

### To the Student:

After your registration is complete, you may take the online Credit by Examination for IPC 1B.

### WHAT TO BRING

- calculator
- IPC formula chart, constants/conversion chart, and Periodic Table of Elements included in this document
- several sharpened No. 2 pencils
- blank lined scratch paper

### ABOUT THE EXAM

The examination for the second semester of Integrated Physics and Chemistry consists of 60 multiple choice, short answer, and problem-solving questions. The exam is based on the Texas Essential Knowledge and Skills (TEKS) for this subject. The full list of TEKS is included in this document (it is also available online at the [Texas Education Agency website](#)). The TEKS outline specific topics covered in the exam, as well as more general areas of knowledge and levels of critical thinking. Use the TEKS to focus your study in preparation for the exam. TEKS covered in this semester are indicated by a checkmark; the exam will focus on the checkmarked TEKS, but may touch on any of the full list.

The CBE for IPC 1B must be completed in one sitting without aid from persons, notes, textbooks, or electronic devices, but you may use a calculator and a formula chart during the entire examination. Where appropriate, show formulas used, essential steps for the solutions of problems, clearly indicate answers, and give appropriate units.

The examination will take place under supervision, and the recommended time limit is three hours. A percentage score from the examination will be reported to the official at your school.

A list of key concepts is included in this document to focus your studies. It is important to prepare adequately. There is no specific textbook for this content. Since questions are not taken from any one source, you may use any Integrated Physics and Chemistry or Physical Science textbook to assist you in your preparation.

Good luck on your examination!

## IPC 1B Key Concepts

Topics covered on this exam are:

- motion;
- forces;
- momentum;
- energy;
- waves;
- electricity;
- thermal energy;
- energy conservation;
- connections between physics, chemistry, and other scientific disciplines; and
- physics-related careers.

## IPC 1B CBE Charts

### EXIT LEVEL SCIENCE CHART

Density = $\frac{\text{mass}}{\text{volume}}$	$D = \frac{m}{v}$
$\left( \begin{array}{c} \text{heat gained} \\ \text{or lost} \end{array} \right) = \left( \text{mass} \right) \left( \begin{array}{c} \text{change in} \\ \text{temperature} \end{array} \right) \left( \begin{array}{c} \text{specific} \\ \text{heat} \end{array} \right)$	$Q = (m)(\Delta T)(C_p)$
Speed = $\frac{\text{distance traveled}}{\text{time}}$	$v = \frac{d}{t}$
Acceleration = $\frac{\text{final velocity} - \text{initial velocity}}{\text{change in time}}$	$a = \frac{v_f - v_i}{\Delta t}$
Momentum = mass $\times$ velocity	$p = mv$
Force = mass $\times$ acceleration	$F = ma$
Work = force $\times$ distance	$W = Fd$
Power = $\frac{\text{work}}{\text{time}}$	$P = \frac{W}{t}$
% efficiency = $\frac{\text{work output}}{\text{work input}} \times 100$	$\% = \frac{W_O}{W_I} \times 100$
Kinetic energy = $\frac{1}{2} (\text{mass} \times \text{velocity}^2)$	$KE = \frac{mv^2}{2}$
Gravitational potential energy = mass $\times$ acceleration due to gravity $\times$ height	$PE = mgh$
Energy = mass $\times$ (speed of light) <sup>2</sup>	$E = mc^2$
Velocity of a wave = frequency $\times$ wavelength	$v = f\lambda$
Current = $\frac{\text{voltage}}{\text{resistance}}$	$I = \frac{V}{R}$
Electrical power = voltage $\times$ current	$P = VI$
Electrical energy = power $\times$ time	$E = Pt$

<b>Constants/Conversions</b>		
$g = \text{acceleration due to gravity} = 9.8 \text{ m/s}^2$		
$c = \text{speed of light} = 3 \times 10^8 \text{ m/s}$		
speed of sound = 343 m/s at sea level and 20°C		
$1 \text{ cm}^3 = 1 \text{ mL}$		
1 wave cycle/second = 1 hertz (Hz)		
1 calorie (cal) = 4.18 joules		
1000 calories (cal) = 1 Calorie (Cal) = 1 kilocalorie (kcal)		
newton (N) = $\text{kg m/s}^2$		
joule (J) = Nm		
watt (W) = J/s = Nm/s		
volt (V)	ampere (A)	ohm ( $\Omega$ )

# Periodic Table of the Elements

Atomic number 14  
 Symbol **Si**  
 Atomic mass 28.086  
 Name Silicon

		18 VIII A											
		13 III A		14 IV A		15 V A		16 VI A		17 VII A		18 VIII A	
		5 B		6 C		7 N		8 O		9 F		10 Ne	
		10.81 Boron		12.011 Carbon		14.007 Nitrogen		15.999 Oxygen		18.998 Fluorine		20.179 Neon	
		13 Al		14 Si		15 P		16 S		17 Cl		18 Ar	
		26.982 Aluminum		28.086 Silicon		30.974 Phosphorus		32.066 Sulfur		35.453 Chlorine		39.948 Argon	
		31 Ga		32 Ge		33 As		34 Se		35 Br		36 Kr	
		65.39 Gallium		72.61 Germanium		74.922 Arsenic		78.96 Selenium		79.904 Bromine		83.80 Krypton	
		48 Zn		49 In		50 Sn		51 Sb		52 Te		54 Xe	
		112.41 Zinc		114.82 Indium		118.71 Tin		121.763 Antimony		127.60 Tellurium		131.29 Xenon	
		80 Hg		81 Tl		82 Pb		83 Bi		84 Po		86 Rn	
		200.59 Mercury		204.383 Thallium		207.2 Lead		208.980 Bismuth		(209) Polonium		(222) Radon	
		29 Cu		30 Zn		31 Ga		32 Ge		33 As		34 Se	
		63.546 Copper		65.39 Zinc		69.72 Gallium		72.61 Germanium		74.922 Arsenic		78.96 Selenium	
		47 Ag		48 Cd		49 In		50 Sn		51 Sb		52 Te	
		107.868 Silver		112.41 Cadmium		114.82 Indium		118.71 Tin		121.763 Antimony		127.60 Tellurium	
		79 Au		80 Hg		81 Tl		82 Pb		83 Bi		84 Po	
		196.967 Gold		200.59 Mercury		204.383 Thallium		207.2 Lead		208.980 Bismuth		(209) Polonium	
		28 Ni		29 Cu		30 Zn		31 Ga		32 Ge		33 As	
		58.69 Nickel		63.546 Copper		65.39 Zinc		69.72 Gallium		72.61 Germanium		74.922 Arsenic	
		46 Pd		47 Ag		48 Cd		49 In		50 Sn		51 Sb	
		106.42 Palladium		107.868 Silver		112.41 Cadmium		114.82 Indium		118.71 Tin		121.763 Antimony	
		78 Pt		79 Au		80 Hg		81 Tl		82 Pb		83 Bi	
		195.08 Platinum		196.967 Gold		200.59 Mercury		204.383 Thallium		207.2 Lead		208.980 Bismuth	
		27 Co		28 Ni		29 Cu		30 Zn		31 Ga		32 Ge	
		58.933 Cobalt		58.69 Nickel		63.546 Copper		65.39 Zinc		69.72 Gallium		72.61 Germanium	
		45 Rh		46 Pd		47 Ag		48 Cd		49 In		50 Sn	
		102.906 Rhodium		106.42 Palladium		107.868 Silver		112.41 Cadmium		114.82 Indium		118.71 Tin	
		77 Ir		78 Pt		79 Au		80 Hg		81 Tl		82 Pb	
		192.22 Iridium		195.08 Platinum		196.967 Gold		200.59 Mercury		204.383 Thallium		207.2 Lead	
		26 Fe		27 Co		28 Ni		29 Cu		30 Zn		31 Ga	
		55.847 Iron		58.933 Cobalt		58.69 Nickel		63.546 Copper		65.39 Zinc		69.72 Gallium	
		44 Ru		45 Rh		46 Pd		47 Ag		48 Cd		49 In	
		101.07 Ruthenium		102.906 Rhodium		106.42 Palladium		107.868 Silver		112.41 Cadmium		114.82 Indium	
		76 Os		77 Ir		78 Pt		79 Au		80 Hg		81 Tl	
		190.23 Osmium		192.22 Iridium		195.08 Platinum		196.967 Gold		200.59 Mercury		204.383 Thallium	
		25 Mn		26 Fe		27 Co		28 Ni		29 Cu		30 Zn	
		54.938 Manganese		55.847 Iron		58.933 Cobalt		58.69 Nickel		63.546 Copper		65.39 Zinc	
		43 Tc		44 Ru		45 Rh		46 Pd		47 Ag		48 Cd	
		(98) Technetium		101.07 Ruthenium		102.906 Rhodium		106.42 Palladium		107.868 Silver		112.41 Cadmium	
		75 Re		76 Os		77 Ir		78 Pt		79 Au		80 Hg	
		186.207 Rhenium		190.23 Osmium		192.22 Iridium		195.08 Platinum		196.967 Gold		200.59 Mercury	
		24 Cr		25 Mn		26 Fe		27 Co		28 Ni		29 Cu	
		51.996 Chromium		54.938 Manganese		55.847 Iron		58.933 Cobalt		58.69 Nickel		63.546 Copper	
		42 Mo		43 Tc		44 Ru		45 Rh		46 Pd		47 Ag	
		95.94 Molybdenum		(98) Technetium		101.07 Ruthenium		102.906 Rhodium		106.42 Palladium		107.868 Silver	
		74 W		75 Re		76 Os		77 Ir		78 Pt		79 Au	
		183.84 Tungsten		186.207 Rhenium		190.23 Osmium		192.22 Iridium		195.08 Platinum		196.967 Gold	
		106 Sg		107 Bh		108 Hs		109 Mt		110 (269)			
		(263) Seaborgium		(262) Bohrium		(265) Hassium		(266) Meitnerium		(269)			
		23 V		24 Cr		25 Mn		26 Fe		27 Co		28 Ni	
		50.942 Vanadium		51.996 Chromium		54.938 Manganese		55.847 Iron		58.933 Cobalt		58.69 Nickel	
		41 Nb		42 Mo		43 Tc		44 Ru		45 Rh		46 Pd	
		92.906 Niobium		95.94 Molybdenum		(98) Technetium		101.07 Ruthenium		102.906 Rhodium		106.42 Palladium	
		73 Ta		74 W		75 Re		76 Os		77 Ir		78 Pt	
		180.948 Tantalum		183.84 Tungsten		186.207 Rhenium		190.23 Osmium		192.22 Iridium		195.08 Platinum	
		105 Db		106 Sg		107 Bh		108 Hs		109 Mt			
		(262) Dubnium		(263) Seaborgium		(262) Bohrium		(265) Hassium		(266) Meitnerium			
		22 Ti		23 V		24 Cr		25 Mn		26 Fe		27 Co	
		47.88 Titanium		50.942 Vanadium		51.996 Chromium		54.938 Manganese		55.847 Iron		58.933 Cobalt	
		40 Zr		41 Nb		42 Mo		43 Tc		44 Ru		45 Rh	
		91.224 Zirconium		92.906 Niobium		95.94 Molybdenum		(98) Technetium		101.07 Ruthenium		102.906 Rhodium	
		72 Hf		73 Ta		74 W		75 Re		76 Os		77 Ir	
		178.49 Hafnium		180.948 Tantalum		183.84 Tungsten		186.207 Rhenium		190.23 Osmium		192.22 Iridium	
		104 Rf		105 Db		106 Sg		107 Bh		108 Hs			
		(261) Rutherfordium		(262) Dubnium		(263) Seaborgium		(262) Bohrium		(265) Hassium			
		21 Sc		22 Ti		23 V		24 Cr		25 Mn		26 Fe	
		44.956 Scandium		47.88 Titanium		50.942 Vanadium		51.996 Chromium		54.938 Manganese		55.847 Iron	
		39 Y		40 Zr		41 Nb		42 Mo		43 Tc		44 Ru	
		88.906 Yttrium		91.224 Zirconium		92.906 Niobium		95.94 Molybdenum		(98) Technetium		101.07 Ruthenium	
		57 La		58 Ce		59 Pr		60 Nd		61 Pm		62 Sm	
		138.906 Lanthanum		140.12 Cerium		140.908 Praseodymium		144.24 Neodymium		(145) Promethium		150.36 Samarium	
		89 Ac		90 Th		91 Pa		92 U		93 Np		94 Pu	
		227.028 Actinium		232.038 Thorium		231.036 Protactinium		238.029 Uranium		237.048 Neptunium		244 Plutonium	
		19 K		20 Ca		21 Sc		22 Ti		23 V		24 Cr	
		39.098 Potassium		40.08 Calcium		44.956 Scandium		47.88 Titanium		50.942 Vanadium		51.996 Chromium	
		37 Rb		38 Sr		39 Y		40 Zr		41 Nb		42 Mo	
		85.468 Rubidium		87.62 Strontium		88.906 Yttrium		91.224 Zirconium		92.906 Niobium		95.94 Molybdenum	
		55 Cs		56 Ba		57 La		58 Ce		59 Pr		60 Nd	
		132.905 Cesium		137.33 Barium		138.906 Lanthanum		140.12 Cerium		140.908 Praseodymium		144.24 Neodymium	
		87 Fr		88 Ra		89 Ac		90 Th		91 Pa		92 U	
		(223) Francium		226.025 Radium		227.028 Actinium		232.038 Thorium		231.036 Protactinium		238.029 Uranium	

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

Lanthanide Series

Actinide Series

**Texas Essential Knowledge and Skills  
IPC 1B – Integrated Physics and Chemistry, Second Semester**

TTU: IPC 1B CBE, v.4.0	
TEKS: §112.38. Integrated Physics and Chemistry (One-Half Credit)	
TEKS Requirement (Secondary)	TEKS Covered
<b>§112.38. Integrated Physics and Chemistry, Beginning with School Year 2010-2011.</b>	
<b>(a) General requirements.</b> Students shall be awarded one credit for successful completion of this course. Prerequisites: none. This course is recommended for students in Grade 9 or 10.	
(b) Introduction.	
(1) Integrated Physics and Chemistry. In Integrated Physics and Chemistry, students conduct laboratory and field investigations, use scientific methods during investigation, and make informed decisions using critical thinking and scientific problem solving. This course integrates the disciplines of physics and chemistry in the following topics: force, motion, energy, and matter.	
(2) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.	
(3) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.	
(4) Science and social ethics. Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).	
(5) Science, systems, and models. A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.	
(c) