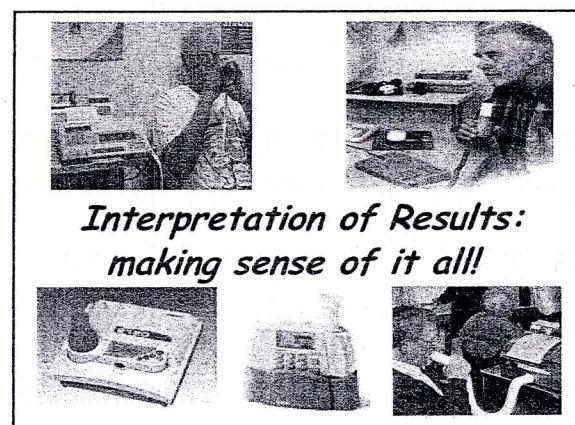
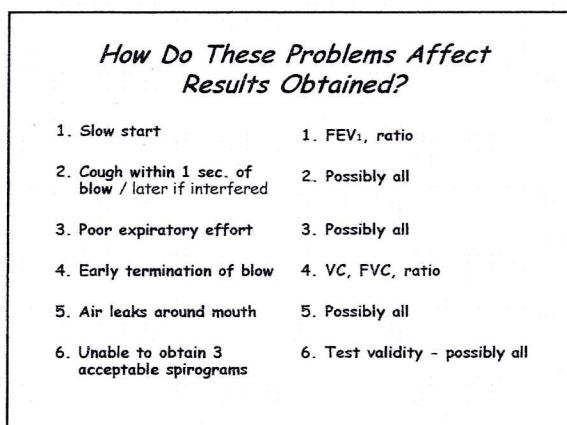
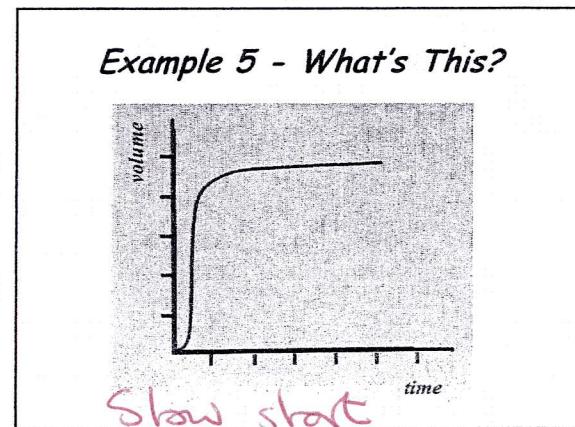
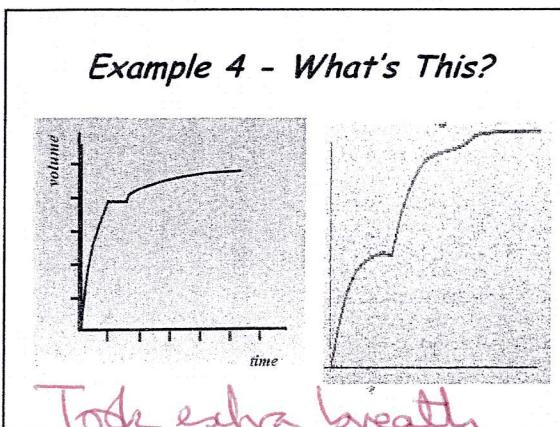
Making Sense of Spirometry

Sue Hunter
HealthCare Training Solutions



Residual Volume is ↑ in COPD
Air Trapping





Use own puffer if has one

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COPD Classifications

NICE (2010) has 4 stages:
mild, moderate, severe & very severe

Table 1: Severity of airflow obstruction

		NICE clinical guideline 12 (2004)	ATS/ERS 2004 ³	GOLD 2008 ⁴	NICE clinical guideline 101 (2010)
Post-bronchodilator	FEV ₁ % predicted		Post-bronchodilator	Post-bronchodilator	Post-bronchodilator
< 0.7	≥ 80%		Mild	Stage 1 – Mild	Stage 1 – Mild ¹
< 0.7	50–79%	Mild	Moderate	Stage 2 – Moderate	Stage 2 – Moderate
< 0.7	30–49%	Moderate	Severe	Stage 3 – Severe	Stage 3 – Severe
< 0.7	< 30%	Severe	Very severe	Stage 4 – Very severe ^{**}	Stage 4 – Very severe ^{**}

¹ Symptoms should be present to diagnose COPD in people with mild airflow obstruction
^{**} Or FEV₁ < 50% with respiratory failure
 ATS, American Thoracic Society; ERS, European Respiratory Society; FVC, forced vital capacity; GOLD, Global Initiative for Chronic Obstructive Lung Disease

Reference Ranges

- ✓ Derived mathematically by using age & ht. to calculate pred. value & allow for some variation around that value (i.e. ref. 'range')
- ✓ Lung function measurements include 90% of general pop.
- ✓ Can often explain 'normal' results even if lower than 'standard' UK parameters
- * Data limited for children & adolescents (over-predict), elderly (under-predict) & non-Caucasian populations

Figure 4.3: Generic plot of standard deviation

Normal

You will see:

- ✓ VC & FVC ≥ 80% pred.
- ✓ FEV₁ ≥ 80% pred
- ✓ ratio ≥ 70% (measured / base column)

VC vs. FVC

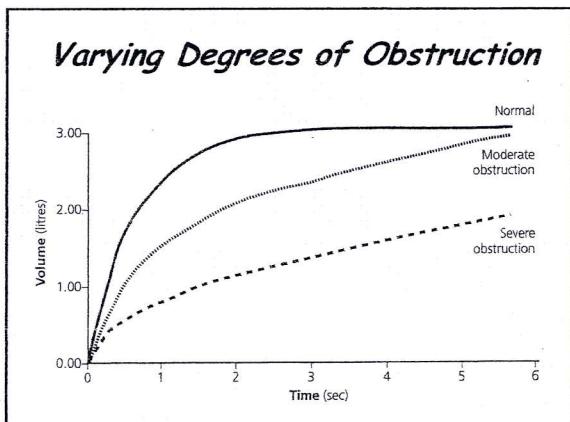
- ✓ Healthy subjects expel all air equally well whether forced or relaxed manoeuvre. vol. measurements should be roughly equal
- ✓ FVC may sometimes be ↑ if more effort is put into this manoeuvre

In obstruction lungs fill normally but empty slowly causing fall in Fev₁

Obstruction

You will see:

- ✓ FVC normal (>80% pred.)
- ✓ FEV₁ ↓ (<80% pred.)
- ✓ ratio ↓ (<70%)



As lungs can empty

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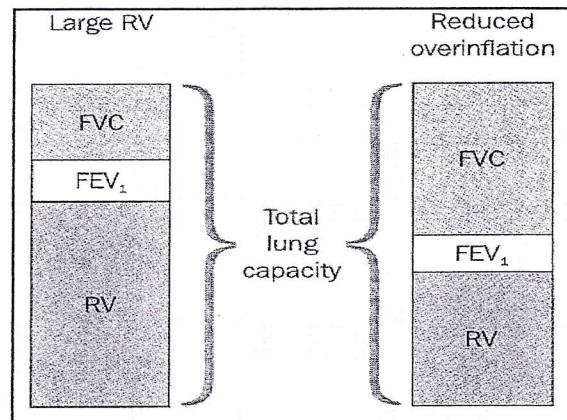
OK the VC and FVC is OK

Obstruction can be from COPD or from Asthma

Machine should show both $\frac{FEV_1}{VC}$
and $\frac{FEV_1}{FVC}$ Choose larger ratio

Air Trapping

- ✓ Some people have lower / smaller airway collapse - air is trapped distally & remains unmeasured
- ✓ Seen in severe COPD & emphysema

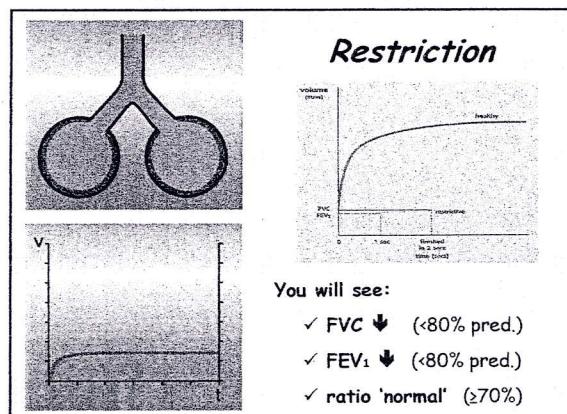


Needs a Lab to measure residual volume

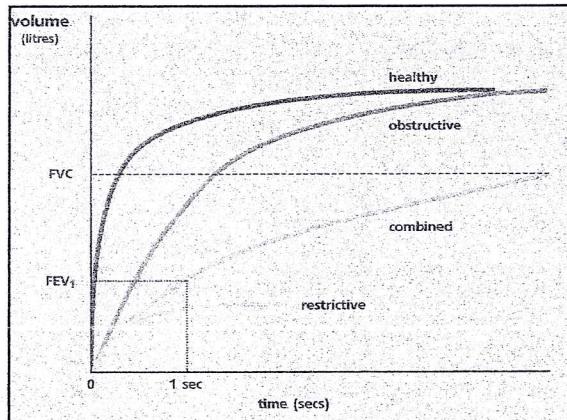
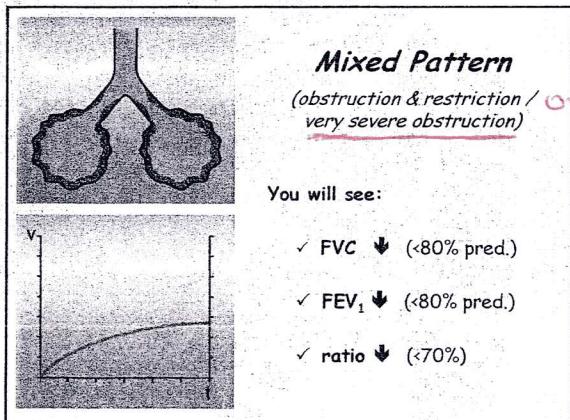
Can't Shout lungs

Restrictive (Small Lung) Disorders

- o **Lung Parenchyma** e.g. pulmonary fibrosis, pneumoconiosis, collapse, consolidation, oedema, fibrosing alveolitis, infection, sarcoidosis, infiltration, rheumatoid arthritis, previous surgery
- o **Chest Wall Disorders** e.g. scoliosis, ankylosing spondylitis
- o **Neuromuscular Disorders** e.g. Myasthenia Gravis, Guillain Barre, Duchenne MD, Poliomyelitis, Muscular Dystrophy
- o **Pleural Diseases** e.g. pneumothorax, pleural effusion, pleural thickening
- o **Subdiaphragmatic conditions** e.g. CCF, obesity, ascites, pregnancy



They just narrowed so can blow out but not as much air to blow with so FVC ↓. Repeat to confirm the ref to chest wall for further lung function test.



Now Look At Some Results....

What's This?

	Predicted	Measured	% of Predicted
VC			
FVC	5.2	5	96
FEV ₁	4	3.9	98
FEV ₁ /VC%			
FEV ₁ /FVC%	77	78	
FEF _{25-75%}			

normal

Which Trace Is It?

What's This?

	Predicted	Measured	% of Predicted
VC			
FVC	3.7	2	54
FEV ₁	3	1.8	60
FEV ₁ /VC%			
FEV ₁ /FVC%	81	90	
FEF _{25-75%}			

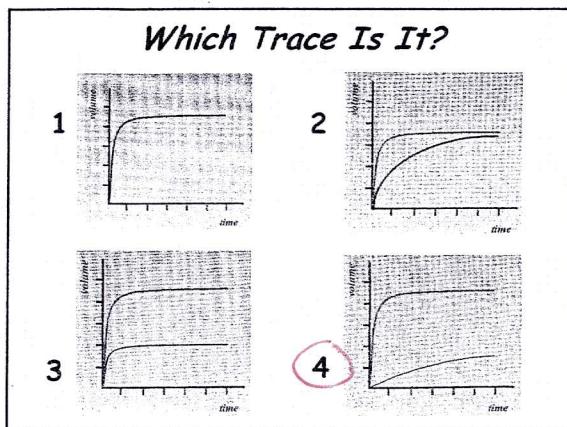
Restriction

Which Trace Is It?

