King Saud University
College of Medicine
First Year – 428
2nd Semester

Handout #:
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Physiology Practical Manual

(Dr.Mustafa's Revision)

By :

Mo3ath AL-Saiady

Thanks To :

Ahmed Al-Aqeel
Bilal Marwa
Mohamed AlOtaiby
Batel Al-Toraiqy
Faisal Al-Sarrani

بداية..

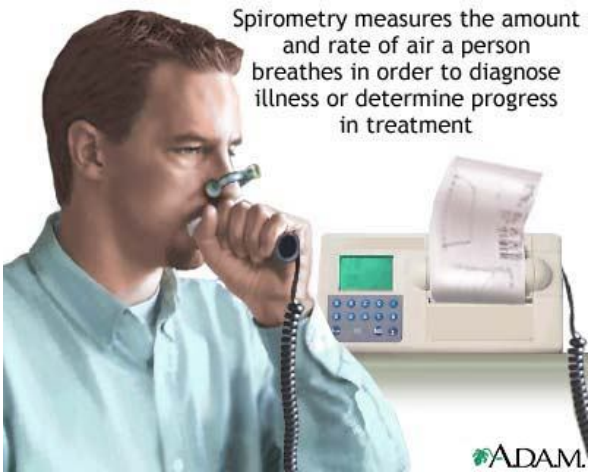
المواضيع اللي داخلة معنا هي:

1-The Spirometry
2- The Dynamic Spirometry
3 -Diuresis
4- Glucose Tolerance Test GTT

مرجع المذاكرة:

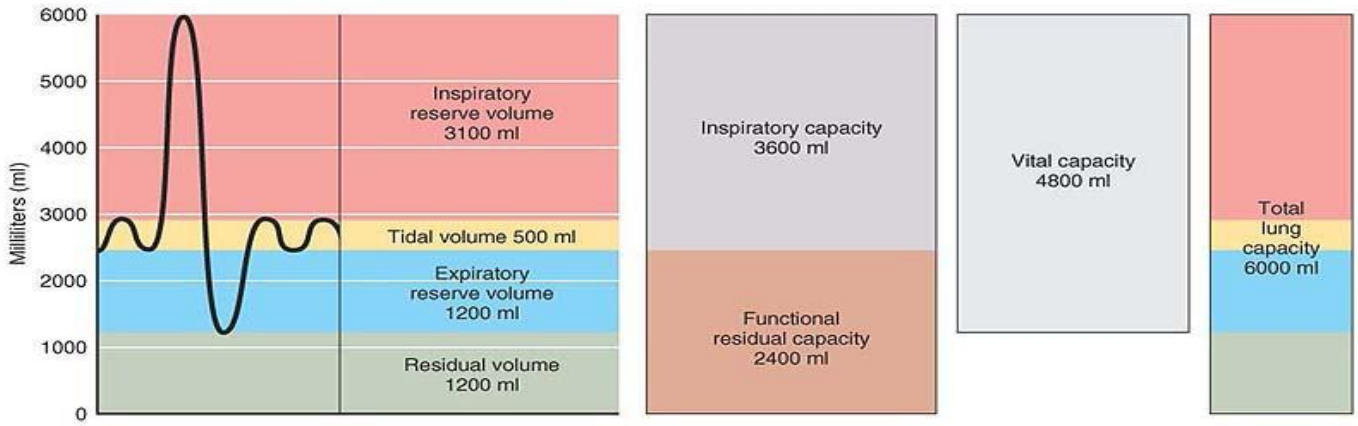
مذكرة اخو بلال (البرآء) موجودة في الكويك كوبي برقم 128

The Spirometry / الموضوع الاول



اهم النقاط اللي لازم تُعرف في هذا الموضوع:

- Definitions of Lung volumes & capacities
- Normal values of Lung volumes & capacities
- Residual Volume Can not be measured by spirometry , it is measured by Helium dilution technique

