

STEM Society Meeting, September 10, 2013

James Emery

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1 About the STEM Society and the STEM Society Website

STEM is an abbreviation for Science, Technology, Engineering and Mathematics. The acronym STEM is commonly associated with K-12 education, but our use of the term is only slightly bound to this meaning. There are over one hundred people on the mailing list, although a much smaller group attends any one meeting. We meet on the second Tuesday of each month at

the Trailside Center at 99th and Holmes in Kansas City, Missouri. The meetings are open to all. The start time is 6PM. We make presentations, have discussions, and have demonstration experiments. These relate to Science, the History of Science, Mathematics, Engineering, Philosophy and Technology at all levels. The topics have ranged from a technical discussion of the mathematics of General Relativity to scientific experiments for young students.

The set of meeting notes may be viewed by going down the list of notes appearing on the front page of the site. These notes contains links to documents, which may be viewed or downloaded by clicking the link. Other documents can be reached by clicking the heading "Documents and Downloads" that appears on the left side of the front page. Then click on "documents." The meeting notes may also be viewed in an archive file in the list of documents. Most of the documents are PDF files. They may be viewed or downloaded to the computer by clicking, provided Adobe Reader is present, or another program capable of reading PDF files. There are usually more documents available at the site than are listed under "Documents" because they are not in the documents.htm file.

The web site is:

<http://www.stem2.org/>

Direct to the documents list:

<http://www.stem2.org/je/documents.htm>

Direct to the archive file:

<http://www.stem2.org/je/archive.pdf>

Last Months Notes:

<http://www.stem2.org/je/stemsoc070913.pdf>

2 The September Meeting Announcement

The September meeting of the STEM Society will take place on the second Tuesday of the month, September 10, 2013, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

A List of Possible Topics:

There are several topics left over from last months meeting.

(1) Jim Emery, The Quantum Mechanics of Semiconductors. Because this topic has been on the agenda for the last few meetings without being treated. I would like to present very briefly at the beginning of the meeting an outline of this subject.

(2) Chris Sanderson wishes to speak about genetics and intelligence tests, which he says are taboo subjects in the United States, but freely talked about in other contries such as China. He also believes there is some connection between this and Immanuel Kant's book **The Critique of Pure Reason**. I can't imagine what the connection is, so I look forward to his talk. Because this and other topics for this meeting may be controversial, the audience is reminded that any tomatoes thrown need to be cleaned up before we leave the Trailside Center.

(3) Kent Smith has been doing research on skunks, and wishes to have a discussion about the biology and behavior of these animals.

(4) Steve Cummins wants to speak about his malfunctioning Peltier Cooling device and also about a similar misbehaving Power Supply.

(5) Rich Kaufman will talk about "Natural Gas Fracking" and perhaps about a communiiversity class he is teaching.

(6) Bob Kessler may wish to give some book reports.

(7) As always, we expect there may be impromptu topics, projects, shows-and-tells, new theorems, experiments, book reports, problems and solutions in mathematics, physics, engineering, biology, scientific biographies, et cetera.

Perhaps we should try to put a time limit on the length of these talks. Also since our meetings sometimes go on too long, no one will be offended if you choose to leave early.

We might take guidance from the Ig Nobel Prize Science awards presented annually at either Harvard or MIT, and which are broadcast on Science Friday. If a talk goes on too long, a small girl's voice, announces: "Please

Stop, I'm Bored, Please Stop, I'm Bored ..."
The STEM Society Website:

<http://www.stem2.org/>

3 Jim Emery: Quantum Mechanics of Semiconductors

This topic relates to our previous document on Transistors and Diodes:

<http://www.stem2.org/je/diodetran.pdf>

We are trying to treat the background of the theory of energy bands in semiconductors. This is of course a large subject in the branch of physics called **Solid State Physics**, which is now more commonly called **Condensed Matter Physics**. As a start we are looking at solutions of Schrödinger's equation for quantum potential wells. There is a simple one dimensional theory of energy bands that uses a step potential called the Kronig-Penney Model for the Crystal Lattice Potential. We would like to create some computer programs to solve Schrödinger's equation for the wave functions and the corresponding energy levels and indicate how closely spaced levels can be represented as energy bands with band gaps.

The following document is a very rough partial start on this project (obviously requiring editing, corrections, and additions).

