Place case sticker here

ISU Student ECG Interpretation Worksheet

Step 1: Get oriented/know what you are looking at

- How many & which leads are recorded? Leads: _____
- What is the paper speed? _____ mm/sec
- What is the calibration? _____ mm/mV

Some Reference numbers:
Small boxes = 0.04s @25 mm/s & 0.02s @50 mm/s
"Standard" cal. = 10 mm/mV; Half-Std. = 5 mm/mV

Step 2: Calculate heart rate

	Average HR (use this method for almost all patients)	**Instantaneous HR** (only use if R-R intervals do NOT vary)
@ 25 mm/sec	1. Mark off 15 LARGE boxes (3 sec), *[or 30 for 6 sec]* 2. Count # of QRS complexes in 3 *[or 6]* sec 3. Multiply by 20 *[or 10]* = beats/minute	1. Count # of SMALL boxes between single R-R interval 2. 1500 / (# small boxes) = beats/minute
@ 50 mm/sec	1. Mark off 30 LARGE boxes (3 seconds) 2. Count # of QRS complexes in 3 seconds 3. Multiply by 20 = beats/minute	1. Count # of SMALL boxes between single R-R interval 2. 3000 / (# small boxes) = beats/minute

HEART RATE: _____ beats/minute (bpm) For this patient, is this **tachycardia, bradycardia,** or a **normal** HR?

Step 3: Rhythm diagnosis

- What are you calling a "P," "QRS," and "T" wave?
- Are the R-R intervals regular or irregular? ☐ Regular ☐ Irregular
- Is sinus rhythm present? (with or without other findings) ☐ Yes, regular sinus ☐ Yes, sinus arrhythmia ☐ No
  - Regular sinus rhythm or sinus arrhythmia?
- Are P waves and QRS complexes related? ☐ 1 P wave precedes each QRS at consistent intervals
  - Is every P followed by QRS? ☐ > 1 P wave precedes each QRS (at least sometimes)
  - Is every QRS preceded by P? ☐ P waves & QRS complexes present, but unrelated
  - Are all P-R intervals consistent?
- Do all P waves look similar to each other? ☐ No identifiable P waves
  - Or are there no consistent, identifiable P waves?
- Do all QRS-T waveforms look similar to each other? ☐ All QRS-T waveforms similar ☐ Some QRS-Ts are different
- Do abnormal (non-sinus) QRS complexes occur: ☐ Early (premature) ☐ Late (escape)
  - Early (before next expected sinus complex)?, or
  - Late (after a longish pause)?
- How many different rhythms are present? ☐ 1 rhythm only ☐ Multiple rhythms

RHYTHM DIAGNOSIS: _____

For this patient, is this rhythm **normal** or **abnormal**? _____
If **abnormal**, list differential diagnoses for/underlying this patient's arrhythmia:

_____ _____

_____ _____

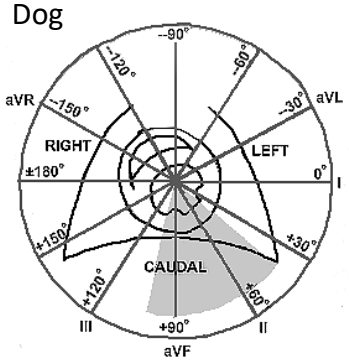
Does this patient require **treatment** for its heart rate/rhythm? ☐ No ☐ Yes
If so, what treatment do you recommend? _____

ECG REFERENCE VALUES	**Dogs**	**Cats**
Heart Rate	60-160 bpm (up to 220 for puppies)	140-240 bpm
MEA	+40 to +100°	0 to +150°
P wave duration	0.04 sec (max) (to 0.05 in giant breeds)	0.035 seconds (max)
P wave height (lead II)	0.4 mV (max)	0.2 mV (max)
PR (Q) interval	0.06 - 0.13 sec (to 0.14 in giant breeds)	0.05 - 0.09 seconds
QRS duration	0.04 - 0.06 sec	0.04 seconds
R wave height (lead II)	2.5 – 3.0 mV (max)	≤0.9 mV; (total QRS excursion <1.2 mV)
ST segment (J point)	Within 0.2 mV from baseline	No change from baseline
QT interval (is HR dependent)	0.15 - 0.28 sec	0.12 - 0.20 sec

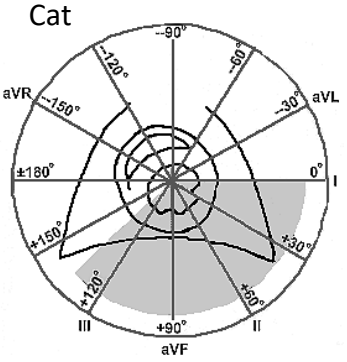
<u>Step 4</u>: Mean Electrical Axis (MEA)