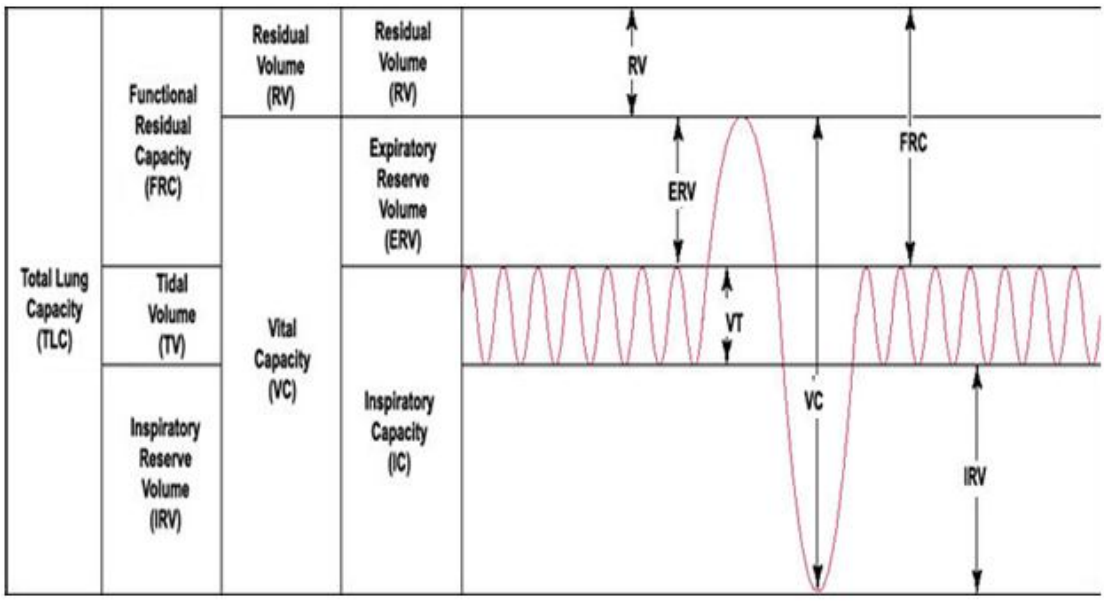


(a) Spirographic record for a male

	Measurement	Adult male average value	Adult female average value	Description
Respiratory volumes	Tidal volume (TV)	500 ml	500 ml	Amount of air inhaled or exhaled with each breath under resting conditions
	Inspiratory reserve volume (IRV)	3100 ml	1900 ml	Amount of air that can be forcefully inhaled after a normal tidal volume inhalation
	Expiratory reserve volume (ERV)	1200 ml	700 ml	Amount of air that can be forcefully exhaled after a normal tidal volume exhalation
	Residual volume (RV)	1200 ml	1100 ml	Amount of air remaining in the lungs after a forced exhalation
Respiratory capacities	Total lung capacity (TLC)	6000 ml	4200 ml	Maximum amount of air contained in lungs after a maximum inspiratory effort: TLC = TV + IRV + ERV + RV
	Vital capacity (VC)	4800 ml	3100 ml	Maximum amount of air that can be expired after a maximum inspiratory effort: VC = TV + IRV + ERV (should be 80% TLC)
	Inspiratory capacity (IC)	3600 ml	2400 ml	Maximum amount of air that can be inspired after a normal expiration: IC = TV + IRV
	Functional residual capacity (FRC)	2400 ml	1800 ml	Volume of air remaining in the lungs after a normal tidal volume expiration: FRC = ERV + RV

(b) Summary of respiratory volumes and capacities for males and females

-وايضا لازم تعرفون المعلومات اللي في هذي الصورة :



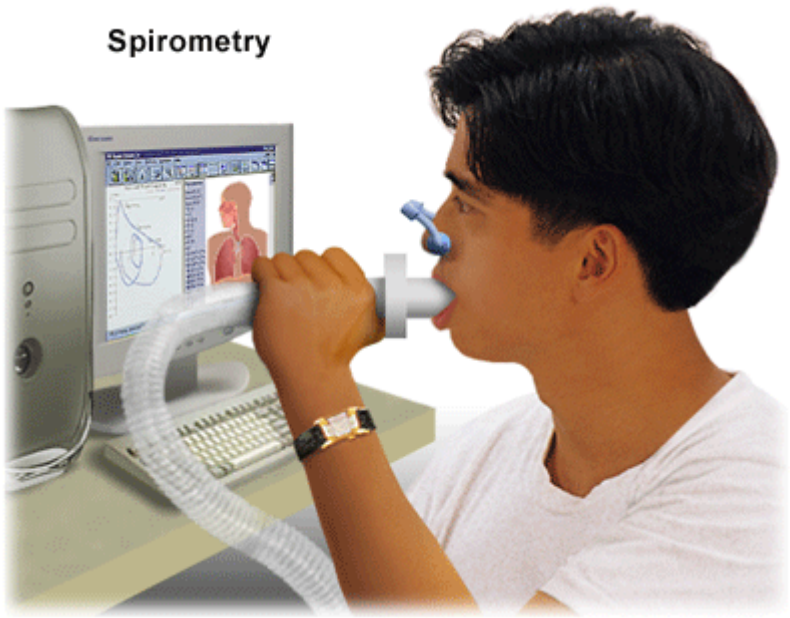
-واخيرا **The significance of residual volume**

@ To prevent lung collapse

@ To facilitate work of breathing

@ To allow continuous gas exchange between breaths

/ The Dynamic Spirometryالموضوع الثاني



اهم النقاط اللي لازم تُعرف في هذا الموضوع:

- **The FEV1/FVC ratio :** is a calculated ratio used in the diagnosis of obstructive and restrictive lung disease

@ FEV1%= FEV1/FVC ×100

@ **Normal** values are approximately **80%**

@ In **obstructive** lung disease, the FEV1 is reduced due to obstruction to air escape. Thus, the FEV1/FVC ratio will be **reduced**

@ In **restrictive** lung disease, the FEV1 and FVC are equally reduced due to fibrosis or other lung pathology (not obstructive pathology). Thus, the FEV1/FVC ratio should be approximately **normal**.

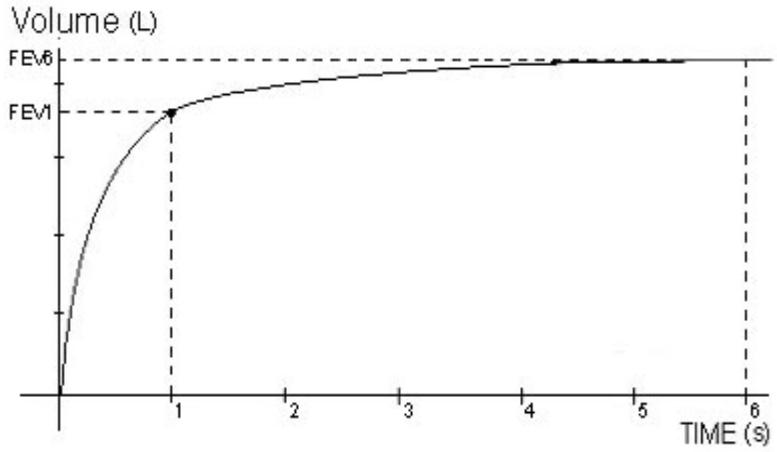
in summary :

Obstructive
- FEV1/FVC % >>> ↓↓↓ far below 80%
- FEV1 >>> ↓
- FVC >>> Normal or ↓

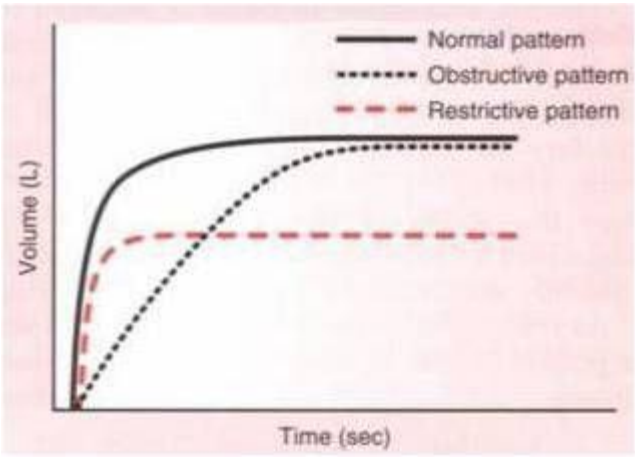
Restrictive
- FEV1/FVC % >>> Normal or slightly ↑
- FEV1 >>> ↓
- FVC >>> ↓↓↓ can reach 3L