<http://www.stem2.org/je/quantumsc.pdf>

4 Cris Sanderson: Genetics and Intelligence Tests

Editorial Note. Immanuel Kant actually played a role in the history of astronomy. He was one of the first to put forth the theory that our galaxy, the Milky Way, has the shape of a thin disk.

Cris Sanderson: Notes and reference information.

There are two basic references.

The reference that wasn't there is Zhao Bowen. He is the kid if cherubic face who dropped out of the most prestigious high school in China to work at BGI.

The other reference is Steven Hsu. He is at the physics department at Michigan State. His blog pegs him as a person of too many interests. Track, MMA, thus not just academic topics. Hsu wrote most of the slides I use. It was an accidental meeting of Bowen and Hsu at BGI, when Hsu was on sabbatical, that kicked off this story. There is a piece in WSJ much like the one in Wired, but with a business bent.

Chris

5 Greg Hodes: Notes on the Intelligence Presentation

Jim,

I've attached some standard references and some graphs, etc., that I thought might interest you. There is a free battery of complex choice reaction time tests at:

cognitivelabs.com (click on the "Einstein" icon.)

(The site is not well managed, and some of the tests have been removed; the most G loaded is "Odd Man Out.")

The weighted sum of a number of tests correlates about .70 with standard IQ tests. Notice that the cognitive tasks in themselves are quite simple and require essentially no prior learning. The G loading arises from speed (reaction time in micro seconds) and efficiency (the S.D. of response times). Such measures of G are of considerable research value because they are directly related to brain functions and have an absolute zero point.

There is a battery of such tests which yields an IQ (mean = 100, S.D. = 20, rather than 16, as for most tests)online at:

<Mybraintrainer>

However, there is a fee. You can try logging in using my U.N. and P.W. (xxxxxx; xxxxxx), but the program may be tied to my computer. Feel free to try it out -- the program won't know the difference, and it will improve by record. These test have a very long and steep learning curve, so the first 10-15 scores are underestimates. Even then, scores don't really level out until 50 or more trials.

Hope this is useful.

Greg

816-361-9968

From: jim emery <jdemery1@yahoo.com>
To: greg hodes <ghodes@juno.com>
Subject: Any References?
Date: Wed, 11 Sep 2013 11:49:09 -0700 (PDT)

Jim,

I suspect one of the tables I attached got garbled. I've cut and pasted a readable version it below.

Greg

New GRE to IQ Theoretical Estimator

<<1610 = GRE >>; <<159.67 =I Q (SD = 15)<<163.65 =IQ,(SD =16)>>
<< 99.997 = %ile. (Applicants for Grad. School)>>

1600	158.88	162.80	99.996	1000	111.06	111.80	76.959
1590	158.08	161.95	99.995	990	110.27	110.95	75.313
1580	157.28	161.10	99.993	980	109.47	110.10	73.606
1570	156.48	160.25	99.992	970	108.67	109.25	71.841
1560	155.69	159.40	99.990	960	107.88	108.40	70.021
1550	154.89	158.55	99.987	950	107.08	107.55	68.149
1540	154.09	157.70	99.984	940	106.28	106.70	66.230
1530	153.30	156.85	99.981	930	105.48	105.85	64.268
1520	152.50	156.00	99.977	920	104.69	105.00	62.267
1510	151.70	155.15	99.972	910	103.89	104.15	60.233
1500	150.91	154.30	99.966	900	103.09	103.30	58.170
1490	150.11	153.45	99.958	890	102.30	102.45	56.085
1480	149.31	152.60	99.949	880	101.50	101.60	53.983

GRE
V+Q

IQ
15 SD

IQ
16 SD

%ile

GRE
V+Q

IQ
15 SD

IQ
16 SD

%ile							
1470	148.52	151.75	99.939	870	100.70	100.75	51.869
1460	147.72	150.90	99.927	860	99.91	99.90	49.751
1450	146.92	150.05	99.912	850	99.11	99.05	47.633
1440	146.13	149.20	99.895	840	98.31	98.20	45.521
1430	145.33	148.35	99.874	830	97.52	97.35	43.423
1420	144.53	147.50	99.850	820	96.72	96.50	41.342
1410	143.73	146.65	99.823	810	95.92	95.65	39.286
1400	142.94	145.80	99.790	800	95.13	94.80	37.259
1390	142.14	144.95	99.752	790	94.33	93.95	35.267
1380	141.34	144.10	99.708	780	93.53	93.10	33.314
1370	140.55	143.25	99.657	770	92.73	92.25	31.406
1360	139.75	142.40	99.598	760	91.94	91.40	29.546
1350	138.95	141.55	99.530	750	91.14	90.55	27.739
1340	138.16	140.70	99.452	740	90.34	89.70	25.987
1330	137.36	139.85	99.362	730	89.55	88.85	24.294

