Integrated Physics and Chemistry 1A Study Guide
Examination for Acceleration (EA)/Credit by Exam (CBE)

The exam you are interested in taking is designed to test your proficiency in the relevant subject matter. You should be thoroughly familiar with the subject matter before you attempt to take the exam. This EA/CBE Study Guide can help you prepare for the exam by giving you an idea of what you need to review. You can check your familiarity level by reviewing the Texas Essential Knowledge and Skills (TEKS) for this course (see below). To refine your skills, you can refer to any of the state-adopted textbooks.

Texas Essential Knowledge and Skills (TEKS)

Every question that appears on this exam is derived from the knowledge and skills statements and student expectations within the Texas-mandated standards, the Texas Essential Knowledge and Skills (TEKS). You can view the TEKS for this exam online via the following link: http://ritter.tea.state.tx.us/rules/tac/chapter112/ch112c.html#112.38. Refer to section (c), Knowledge and skills, 1A–7F.

Throughout this guide, you'll see TEKS references. These refer to the numbers listed under (c) Knowledge and skills; for example, 1A or 3B. **Note:** Coverage of the TEKS is split between Integrated Physics and Chemistry 1A and 1B; so those TEKS not covered in this exam are covered in the Integrated Physics and Chemistry 1B EA/CBE.

Materials Needed

You will need to bring a #2 pencil to complete the exam. You are also allowed to bring and use a graphing calculator. You will receive a computer-graded answer sheet when you arrive at the testing center. You will be provided a formula sheet and periodic table with your exam. The formula sheet and periodic table are also included in this Study Guide for your review.

Exam Structure

You will be allowed **3 hours** to complete this exam. The exam consists of 50 multiple-choice questions worth 2 points each for a total of 100 points. The exam consists of the following 3 parts:

Part 1: Science Processes and Methods (15 questions)
Part 2: Position, Speed, Velocity, and Acceleration (15 questions)
Part 3: Work, Energy, and Power (20 questions)

Scholastic Honesty

When you arrive at the testing center, you will be asked to carefully read the exam rules and sign a statement agreeing to take the exam in accordance with the rules. This is called the Examinee's Certification. The following is a copy of these rules:

Examinee's Certification

This certification must be signed *before* the exam is administered and then returned with the completed examination attached, or credit for the exam will not be given.

Scholastic dishonesty is a serious academic violation that will not be tolerated. Scholastic dishonesty encompasses, but is not limited to:

- copying from another student's work;
- using an unauthorized testing proctor or taking the exam at an unauthorized testing location;
- using materials not authorized by a testing proctor;
- possessing materials that are not authorized by a testing proctor, such as lessons, books, or notes;
- knowingly using or soliciting, in whole or part, the contents of an unadministered test;
- collaborating with or seeking aid from another student without authorization during the test;
- substituting for another person, or permitting another person to substitute for oneself, in taking a course test or completing any course-related assignment;
- using, buying, stealing, or transporting some or all of the contents of an unadministered test, test rubric, homework answer, or computer program.

Evidence of scholastic dishonesty will result in a grade of *F* on the examination and an *F* in the course (if applicable).

At the testing center, you will be asked to sign a statement that says you have read the above and agree to complete the examination with scholastic honesty.

General Study Tips

The bulleted lists and sample questions in this study guide can assist you in preparing for the exam. It is a fairly complete guide, but does not cover every item on the test. Ultimately, you should use the TEKS to guide your exam preparation.

Additional Study Tips

The following information provides direction for your studies. For each part, you will find study tips and sample questions to give you a general idea of the types of questions you can expect to see on the exam.

Part 1: Science Processes and Methods

This part relates to your knowledge of lab safety, a definition of science and its limits, scientific methods, scientific data, scientific thinking, and the historical contributions of scientists. It includes 15 questions worth 2 points each, for a total of 30 points.