The Volume-Time curve :

Normal

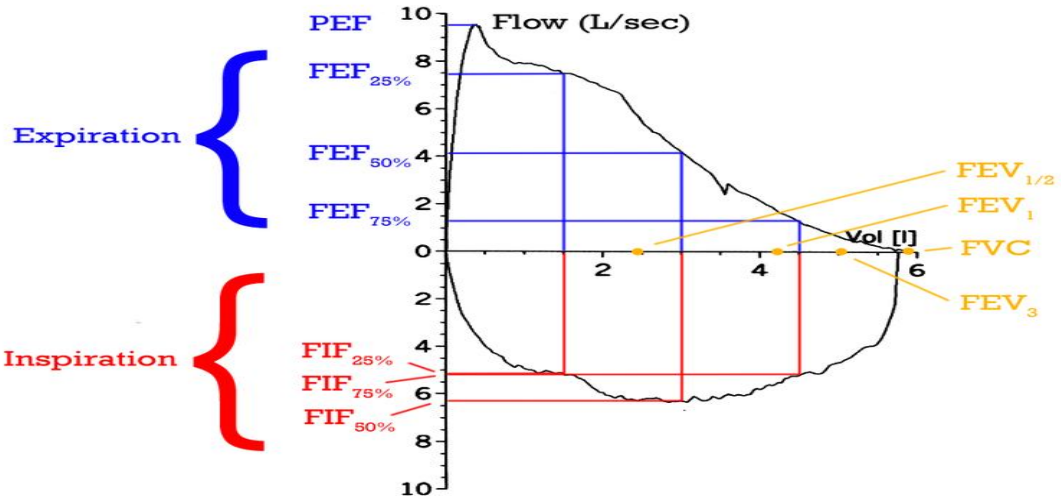


normal , restrictive & obstructive lung disease

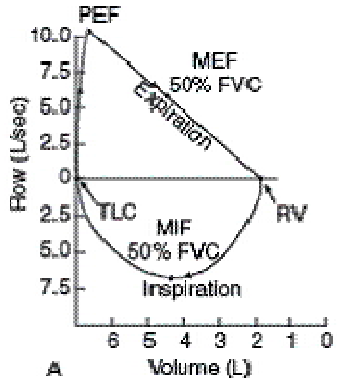


تابع الموضوع الثاني / The Dynamic Spirometry

Flow-Volume loop :



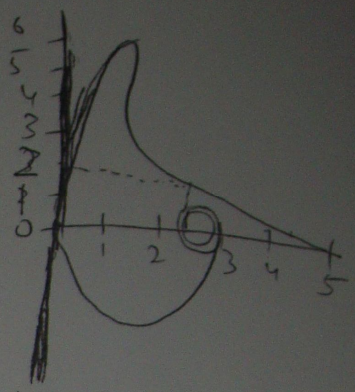
Normal Flow Volume Loop



Normal. Inspiratory limb of loop is symmetric and convex. Expiratory limb is linear. Flow rates at the midpoint of the inspiratory and expiratory capacity are often measured. Maximal inspiratory flow at 50% of forced vital capacity (MIF 50% FVC) is greater than maximal expiratory flow at 50% FVC (MEF 50%FVC) because dynamic compression of the air-ways occurs during exhalation.

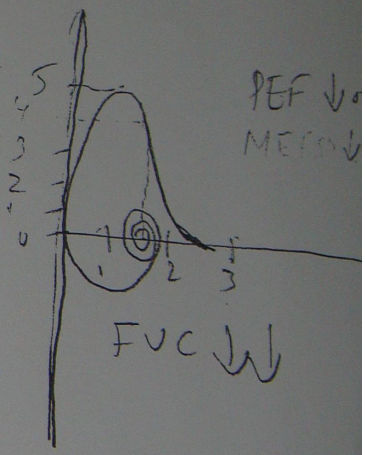
Normal Vales: → Peak (PEF): 6-12 L/sec →$MEF_{50\%}$: 4-8 L/sec
Obstructive: →MEF ↓ → PEF (normal)
Restrictive : → FVC ↓ (< 3)

Obstructive disease



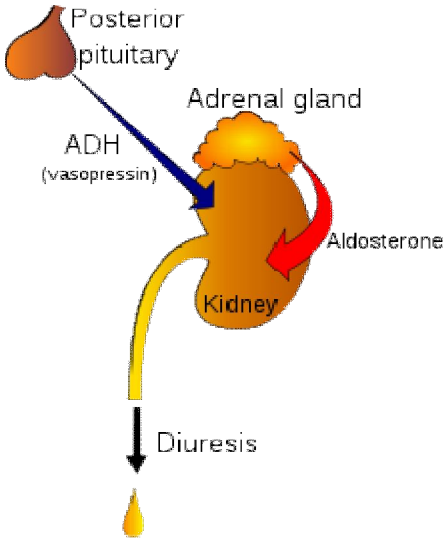
Although all flow rates are diminished, expiratory prolongation predominates, and MEF < MIF. Peak expiratory flow is sometimes used to estimate degree of airway obstruction but is dependent on patient effort.

Restrictive Disease



The loop is narrowed because of diminished lung volumes, but the shape is generally the same as in nor-mal volume. Flow rates are greater than normal at comparable lung volumes because the increased elastic recoil of lungs holds the airways open

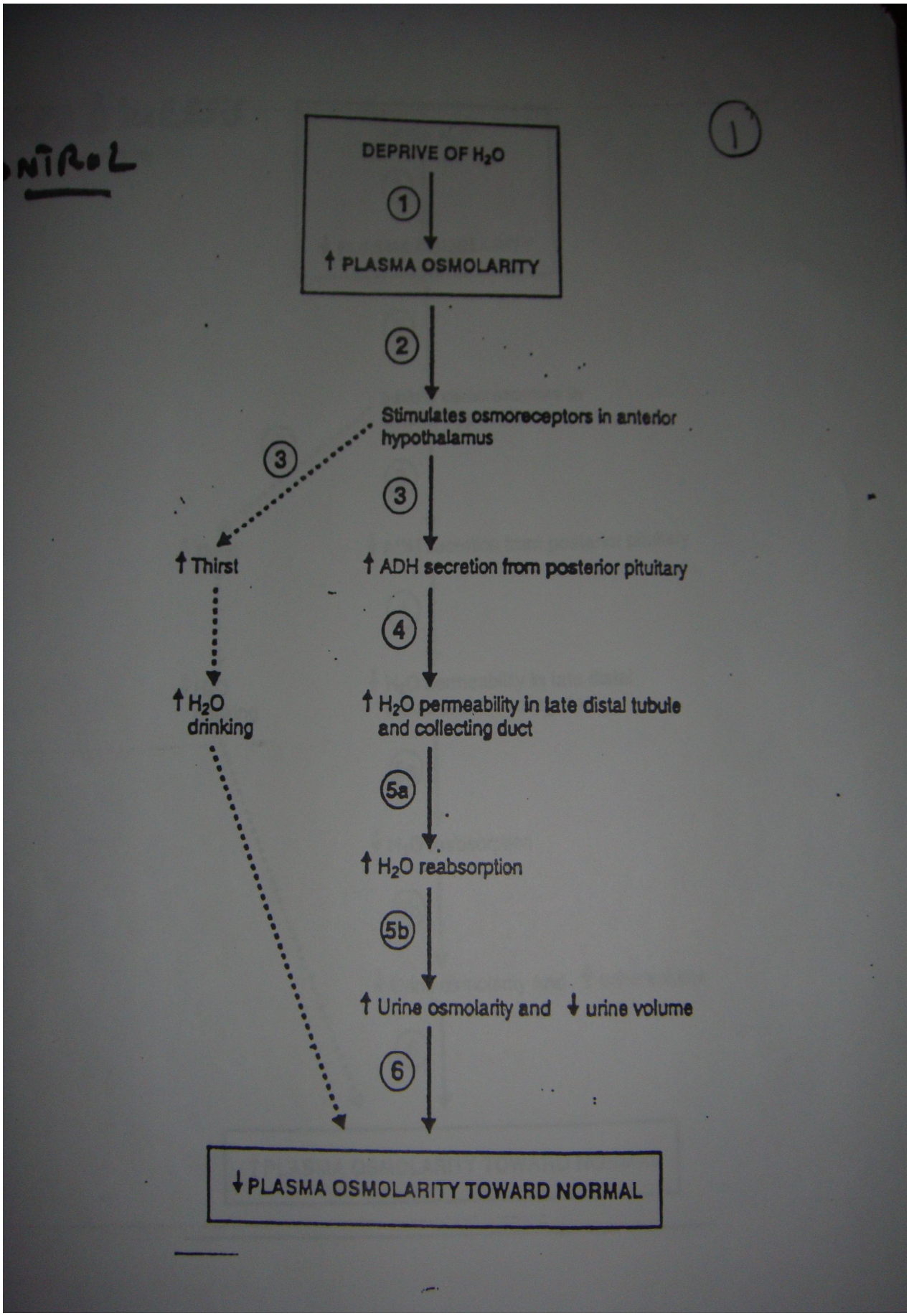
الموضوع الثالثDiuresis /



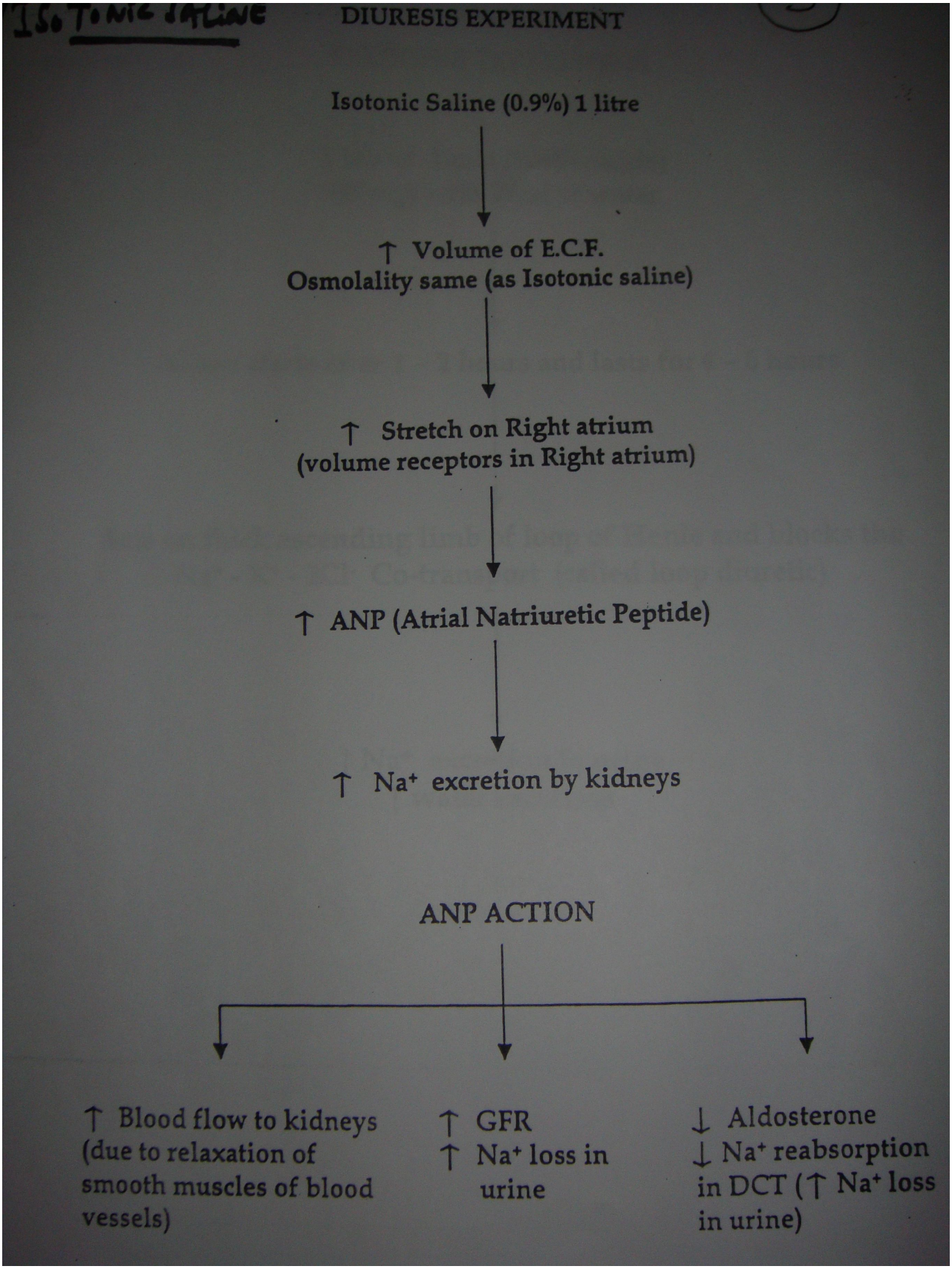
طبعا لو تذكرون ان التجربة طبقت على 4 اشخاص
الاول / شرب موية
الثاني / شربSaline
الثالث / اخذLasix
الرابع / قعد يتفرج(ما شرب او اخذ شي يعني)

المطلوب هو اننا نعرف وش الـ Effect اللي صار لكل شخص وكيف يصحح هذا الـ Effect ؟

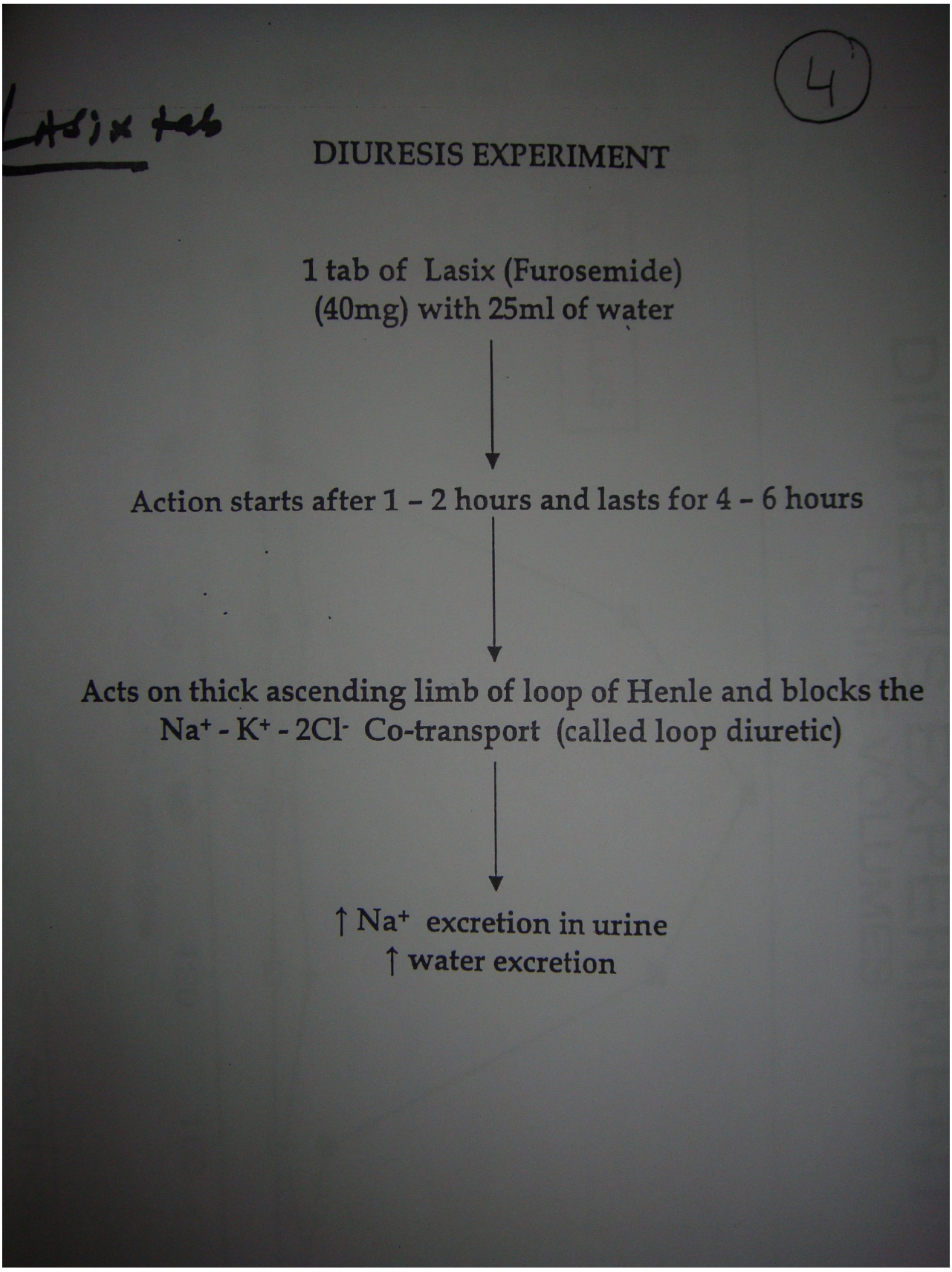
CONTROL


DEPRIVE OF H_2O
1
↑ PLASMA OSMOLARITY
2
Stimulates osmoreceptors in anterior hypothalamus
3
3
↑ Thirst
↑ ADH secretion from posterior pituitary
4
↑ H_2O drinking
↑ H_2O permeability in late distal tubule and collecting duct
5a
↑ H_2O reabsorption
5b
↑ Urine osmolarity and ↓ urine volume
6
↓ PLASMA OSMOLARITY TOWARD NORMAL