GRE
V+Q

IQ
15 SD

IQ
16 SD

%ile

GRE
V+Q

IQ
15 SD

IQ
16 SD

%ile							
1320	136.56	139.00	99.261	720	88.75	88.00	22.663
1310	135.77	138.15	99.145	710	87.95	87.15	21.095
1300	134.97	137.30	99.013	700	87.16	86.30	19.593
1290	134.17	136.45	98.864	690	86.36	85.45	18.158
1280	133.38	135.60	98.696	680	85.56	84.60	16.790
1270	132.58	134.75	98.507	670	84.77	83.75	15.490
1260	131.78	133.90	98.294	660	83.97	82.90	14.259
1250	130.98	133.05	98.057	650	83.17	82.05	13.096
1240	130.19	132.20	97.792	640	82.38	81.20	12.000
1230	129.39	131.35	97.497	630	81.58	80.35	10.970
1220	128.59	130.50	97.169	620	80.78	79.50	10.005
1210	127.80	129.65	96.807	610	79.98	78.65	9.104
1200	127.00	128.80	96.407	600	79.19	77.80	8.264
1190	126.20	127.95	95.967	590	78.39	76.95	7.485

1180	125.41	127.10	95.484	580	77.59	76.10	6.762
GRE							
V+Q							
IQ							
15 SD							
IQ							
16 SD							
%ile							
GRE							
V+Q							
IQ							
15 SD							
IQ							
16 SD							
%ile							
1170	124.61	126.25	94.956	570	76.80	75.25	6.095
1160	123.81	125.40	94.380	560	76.00	74.40	5.480
1150	123.02	124.55	93.753	550	75.20	73.55	4.915
1140	122.22	123.70	93.073	540	74.41	72.70	4.398
1130	121.42	122.85	92.337	530	73.61	71.85	3.926
1120	120.63	122.00	91.543	520	72.81	71.00	3.495
1110	119.83	121.15	90.690	510	72.02	70.15	3.105
1100	119.03	120.30	89.773	500	71.22	69.30	2.751
1090	118.23	119.45	88.794	490	70.42	68.45	2.431
1080	117.44	118.60	87.748	480	69.63	67.60	2.143
1070	116.64	117.75	86.637	470	68.83	66.75	1.885
1060	115.84	116.90	85.457	460	68.03	65.90	1.653
1050	115.05	116.05	84.210	450	67.23	65.05	1.447
1040	114.25	115.20	82.894	440	66.44	64.20	1.263
1030	113.45	114.35	81.511	430	65.64	63.35	1.099
1020	112.66	113.50	80.060	420	64.84	62.50	0.955

Please note that the decimal places give the impression that the numbers are more precise than they really are.

Mean of college graduates: p. 178,
 Wechsler's Measurement and appraisal of adult intelligence by J.D. Matarazzo.
 Baltimore: Williams and Wilkins, 1972

6 Rich Kaufman: Natural Gas Fracking

Rich at one time worked for the Phillips Petroleum Company at the Refinery in Kansas City, Kansas. Also Rich attended Cornell University, and is

concerned about the possible destruction of the beautiful region of upstate New York, the Finger Lakes and surrounding areas.

Rich gave an interesting discussion on the technology of oil drilling, the modern methods of drilling horizontally with special bits, the pipes and casings and such. He also described the technology of fracking where rock is fractured by intense water pressure. And about the escape of natural gas into the local water tables.

7 Cecile Lagrande: Investigation of An Allergic Reaction

Her mother in Paris was suffering a strange rash with unknown cause. She had obtained a rare plant recently. Cecile suspected that the rash was caused by an allergic reaction and looked up information on the plant.

8 Jim Emery: A Reference to a Book Relating to Intelligence Testing

By the way the mathematician and physicist who wrote the book I mentioned at the meeting, which is called **The Tyranny of Testing**, was Banesh Hoffman, a famous colleague of Albert Einstein.