Study Tips for Part 1

This part relates to TEKS 1A–3F. Familiarize yourself with those TEKS, and then be prepared to demonstrate knowledge of the following topics:

Lab Safety

- Identify safe lab practices, including common safety equipment and symbols and why they are important.
- Recognize how to properly dispose of lab materials.

Science and Its Limits

- Define science and understand the limits of the discipline.

Scientific Methods

- Recognize an effective hypothesis.
- Identify the common components of scientific methods.
- Identify the components of a valid experiment, including the terms *control*, *dependent variable*, and *independent variable*.
- Know how to select appropriate equipment for experiments.

Scientific Data

- Understand the value of effective data and how to gather information and perform common calculations.
- Perform accurate and precise measurements.
- Distinguish between accuracy and precision.
- Interpret graphs; e.g., if given the *x*-axis value, determine the value on the *y*-axis and know on which axis the independent and the dependent variables are located.

Scientific Thinking

- Draw valid scientific conclusions by noting trends from data and thinking critically about and analyzing scientific explanations.
- Analyze media messages and understand how the term "false balance" applies to the use of scientific messages by the media.

History of Science

- Know the history of chemistry and contributions of scientists; particularly, Aristotle, Niels Bohr, John Dalton, James Prescott Joule, Antoine-Laurent Lavoisier, Dmitry Mendeleyev, Sir Isaac Newton, Joseph Priestley, and Ernest Rutherford.
- Identify basic facts about the history of the periodic table of the elements.
- Demonstrate a general understanding of the history of atomic theory.
- Know who put forth the idea that protons and neutrons are made of smaller particles called quarks.
- Distinguish between theories associated with classical physics and theories associated with modern physics.

Sample Questions for Part 1

The following are sample questions. You can find the correct answers listed after the questions, but try answering the questions without looking at the answers first to check your comprehension.

DIRECTIONS: Select the BEST response to each of the following questions.

1. Assume you have collected a series of measurements. Which of the following statements about the accuracy and precision of those measurements is correct?

   A. All measurements that are accurate are also precise.
   B. All measurements that are precise are also accurate.
   C. Accuracy is the agreement of repeated measurements; precision is the closeness of a measurement to the actual value.
   D. Precision is the agreement of repeated measurements; accuracy is the closeness of a measurement to the actual value.

2. Which person is credited for being the first to describe a chemical reaction, and therefore the first modern chemist?

   A. Aristotle
   B. John Dalton
   C. Joseph Priestley
   D. Antoine-Laurent Lavoisier

[1: D; 2: D]

Part 2: Position, Speed, Velocity, and Acceleration

This part relates to your knowledge of various aspects of position, speed, velocity, and acceleration. In addition, it covers Newton's laws of motion, momentum, mass, weight, gravity, work, simple machines, and compound machines. It includes 15 questions worth 2 points each, for a total of 30 points.

Study Tips for Part 2

This part relates to TEKS 4A–4F. Familiarize yourself with those TEKS, and then be prepared to demonstrate knowledge of the following topics:

Position, Speed, Velocity, and Acceleration

- Interpret the slope of a Speed vs. Time graph to determine acceleration.
- Calculate speed and convert the dimensions to different units.
- Distinguish between velocity versus zero velocity; velocity versus speed; and average versus instantaneous velocity.
- Know the definitions of escape velocity and terminal velocity.
- Solve for velocity, distance, or time.
- Compare the velocity of various objects expressed in different units.
- Solve for acceleration, initial velocity, final velocity, or time.
- Understand gravitational acceleration.
- Calculate and know the difference between distance and displacement.

Newton's Laws of Motion

- Recognize examples of Newton's 1^{st}, 2^{nd}, and 3^{rd} laws.
- Understand the relationship between an object's motion and net force.
- Use Newton's 2^{nd} law to solve for force, mass, and acceleration.

Momentum

- Know that overall momentum in a system is conserved, where the momentum of one object is transferred to another.
- Compare the momentum of various objects given their masses and velocities.
- Recognize that an object will not have momentum if it does not have velocity.
- Determine which object will have more momentum if two objects have identical velocities.
- Understand the law of conservation of momentum.

Mass, Weight, and Gravity

- Explain the difference between mass and weight.
- Use the formula for weight to calculate the mass, the acceleration from gravity, or the weight of an object.
- Understand the relationship between the mass of two objects and the amount of gravitational attraction between them.
- Understand rotational force.

- Understand the relationship of the distance between two objects and the amount of gravitational attraction between them.

Work, Simple Machines, and Compound Machines

- Recognize that work is only done when the applied force on an object, and the direction of motion of the object, are both in the same direction.
- Be able to identify everyday examples of machines.
- Explain the ways in which machines are able to make work easier (mechanical advantage).
- Determine the efficiency of a machine, given its work input and work output.
- Calculate the work (input and output) done by a simple machine.
- Convert between newtons and kilograms and joules to newtons to watts.

Sample Questions for Part 2

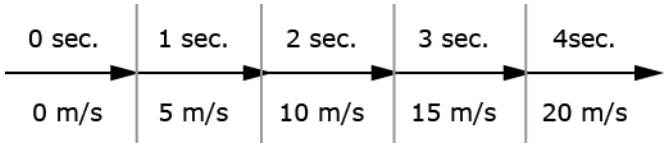
The following are sample questions. You can find the correct answers listed after the questions, but try answering the questions without looking at the answers first to check your comprehension.

DIRECTIONS: Select the BEST response to each of the following questions.

1. Approximately how much work is needed to pull a 4 kg bucket of water from the bottom of a 15 m well to the surface?

   A. 4 J
   B. 40 J
   C. 60 J
   D. 600 J

2. The diagram below shows the speed of a moving object at different time intervals. What logical inference can you make from this information?



   A. The object is in motion.
   B. The object is speeding up.
   C. The object has a constant velocity of 5 m/s.
   D. The object is accelerating at a rate of 5 m/s^2.

[1: D; 2: D]

Part 3: Work, Energy, and Power

This part relates to your knowledge of the conservation of energy, harmonic motion and pendulums, thermal energy, waves, and wave applications. It includes 20 questions worth 2 points each, for a total of 40 points.

Study Tips for Part 3

This part relates to TEKS 5A, 5B, 5D, 5E, 5G, and 5H. Familiarize yourself with those TEKS, and then be prepared to demonstrate knowledge of the following topics:

Conservation of Energy

- Be familiar with the law of conservation of energy and its ramifications for the work input and work output of a machine.
- Recognize the types of energy conversions happening in given situations; e.g., kinetic to potential to mechanical.
- Calculate the kinetic energy of an object, using the appropriate formula.
- Recognize the factors that affect the kinetic energy, mass, and velocity of an object.
- Recognize common forms of gravitational potential energy.
- Compare the gravitational potential energy of various objects, using the formula and the mass and height of each object.
- Know the meaning of chemical potential energy and where it is usually found.

Harmonic Motion and Pendulums

- Recognize what conditions and factors affect the harmonic motion of a pendulum and of a mass on a spring.
- Calculate the period of a pendulum, or the period of a mass on a spring, using the appropriate formula.

Thermal Energy

- Explain the direction of heat transfer.
- Name the three types of heat transfer, describe their characteristic properties, describe the difference between each, and recognize examples of each type in real-world situations.
- Describe the difference between heat and temperature.
- Recognize that the color of an object may determine the extent that object reflects or absorbs radiation.
- Recognize the difference between conductors and insulators, and give examples of each.

Waves

- Know the speed of light, and use this value in the formula for the velocity of a wave to determine the time the wave has traveled, or the distance it has traveled.
- Use the formula for the speed of a wave, determine the wave's frequency, wavelength, or speed.
- Summarize the features of a wave, including crest, trough, wavelength, frequency, speed, and amplitude.
- Describe the behavior of waves, including reflection, refraction, diffraction, constructive interference, and destructive interference.