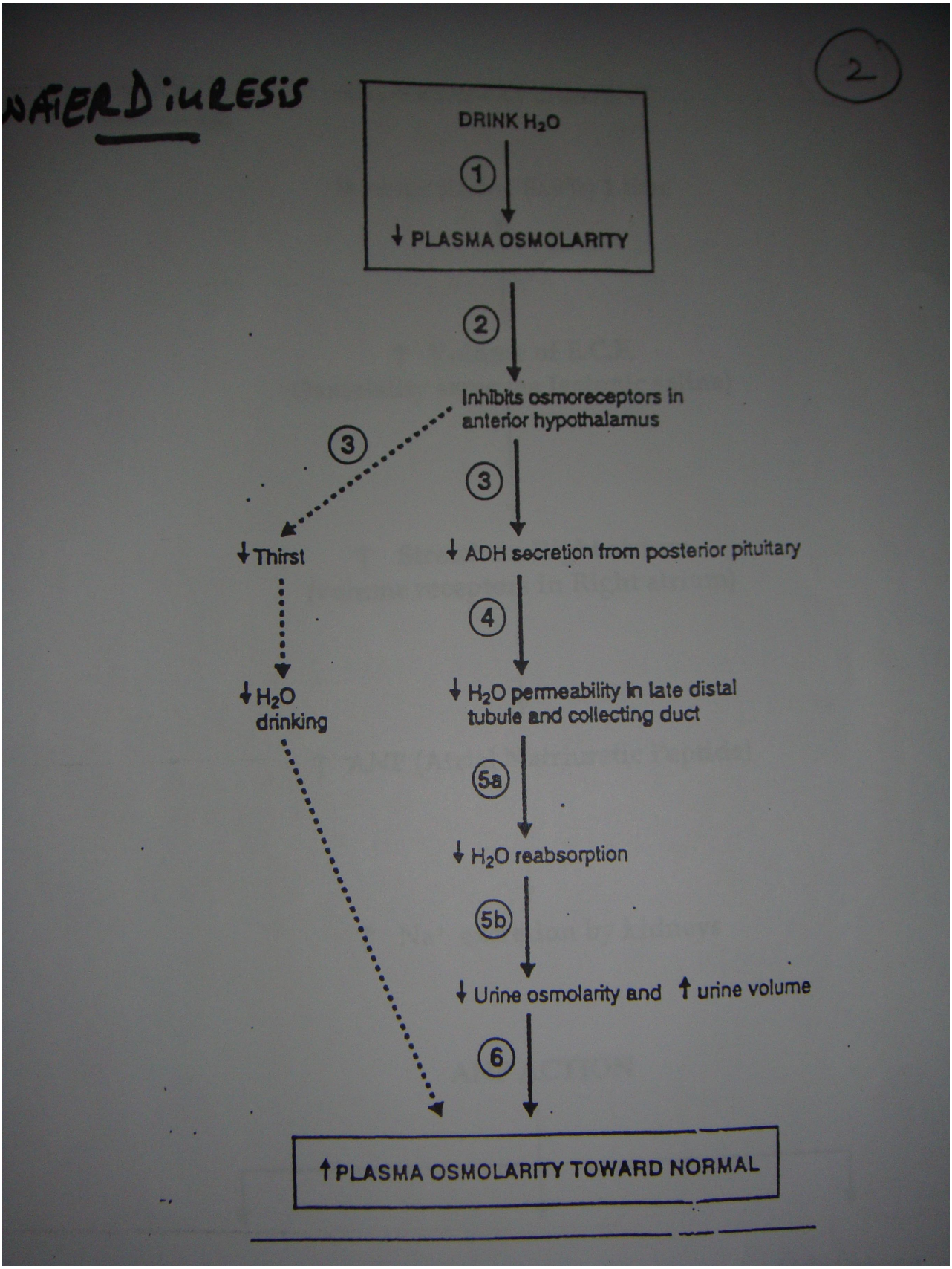
SALINE


ISOTONIC SALINE
DIURESIS EXPERIMENT
Isotonic Saline (0.9%) 1 litre
↑ Volume of E.C.F.
Osmolality same (as Isotonic saline)
↑ Stretch on Right atrium
(volume receptors in Right atrium)
↑ ANP (Atrial Natriuretic Peptide)
↑ Na+ excretion by kidneys
ANP ACTION
↑ Blood flow to kidneys (due to relaxation of smooth muscles of blood vessels)
↑ GFR
↑ Na+ loss in urine
↓ Aldosterone
↓ Na+ reabsorption in DCT (↑ Na+ loss in urine)

LASIX


Lasix tab
4
DIURESIS EXPERIMENT
1 tab of Lasix (Furosemide)
(40mg) with 25ml of water
Action starts after 1 – 2 hours and lasts for 4 – 6 hours
Acts on thick ascending limb of loop of Henle and blocks the
Na+ - K+ - 2Cl- Co-transport (called loop diuretic)
↑ Na+ excretion in urine
↑ water excretion

WATER


WATER DIURESIS
2
DRINK H_2O
1
↓ PLASMA OSMOLARITY
2
Inhibits osmoreceptors in anterior hypothalamus
3
3
↓ Thirst
↓ ADH secretion from posterior pituitary
4
↓ H_2O drinking
↓ H_2O permeability in late distal tubule and collecting duct
5a
↓ H_2O reabsorption
5b
↓ Urine osmolarity and ↑ urine volume
6
↑ PLASMA OSMOLARITY TOWARD NORMAL

حسابات مهمة 100%بالاختبار:

1. To calculate **urine excretion rate (ml/min)** you use the following formula:

$$\frac{\text{volume of urine (mL)}}{\text{time (min)}}$$

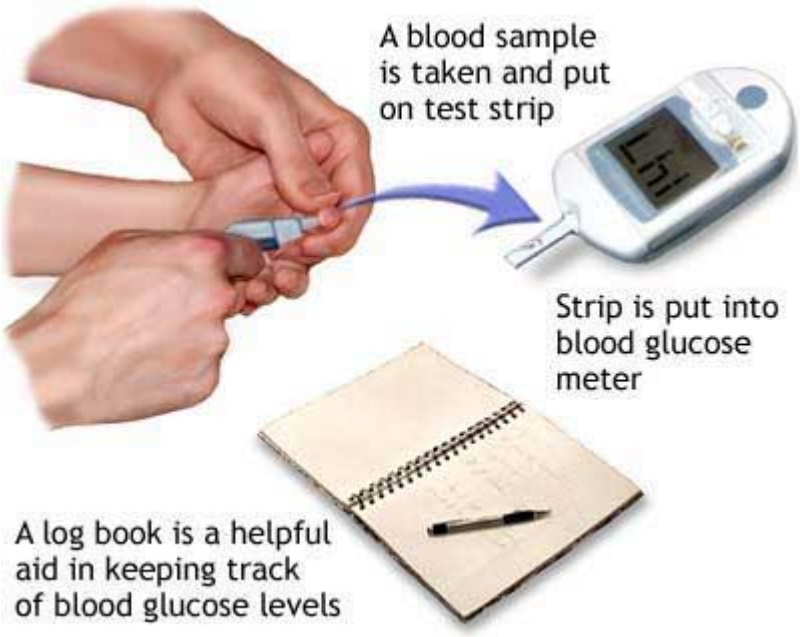
2. To calculate the **total sodium excretion (mmoles)** you use the following formula:

$$\frac{\text{sodium concentration (mmol/L)} \times \text{volume of urine (mL)}}{1000}$$

