Assessing Learning:
June 2005 Regents Exams

New Jersey Science Convention
October 2005

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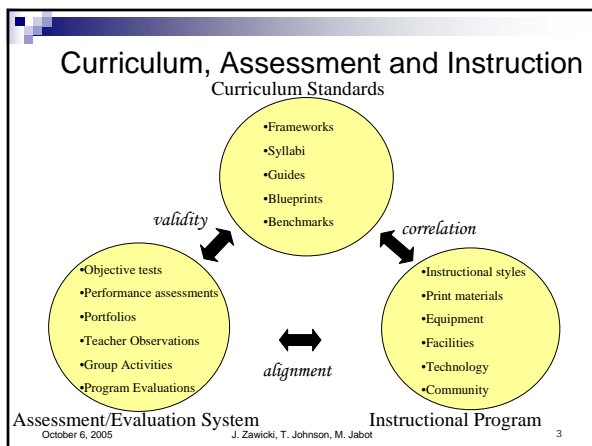**T. Johnson**
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Assessment Purposes

- Measure knowledge
- Measure gain in knowledge
- Measure preparation (predict success)
- Sorting (Grading)
- Degree requirements (benchmarks)
- …

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Curriculum, Assessment and Instruction

Curriculum Standards

- Frameworks
- Syllabi
- Guides
- Blueprints
- Benchmarks

validity

correlation

- Objective tests
- Performance assessments
- Portfolios
- Teacher Observations
- Group Activities
- Program Evaluations

- Instructional styles
- Print materials
- Equipment
- Facilities
- Technology
- Community

alignment

Assessment/Evaluation System

Instructional Program

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A Rich History

- First administered November 1865
- Science topics included (1879):

Physical geography

Physiology and hygiene

Zoology

Astronomy

Chemistry

Botany

Geology

NYSED

Science Assessments

- **Elementary Science**

  Elementary Science Program Evaluation Test (ESPET)   Administered at Grade 4

- **Intermediate Science**

  Intermediate Level Science Administered at Grade 8

- **Commencement Level**

  Regents Science Exams

  Living Environment

  Physical Setting/Earth Science

  Physical Setting/Chemistry

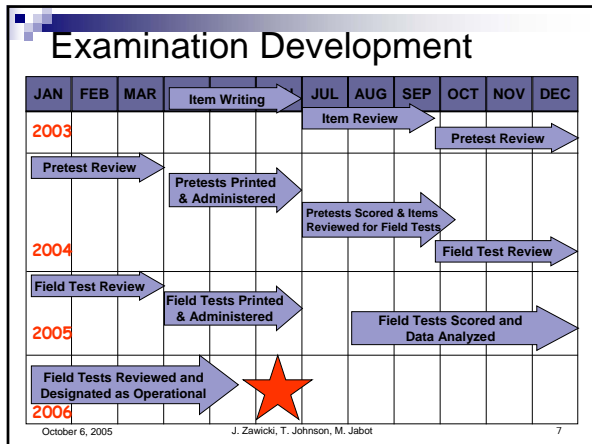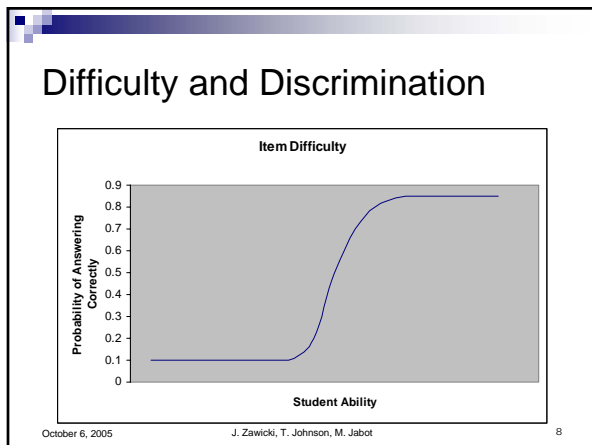 Physical Setting/Physics

