Doppler Effect and Working With Redshifts

Name_____

Purpose:
- To provide you with necessary skills to understand how to calculate redshifts and apply the Doppler Effect

Estimated Completion Time: 45 minutes

Resources needed:
- Calculator (preferably scientific)
- Textbook
- Web access is highly desirable

Questions

1. Complete the following table (5 marks):

Galaxy	Spectral Line Observed	Rest λ (nm)	Observed λ (nm)	z	Approaching or receding?	Velocity (km/s)
1	Hα	656.3	670	0.02	R	6262
2	H (calcium)	396.9	380	-0.043	A	-12774
3	K (calcium)	393.4	410	0.04	R	12 392
4	Hβ	486.1	600	0.23	R	62 238
5	Hγ	434.1	800	0.84	R	163 520

2. For which galaxies in question 1 was it necessary to use the relativistic correction? See http://www.kcvs.ca/martin/astro/kingsu/unit5/141/z_rel.html. (2 marks)

Only for # 4, 5

3. The H line of calcium is a commonly used spectral line in galaxies. Suppose you measure the spectrum of a galaxy and find that λ = 450 for the H line. Is this galaxy moving toward you or away from you and at what speed? (3 marks)

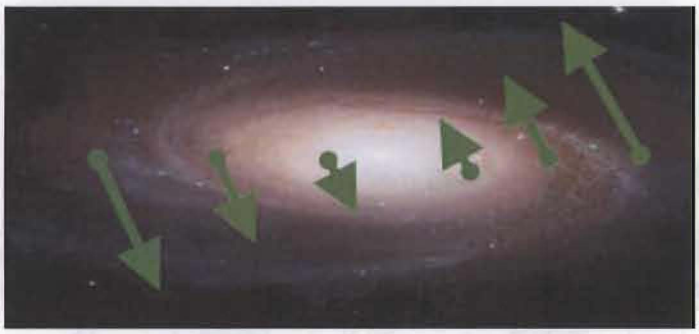
$$\frac{\Delta\lambda}{\lambda} = \frac{450 - 396.9}{396.9} = z = 0.133$$

Since $z > 0.1$ use the relativistic formula

$$v/c = \frac{(z+1)^2 - 1}{(z+1)^2 + 1} = 0.125$$

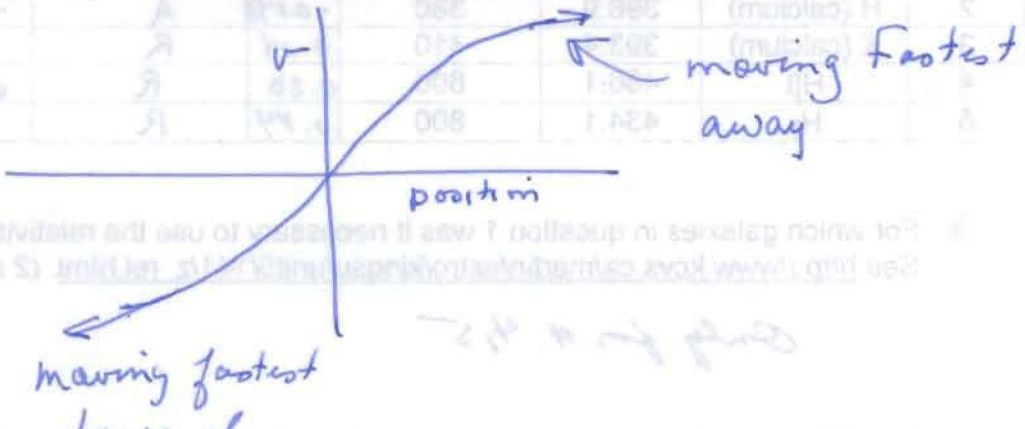
$$\therefore v = 37\,472 \text{ km/s}$$

4. The following figure shows arrows that represent the rotational velocity of a spiral galaxy measured at various locations across the galaxy. Sketch what the rotational velocity graph for this galaxy would look like and explain why it is shaped the way it is. Note the direction and length of the arrows. Also – your answer will just be qualitative – you are not expected to provide actual numbers on your graph. You may wish to consult the on line lectures http://www.kcvs.ca/martin/astro/kingsu/unit5/132/chp13_2.html (4 marks)



This edge is rotating toward you ∴ blue shifted or negative velocity

Rotate away ∴ redshifted or positive velocity



Other useful links:
http://www.kcvs.ca/martin/astro/kingsu/unit2/63/chp6_3.html
http://www.kcvs.ca/martin/astro/kingsu/unit5/132/chp13_2.html