3. To calculate the **sodium excretion rate (µmol/min)** you use the following formula:

$$\frac{\text{sodium concentration (mmol/L)} \times \text{volume of urine (mL)}}{\text{time (min)}}$$

الموضوع الرابع GTT Glucose Tolerance Test /



طبعا لازم نعرف انه فيه اكثر من اختبار لقياس مستوى الجلوكوز في الدم:

Fasting blood sugar (FBS) measures blood glucose after you have not eaten for at least 8 hours. It often is the first test done to check for diabetes

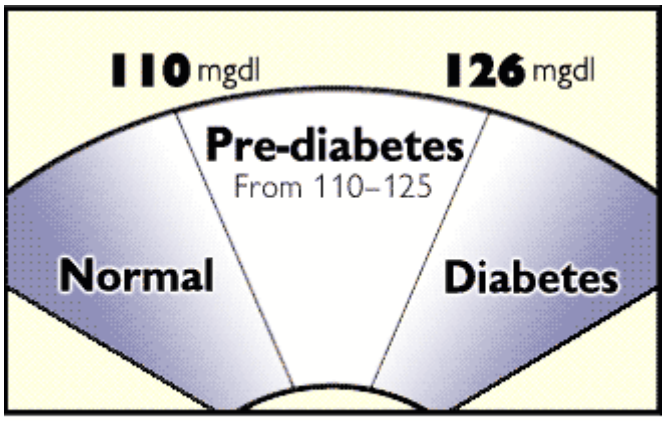
two hour postprandial blood sugar measures blood glucose exactly 2 hours after you eat a meal.

Random blood sugar (RBS) measures blood glucose regardless of when you last ate. Several random measurements may be taken throughout the day. Random testing is useful because glucose levels in healthy people do not vary widely throughout the day. Blood glucose levels that vary widely may indicate a problem. This test is also called a casual blood glucose test.

Oral glucose tolerance test is used to diagnose prediabetes and diabetes. An oral glucose tolerance test is a series of blood glucose measurements taken after you drink a sweet liquid that contains glucose. This test is commonly used to diagnose diabetes that occurs during pregnancy (gestational diabetes). For more information, see the medical test Gestational Diabetes. This test is not commonly used to diagnose diabetes in a person who is not pregnant

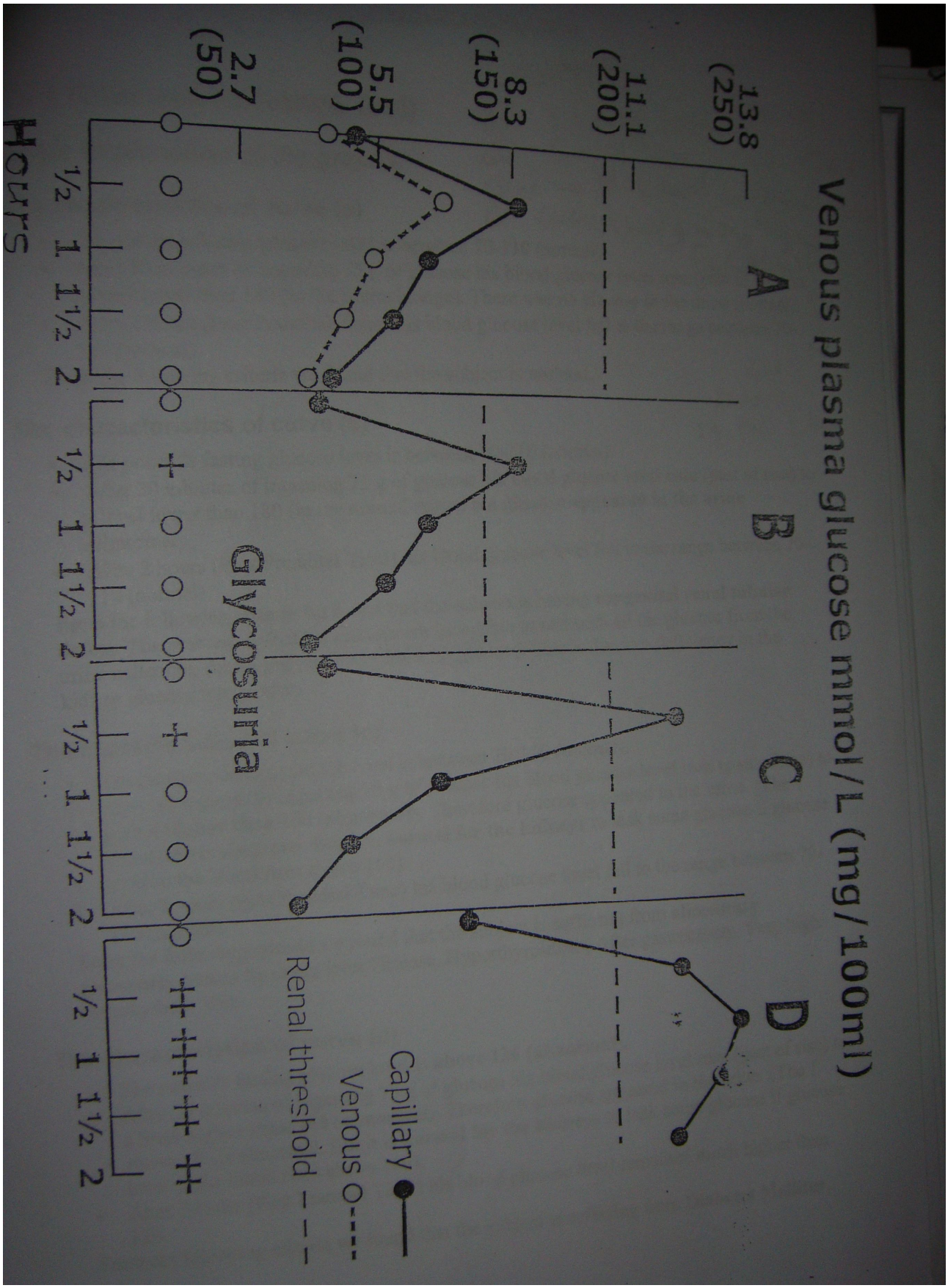
ولازم نعرف الـ Normal Range لكل نوع , والاهم طبعا هو الـ: **Fasting**