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NYSED

Test Construction

- New York State teachers and content consultants, in coordination with Office of State Assessment and Curriculum and Instruction, determine test specifications

- A "test blueprint" determines the percentage of questions weighted for each standard and key ideas

Examination Development

	JAN	FEB	MAR				JUL	AUG	SEP	OCT	NOV	DEC
				Item Writing			Item Review					
2003										Pretest Review		
	Pretest Review			Pretests Printed & Administered			Pretests Scored & Items Reviewed for Field Tests					
2004										Field Test Review		
	Field Test Review			Field Tests Printed & Administered				Field Tests Scored and Data Analyzed				
2005												
	Field Tests Reviewed and Designated as Operational			★								
2006												

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Difficulty and Discrimination

Item Difficulty

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Regents Examinations Scoring

- Test administration for each test form is "equated" so that the same "scale score", represents the same level of achievement

- Test forms vary somewhat in the mix of easier and more difficult items, resulting in the relationship between the raw score and the scale score also varying from each test administration

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Concepts (Continued)

- Difficulty – (Percentage or proportion that are successful on an item)
  - Facility
  - Difficulty
- Discrimination – (How well does the item differentiate between students who understand the subject and those who do not?)

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Concepts (Continued)

- Reliability – can the results be replicated?
  - Inter-rater (Do two or more raters agree on the score for an item?)
  - Test/Re-test (Will a student earn similar scores on different administrations?)
  - Internal Consistency
- Criterion referenced tests – have the students met the "standard"

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Data – Physics

NYS Physics Regents Data, 2005 (n=1505)

Item	AK	Difficulty	1	2	3	4	No Response	2	1	0
34-MC	1	0.92	1385	35	54	30	1			
46-MC	1	0.84	1260	124	67	51	3			
11-MC	2	0.83	73	1255	142	33	2			
21-MC	3	0.81	158	58	1219	69	1			
17-MC	4	0.79	112	34	160	1196	3			

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Data – Physics

NYS Physics Regents Data, 2005 (n=1505)

Item	AK	Difficulty	1	2	3	4	No Response	2	1	0
48-CR	1	0.97					0		1464	41
49-CR	1	0.97					0		1455	50
50-CR	1	0.91					0		1371	134
68-CR	1	0.88					0		1330	175
54-CR	1	0.88					0		1319	186

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Assessment Analysis Sheet

Q #	Core Key Ideas and Labs	Student Difficulties? (content, literacy, interpretation, misconception, effort, other)	Test Difficulties? (Difficulty level, placement on exam, visual distraction, question style, flawed item, other)	Instruction Difficulties? (Didn't teach, taught wrong, other)

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Student Difficulty?

- Content Knowledge?
- Literacy / Reading Comprehension?
- Question interpretation Skills?
- Misconception?
  - From previous instruction?
  - From culture contexts?
  - Insufficient reinforcement?
- Effort?

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Test Difficulty?

- Difficulty (Facility) Level?
- Discrimination?
- Placement on exam?
- Visual distraction by nearby (graphic) items?
- Style of Question?
- Flawed item?

Instructional Difficulty?

- You didn't teach the associated core major understandings.
- You didn't reinforce the core understandings enough.
- You taught the core content wrong.

Test Data – Discussion and Analysis

- Collecting Data
- Analysis
  - □ Difficulty
  - □ Response Pattern

46 A 1.0×10^3-kilogram car travels at a constant speed of 20. meters per second around a horizontal circular track. Which diagram correctly represents the direction of the car's velocity (v) and the direction of the centripetal force (F_c) acting on the car at one particular moment?

(1) (2) (3) (4)

Item	AK	Difficulty	1	2	3	4	No Response
46-MC	1	0.84	1260	124	67	51	3

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5 A golf ball is hit at an angle of 45° above the horizontal. What is the acceleration of the golf ball at the highest point in its trajectory? [Neglect friction.]

(1) 9.8 m/s² upward
(2) 9.8 m/s² downward
(3) 6.9 m/s² horizontal
(4) 0.0 m/s²

Item	AK	Difficulty	1	2	3	4	No Response
05-MC	2	0.39	192	581	114	616	2

In a physics lab, a student used the circuit shown to measure the current through and the potential drop across a resistor of unknown resistance, R. The instructor told the student to use the switch to operate the circuit only long enough to take each reading. The student's measurements are recorded in the data table.

Data Table

Current (A)	Potential Drop (V)
0.80	21.4
1.20	35.8
1.90	56.0
2.30	72.4
3.20	98.4

Directions (48–50): Using the information in the data table, construct a graph on the grid *in your answer booklet,* following the directions below.

48 Mark an appropriate scale on the axis labeled "Potential Drop (V)." [1]

49 Plot the data points for potential drop versus current. [1]

50 Draw the line or curve of best fit. [1]

Item	AK	Difficulty	No Response	1	0
48-CR	1	0.97	0	1464	41
49-CR	1	0.97	0	1455	50
50-CR	1	0.91	0	1371	134

Slide 22

Base your answers to questions 62 through 64 on the information and diagram below.

A 250.-kilogram car is initially at rest at point A on a roller coaster track. The car carries a 75-kilogram passenger and is 20. meters above the ground at point A. [Neglect friction.]

62 Calculate the total gravitational potential energy, relative to the ground, of the car and the passenger at point A. [Show all work, including the equation and substitution with units.] [2]

63 Calculate the speed of the car and passenger at point B. [Show all work, including the equation and substitution with units.] [2]

64 Compare the total mechanical energy of the car and passenger at points A, B, and C. [1]

Item	AK	Difficulty	No Response	1	0
64-CR	1	0.32	0	478	1027

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Slide 23

11 Which factor contributed most to the extinction of many species?
  (1) changes in the environment
  (2) lethal mutations
  (3) inability to evolve into simple organisms
  (4) changes in migration patterns

	Difficulty	1	2	3	4	No Response	"n"
11-MC	0.89	0.89	0.04	0.04	0.03	12	7534

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Slide 24

Base your answers to questions 69 through 72 on the information and diagram below and on your knowledge of biology.

The four wells represented in the diagram were each injected with fragments that were prepared from DNA samples using identical techniques.

72 Identify the substance that was used to treat the DNA to produce the fragments that were put into the wells. [1]

	Difficulty	No Response	0	1	3	4	"n"
72-CR	0.00	0	0.85	0.15	0.00	0.00	7534

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35 The data table below shows elements *Xx*, *Yy*, and *Zz* from the same group on the Periodic Table.

Element	Atomic Mass (atomic mass unit)	Atomic Radius (pm)
Xx	69.7	141
Yy	114.8	?
Zz	204.4	171

What is the most likely atomic radius of element *Yy*?

(1) 103 pm   (3) 166 pm
(2) 127 pm   (4) 185 pm

	Difficulty	1	2	3	4	No Response	"n"
35-MC	0.96	0.01	0.02	0.96	0.00	3	3867

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20 Systems in nature tend to undergo changes toward

(1) lower energy and lower entropy
(2) lower energy and higher entropy
(3) higher energy and lower entropy
(4) higher energy and higher entropy

|	Difficulty	1	2	3	4	No Response	"n"
20-MC	0.32	0.15	0.00	0.25	0.29	5	3867

Base your answers to questions 66 through 70 on the information below.

A substance is a solid at 15°C. A student heated a sample of the solid substance and recorded the temperature at one-minute intervals in the data table below.

Time (min)	0	1	2	3	4	5	6	7	8	9	10	11	12
Temperature (°C)	15	32	46	53	53	53	53	53	53	53	53	60	65

66 On the grid *in your answer booklet*, mark an appropriate scale on the axis labeled "Temperature (°C)." An appropriate scale is one that allows a trend to be seen. [1]

67 Plot the data from the data table. Circle and connect the points. [1]
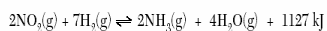
Example: ⊙—⊙

68 Based on the data table, what is the melting point of this substance? [1]

	Difficulty	No Response	0	1	"n"
67-CR	0.00	0	0.01	0.99	3867

Base your answers to questions 57 and 58 on the information below.

Given the reaction at equilibrium:

$$2NO_2(g) + 7H_2(g) \rightleftharpoons 2NH_3(g) + 4H_2O(g) + 1127 \text{ kJ}$$

57 On the diagram *in your answer booklet,* complete the potential energy diagram for the forward reaction. Be sure your drawing shows the activation energy and the potential energy of the products. [2]
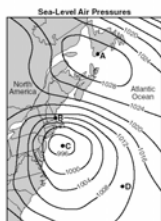
	Difficulty	No Response	0	1	2	"n"
57-CR	0.00	0	0.21	0.31	0.48	3867

Base your answers to questions 36 through 38 on the map below, which shows sea-level air pressure, in millibars, for a portion of the eastern coast of North America. Points A, B, C, and D are sea-level locations on Earth's surface.

Sea-Level Air Pressures

38 The air pressure recorded at point D was most likely
(1) 1014 mb   (3) 1010 mb
(2) 1012 mb   (4) 1006 mb

	Difficulty	1	2	3	4	No Response	"n"
38-MC	0.88	0.01	0.08	0.00	0.02	23	7843

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10 The diagram below shows the noontime shadows cast by a student and a tree.

If the time is solar noon and the student is located in New York State, in what direction is the student facing?
(1) north   (3) east
(2) south   (4) west

	Difficulty	1	2	3	4	No Response	"n"
10-MC	0.30	0.00	0.13	0.19	0.38	5	7843

Slide 1:

Directions (66–83): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the Earth Science Reference Tables.

Base your answers to questions 66 and 67 on the data table below, which lists the apparent diameter of the Sun, measured in minutes and seconds of a degree, as it appears to an observer in New York State. (Apparent diameter is how large an object appears to an observer.)

Apparent Diameter of the Sun During the Year

Date	Apparent Diameter (' = minutes " = seconds)
January 1	32'32"
February 10	32'25"
March 20	32'07"
April 20	31'50"
May 30	31'33"
June 30	31'28"
August 10	31'34"
September 20	31'51"
November 10	32'18"
December 30	32'32"

66 On the grid provided in *your answer booklet*, graph the data shown on the table by marking with a dot the apparent diameter of the Sun for *each* date listed and connecting the dots with a smooth, curved line. [2]

	Difficulty	No Response	0	1	2	"n"
66-CR	0.00	0	0.03	0.07	0.90	7843

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Slide 2:

Base your answers to questions 76 through 79 on the diagram provided in your answer booklet, which shows observations made by a sailor who left his ship and landed on a small deserted island on June 21. The diagram represents the apparent path of the Sun and the position of *Polaris*, as observed by the sailor on this island.

76 On the diagram provided in *your answer booklet*, draw an arrow on the June 21 path of the Sun to show the Sun's direction of apparent movement from sunrise to sunset. [1]

77 The sailor was still on the island on September 23. On the diagram provided in *your answer booklet*, draw the Sun's apparent path for September 23, as it would have appeared to the sailor. Be sure your September 23 path indicates the correct altitude of the noon Sun and begins and ends at the correct points on the horizon. [2]

Sailor's Observations on the Deserted Island

	Difficulty	No Response	0	1	2	"n"
77-CR	0.32	0	0.74	0.20	0.06	7843

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Slide 3:

In Conclusion

- Summary of findings
- Future directions
- Next steps…

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