What's This?

	Predicted	Measured	% of Predicted
VC			
FVC	2.61	1.5	57
FEV ₁	2.08	0.5	24
FEV ₁ /VC%			
FEV ₁ /FVC%	76	33	
FEF _{25-75%}			

MIXED

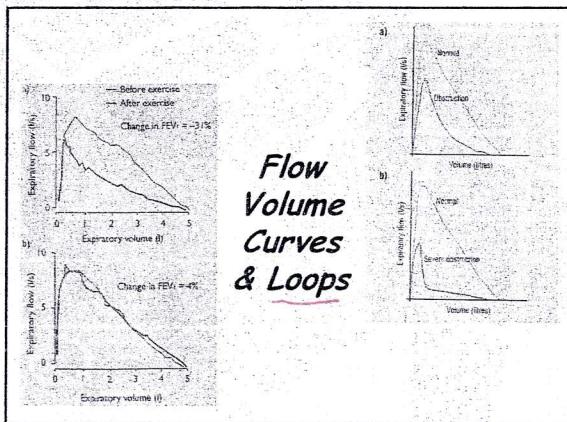
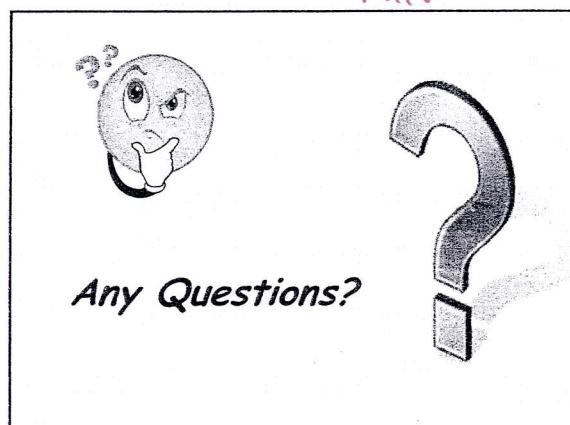
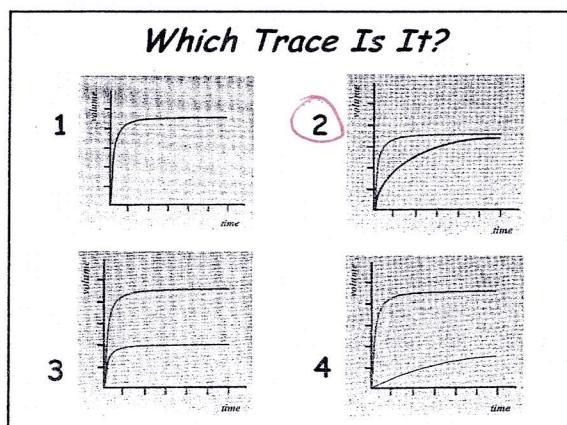


What's This?

	Predicted	Measured	% of Predicted
VC			
FVC	3.52	3.5	99
FEV ₁	2.99	2	67
FEV ₁ /VC%			
FEV ₁ /FVC%	80	57	
FEF _{25-75%}			