Fasting blood glucose



Fasting Plasma Glucose Test

	Fasting blood sugar	PostPrandial Blood Sugar
Normal	70-110 mg/dl 3.9-6 mmol/L	≤ 140 mg/dL ≤ 7.8 mg/dL
Pre-diabetic	111-125 mg/dL 6.2-6.9 mmol/L	141-179 mg/dL 7.8-9.9 mmol/L
Diabetic	≥ 126 mg/dL ≥ 7 mmol/L	≥ 180 mg/dL ≥ 10 mmol/L


Venous plasma glucose mmol/L (mg/100ml)
13.8 (250)
11.1 (200)
8.3 (150)
5.5 (100)
2.7 (50)
A
B
C
D
Capillary
Venous o----
Renal threshold - - -
Glycosuria
Hours
½ 1 1½ 2

لازم نعرف كل الحالات الاربع لان وحدة منها او يمكن اكثر بتجي الاختبار:

The characteristics of curve(a)

The patient's fasting glucose level is• between 70-110 (normal).
After 30 minutes of ingesting 75 g of glucose his• blood glucose level rose (past of rise) to
a level lower than 180 (in the normal range). There was no glucose in the urine (normal).
After 2 hours• (Post Prandital Time) his blood glucose level fell to the range between 70-
110 (normal)
From the following criteria we found that the subject is normal

The characteristics of curve(b)

The• patient's fasting glucose level is between 70-110 (normal).
After 30• minutes of ingesting 75 g of glucose his blood glucose level rose (past of rise) to
a level lower than 180 (in the normal range) but glucose appeared in the urine
(abnormal).
After 2 hours (Post Prandital• Time) his blood glucose level fell to the range between 70-
110 (normal)
From the following criteria we found that the subject is having congenital renal tubular
defect. The problem is that his kidneys are incapable to reabsorb all the glucose from the
urine indicating decreased renal threshold for glucose. This is due to a deficiency in the
kidney glucose transporters.

The characteristics of curve (c)

The patient's fasting glucose level is• between 70-110 (normal). After 30 minutes of ingesting 75 g of glucose his• blood glucose level rose (past of rise) to a level higher than 180 (abnormal). Therefore glucose appeared in the urine. (The ↑ above 180 is abnormal. But it is normal for the kidneys not to leak some glucose if glucose level in the blood rises above 180). After 2 hours (Post Prandial Time) his blood glucose level fell to• the range between 70-110 (normal) From the following criteria we found that the subject is suffering from alimentary glycosuria caused by either liver Disease, Hyperthyroidism, After gatrectomy, Very high

The characteristics of curve (d)

The patient's fasting glucose level is above 126• (abnormal). After 30 minutes of ingesting 75 g of glucose his blood glucose• level rose (past of rise) to a level higher than 180 (abnormal). Therefore glucose appeared in the urine. (The ↑ above 180 is abnormal. But it is normal for the kidneys not to leak some glucose if glucose level in the blood rises above 180). After 2 hours (Post Prandial Time) his blood glucose level• remained much higher than 126. From the following criteria we found that the subject is suffering from Diabetes Mellitus.

طريقة الاختبار من مجهول 426

Spirometry

- جبلنا تعريف

Total lung volume

اعرفوا التعريفات كلها

- فيه اشياء نقدر نقيسها بهذا الجهاز وفيه اشياء لا

residual volume ?!

م نقدر

residual volume -

To prevent lung collapse & facilitate work of breathing

---

obstructive VS restrictive-

متى نقول هذا obstructive ومتى نقولrestrictive

برسمةFEV / FVC

كيف نعرف ؟!

خط ال restrictive يكون تحت دائما مو قادر يوصل ل 6!

خط ال obstructive يقدر يوصل ل 6 الأخير بس فرقه عن الطبيعي FEV1 بأول ثانية قليل جدا بال obstructive

---

MEF 50 ?-

if decrease obstructive

asthma - emphysema

---

restrictive

مو قادر ياخذ نفس فيصيرdecrease FVC & VC

collapse - fibrosis

MEF 50 normal (4-8) L/ sec -

- واحد شربناه موية بيزيد اخراجه للبول بعد 30 دقيقة بس كمية الصوديوم فيه ثابته

واحد شربناه سلين ايزوتنيك زادت كمية البول بعد ساعة لساعتين وزاد الصوديوم المفرز بنسبة ضئيلة (increase ANP) (volume receptor)

وواحد عطيناه lasix هذا شي يسبب اسهال فظيع ويمنع امتصاص الصوديوم والكلوريد والبوتاسيوم فيزيييييييد بشكل مهول افراز البول المحتوي على ماااء و صوديوم بكثرة

متى الانسان سكره طبيعي

70 - 110لو م كان آكل و واقل من 140 لو آكل

متى عندهs كري

160فوق لو م كان كل

طيب فيه مرحلة نسميهاimpaired glucose tolerance

110 - 160

^^^^

هل لو كان مو آكل

طيب لو آكل

140 - 180

طبعا هذه المرحلة يسموها م قبل السكري يعني يكون مهدد نتيجة

pregnancy - obesity - old age - hyperlipedemia

متى يكون عند الشخص سكر

لو م كان آكل وفوق 160 عنده

لو آكل وبعد ساعتين قسناه وفوق 180 عنده

Gestational DM
7
يصير في الحوامل

اقرؤوا المعلومات النظرية بهذا الدرس