- Need 6-lead ECG (or at least 2 ~perpendicular leads)
- <u>Method #1</u>: find the lead with the TALLEST R Wave (remember - R wave is a POSITIVE deflection from baseline). The MEA is directed toward the positive pole of that lead.
- <u>Method #2</u>: Find the lead with the MOST ISOELECTRIC deflection (smallest deflection from baseline or sum of positive and negative QRS deflections ~0 mV). Then find the lead <u>perpendicular</u> to the isoelectric lead. If the QRS is positive in the perpendicular lead, the MEA is at the positive pole of this lead. If QRS is negative in this lead, the MEA points toward the negative pole of this (perpendicular) lead.

Dog



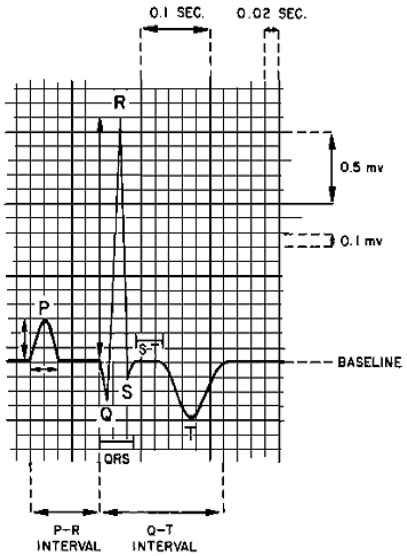
Cat



- Each lead on the diagram to the upper right is labeled at its positive pole. Shaded areas represent normal MEA ranges. (although some normal cats exceed this)

MEAN ELECTRICAL AXIS: _____

For this patient, is this MEA □ **normal** or □ **abnormal**?



<u>Step 5</u>: Measure the complexes (Use calipers! Include **only 1** trace line thickness in meas)

- Lead II required; 10 mm/mV and 50 mm/sec preferred
  - @ 50 mm/sec, 1 small box width = 0.02 seconds
  - @ 10 mm/mV, 1 small box height = 0.1 mV

COMPLEX MEASUREMENTS:

P wave duration: _____ sec P wave height: _____ mV

PR interval: _____ sec

QRS duration: _____ sec R wave height: _____ mV

QT interval: _____ sec ST segment change: _____

For this patient, are these complex measurements □ **normal** or □ **abnormal**?

If **abnormal,** is an **enlargement pattern** or **conduction disturbance** suggested?

_____

Waveform Alteration	Possible Causes
P WAVE:	
Tall P (P pulmonale)	Right atrial enlargement - dogs; left or right atrial enlargement - cats
Wide P (P mitrale)	Left atrial enlargement - dogs & cats
Absent P	Atrial fibrillation (look for "f" waves), hyperkalemia, atrial standstill,
P height variation	Wandering pacemaker (normal finding particularly with sinus arrhythmia)
Abnormal timing/morphology	Supraventricular or junctional premature beats
PR/PQ INTERVAL DURATION*:*	
Shortened	High sympathetic tone
Prolonged	1st degree AV block (high vagal tone, drug effect, or disease)
QRS COMPLEX:	(in cat, total QRS excursion is usually less than 1.2 mV I Lead II (Q+R+S))
Tall R wave	Left ventricular enlargement; hyperthyroidism (cat)
Wide QRS	Ventricular enlargement; intraventricular conduction disturbance (bundle branch block)
Small QRS	Normal variation, pericardial or pleural space disease, hypothyroidism, obesity
Negative QRS in lead II	Mean electrical axis deviation (right ventricular enlargement, right bundle branch block)
ST SEGMENT CHANGES:	
Elevation	Myocardial hypoxia/ischemia (RV), epicardial injury/pericarditis, digoxin toxicity, transmural myoc. Infarct.
Depression	Myocardial hypoxia, digoxin toxicity, subendocardial LV myocardial ischemia/infarction
QT SEGMENT DURATION:	
Prolongation	HYPO (kalemia, calcemia, thermia); bradycardia, quinidine toxicity, other drug (or disease) effect
Shortening	HYPER (kalemia, calcemia); tachycardia, digoxin toxicity
T WAVE:	
Large	Normal, myocardial hypoxia, hyperkalemia, ventricular enlargement/conduction disturbance
Tented	Hyperkalemia (T wave may be large or small)