Obstruction

ratio gives severity. Here MILD



Flow Volume Curves

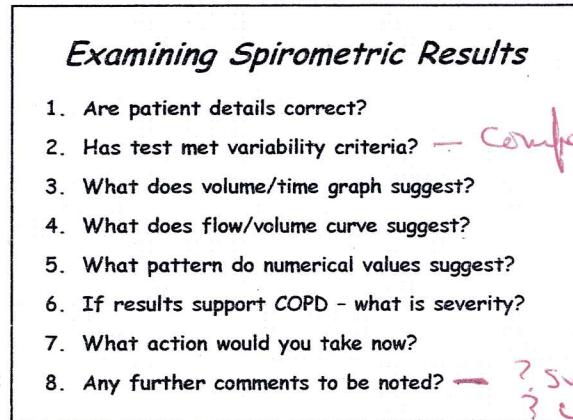
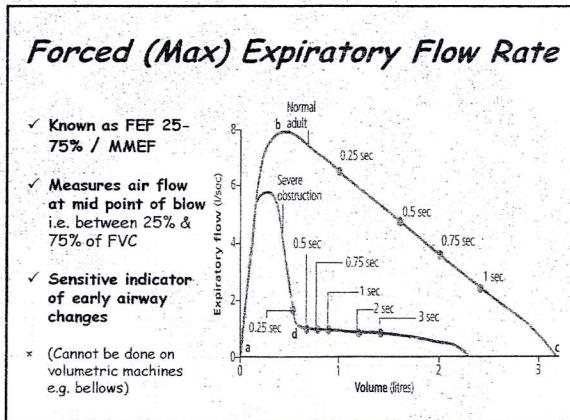
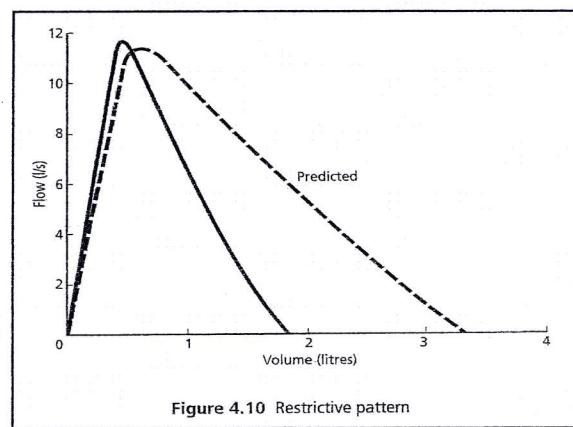
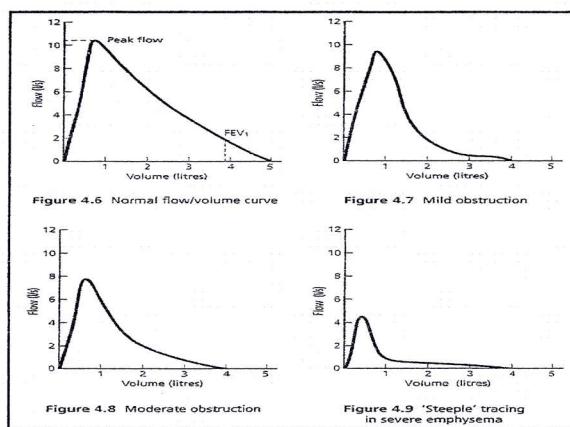
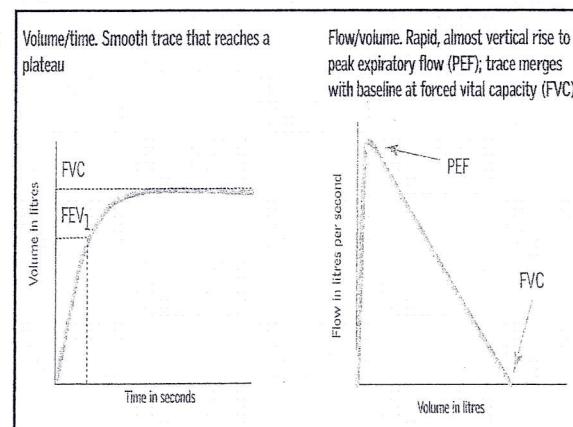
- ✓ Plot AIR FLOW i.e. rate at which air is expelled from all generations of airways ... & ... VOLUME of air expelled at that point
- ✓ Usually relates to patient's forced expiratory manoeuvre = expiratory flow vol. curve
- ✓ Very accurate in demonstrating upper airway obstruction (larynx & trachea)

Loops not available on all machines (measurements when breathing in)

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Flow Volume Curves

- ✓ Flow rate on vertical axis & volume on horizontal axis
- ✓ Rapid ↑ in flow at start - reaches peak quickly (PEF) - rapid ↓ in flow rate as forced expiration completed - curve drops to 0 (= FVC)



FEV₂₅₋₇₅ (MMEF) measures small airways

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<50% = Pathology