- Know the types of waves: electromagnetic and mechanical waves.

Wave Applications

- Recognize the factors that determine the speed of sound.
- Understand how sound is measured in decibels, and know how a change in decibel level relates to a change in pressure (or intensity) of the sound.
- Know how the pitch of a sound and the frequency of a sound are related.
- Know how primary colored lights combine/refract with each other and predict result.

Sample Questions for Part 3

The following are sample questions. You can find the correct answers listed after the questions, but try answering the questions without looking at the answers first to check your comprehension.

DIRECTIONS: Select the BEST response to each of the following questions.

1. Three students step off the same diving platform and drop into a swimming pool below. Which student has the **MOST** kinetic energy as he enters the water?

   A. The student with the most mass
   B. The student with the least volume
   C. The student with the greatest density
   D. The student with the greatest final velocity

2. A red light shining on blue paper makes the paper appear _____.

   A. black
   B. purple
   C. magenta
   D. burgundy

3. Suppose you have a 3.0 kilogram mass on a spring. What is its period if it has a spring constant of 60 newtons per meter?

   A. 0.31 seconds
   B. 0.70 seconds
   C. 1.4 seconds
   D. 28 seconds

[1: A; 2: B; 3: C]

Integrated Physics and Chemistry Formula Chart

General Formulas	
Area = length × width $A = l \times w$	Density = $\frac{\text{mass}}{\text{volume}}$ $D = \frac{m}{v}$
% error = $\frac{\text{actual} - \text{experimental}}{\text{actual}} \times 100$ $\%\ err = \frac{act - exp}{act} \times 100$	
Force and Motion Formulas	
Net force = mass × acceleration $F = m \times a$	distance = velocity × time $d = v \times t$
final velocity = initial velocity + acceleration × time $v_f = v_i + a \times t$	
acceleration = $\frac{\text{final velocity} - \text{initial velocity}}{\text{change in time}}$ $a = \frac{\Delta v}{t}$	
Work = Force × distance $W = F \times d$	Power = $\frac{\text{Work}}{\text{time}}$ $P = \frac{W}{t}$
%Efficiency = $\frac{\text{Work output}}{\text{Work input}} \times 100$	%E = $\frac{W_{out}}{W_{in}}$
Ideal Mechanical Advantage = $\frac{\text{Length}}{\text{Height}}$ $IMA = \frac{L}{H}$	
Ideal Mechanical Advantage = $\frac{\text{Length of slope}}{\text{Height of slope}}$ $IMA = \frac{L_s}{H_s}$	
Ideal Mechanical Advantage = $\frac{\text{Length of effort arm}}{\text{Length of resistance arm}}$ $IMA = \frac{L_e}{L_r}$	
Actual Mechanical Advantage = $\frac{\text{mass}}{\text{effort force}}$ $AMA = \frac{m}{F_{effort}}$	
Power = Force × velocity $P = F \times v$	Current = $\frac{\text{Voltage}}{\text{Resistance}}$ $I = \frac{V}{R}$
Period = $2\pi\sqrt{\frac{\text{Length}}{\text{gravity}}}$ $T = 2\pi\sqrt{\frac{L}{g}}$	Period = $2\pi\sqrt{\frac{\text{mass}}{\text{spring constant}}}$ $T = 2\pi\sqrt{\frac{m}{k}}$
Series circuit: Total Resistance = Sum of Resistance $R_T = R_1 + R_2 + R_3 \ldots$	
Parallel circuit: Total Resistance = Sum of the inverse of Resistance $R_T = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots$	
Energy and Momentum Formulas	
momentum = mass × velocity $p = m \times v$	Weight = mass × gravity $W = m \times g$
Gravitational Potential Energy = mass × acceleration due to gravity × height $GPE = mgh$	
Kinetic Energy = $\frac{1}{2}$ (mass × velocity^2) $KE = \frac{1}{2}mv^2$	

Integrated Physics and Chemistry Formula Chart, continued

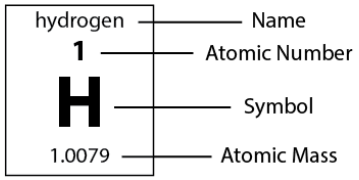
Solutions
$\text{pH} = -\log[\text{concentation of hydronium}] \quad \text{pH} = -\log[H^+]$
Sound Waves and Light Waves Formulas
$\text{frequency} = \dfrac{\text{number of waves}}{\text{time}} \quad f = \dfrac{\#\ of\ waves}{t}$
$\text{wave speed} = \text{frequency} \times \text{wavelength} \quad v = f\lambda$
$\text{Magnification} = \dfrac{\text{height of image}}{\text{height of object}} \quad M = \dfrac{h_i}{h_o}$
Thermochemistry Formulas
$\text{heat gained or lost} = \text{mass} \times \text{specific heat} \times \text{change in temperature} \quad q = m \times c \times \Delta T$
Ideal Gas Law

P = Pressure of the confined gas in atmospheres	$PV = nRT$
V = Volume of the confined gas, in liters	
n = Number of moles of gas	
$\text{R} = \text{Gas constant}, \quad 0.0821\ \text{L} \times \dfrac{\text{atm}}{\text{mol}} \times \text{K}$	
T = Temperature in Kelvin	

Constants and Conversion Factors		
$\text{spring constant} = \dfrac{\text{Force}}{\text{distance}} \quad k = \dfrac{F}{d}$	$\text{acceleration due to gravity} = g = 9.8\dfrac{\text{m}}{\text{s}^2}$	
$\text{speed of sound} = 340\ \text{m/s}$	$\text{speed of light} = c = 3.0 \times 10^8\ \text{m/s}$	
$\text{watt}\ (W) = \dfrac{J}{s} = \dfrac{Nm}{s}$	$\text{newton}\ (N) = kg\ m/s^2$	$\text{joule}\ (J) = Nm$
$°\text{F} = \left(\dfrac{9}{5} \times °\text{C}\right) + 32$	$\text{K} = °\text{C} + 273$	1 wave cycle/second = 1 hertz (Hz)
1 calorie (cal) = 4.18 joules	1000 calories (cal) = 1 Calorie (Cal) = 1 kilocalorie (kcal)	
$1\ \text{cm}^3 = 1\ \text{mL}$	1 meter = 100 centimeters = 1000 millimeters	
1 yard = 0.915 meter	1 mile = 5280 feet	1 inch = 2.54 centimeters
1 foot = 12 inches = 0.305 meter	1 kilometer = 1000 meters	1 kilogram = 1000 grams

Periodic Table of the Elements

Mass numbers in brackets are those of the most stable or most common isotope.



Group	1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIII	10	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	hydrogen 1 H 1.0079																	helium 2 He 4.0026
2	lithium 3 Li 6.941	beryllium 4 Be 9.0122											boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
3	sodium 11 Na 22.990	magnesium 12 Mg 24.305											aluminium 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
4	potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.38	gallium 31 Ga 69.723	germanium 32 Ge 72.64	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.798
5	rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.96	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29
6	caesium 55 Cs 132.91	barium 56 Ba 137.33	57-71 lanthanoids	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
7	francium 87 Fr [223]	radium 88 Ra [226]	89-103 actinoids	rutherfordium 104 Rf [267]	dubnium 105 Db [268]	seaborgium 106 Sg [269]	bohrium 107 Bh [270]	hassium 108 Hs [269]	meitnerium 109 Mt [278]	darmstadtium 110 Ds [281]	roentgenium 111 Rg [281]	copernicium 112 Cn [285]		flerovium 114 Fl [289]		Livermorium 116 Lv [293]		

Lanthanide Series	lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.05	lutetium 71 Lu 174.97
Actinide Series	actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]	lawrencium 103 Lr [262]