Problem 1:

hmc = $\{ 1/6 \Sigma c_i^{-1} \}^{-1}$ = 1503.3 m/s

Traveltime measured by echosounder is tt = 2s/c = 6000m / 1490m/s = 4.027s
Actual depth from transducer to bottom then is s=tt*hmc/2=3027m,
From sea surface to bottom then total water depth is **3034m**.

c_1=1490m/s
c_2=1500m/s
c_3=1500m/s
c_4=1510m/s
c_5=1510m/s
c_6=1510m/s

Problem 2:

Assume a steep/deep ray can go down 4000m, so d=4000m.

Thus need to find the segment of the circle such that d is 4000m.

$\sin(\theta) = \cos(90° - \theta) = (R-d)/R$　　(1)

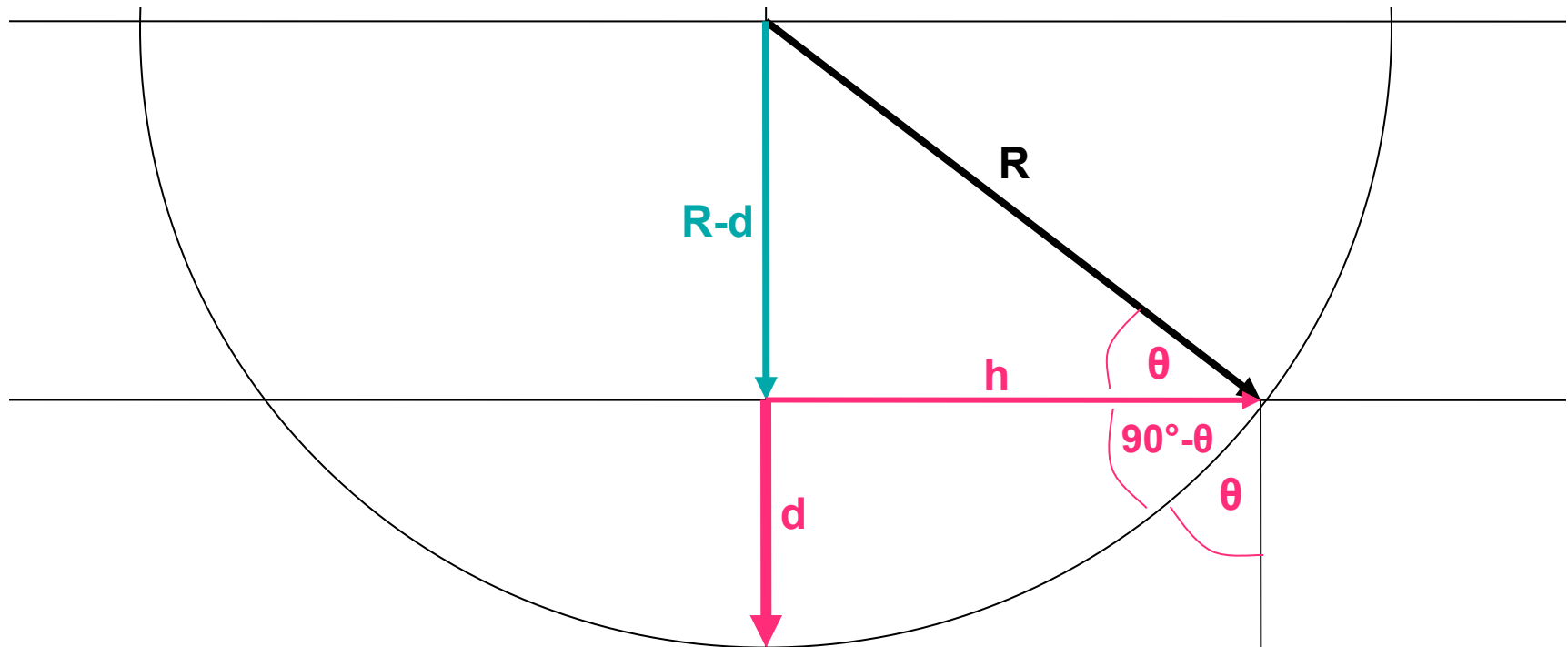$R = A/\sin(\theta)$　　where $A = -c_0/m \approx 93750m$

From (1): $\sin(\theta) = \sin(\theta)/A * (A/\sin(\theta) - d) = 1 - d/A \sin(\theta) \approx 1 - 0.04\sin(\theta)$

$1.04 \sin(\theta) = 1$　or　$\sin(\theta) = 1/1.04$　→　$\theta \approx 74°$

→ $h = R\cos(\theta) = A/\tan(\theta) = 26.8km$

→ lower loop length = 2h = **53.6km**

Problem 3:

SNR = SL – 20 log(r) – α(f)*r – [NL* + 10log(BW)] =

   = 192 – 120   - 0.006db/km*1000km - [67 + 19] =

   =   -20 db

Problem 4:

E(z) = E(0m) e $^{-Kz}$ where K is the diffuse attenuation coefficient from slide 23.

At 450nm water is blue, at 570nm green, since weakest absorption there in each case.

	0.03mg/m^3	9.3mg/m^3
450nm	K≈0.022m^{-1} 10m→ 80% 100m→ 11%	K≈0.5m^{-1} 10m→ 0.6% 100m→ 0%
570nm	K≈0.08m^{-1} 10m→ 45% 100m→ 0.03%	K≈0.22m^{-1} 10m→ 11% 100m→ 0%

Problem 5:

Correct conversion is
$1Wm^{-2} = 4.15 \times 10^{-6}$ E $s^{-1}m^{-2}$

The conversion given in class was for light quanta, not for Einsteins.

With that, most of you got crazy values like 10^{20} g C per day per square meter, which cannot be.

It helps to question your own results, always see if what you get (anywhere in research) makes sense !!!

Wavelength nm	Sargasso Sea	Baltic
400	0.6	0
450	1.0	0.006
500	0.8	0.054
550	0.43	0.17
600	0.07	0.032
650	0.01	0.007
700	0.0023	0
PAR	130Wm	13Wm^{-2}
E $s^{-1}m^{-2}$	5.4×10^{-4}	5.4×10^{-5}
mol day$^{-1}m^2$	4.6	0.46
gram C	73.6day$^{-1}m^{-2}$	7.4day$^{-1}m^{-2}$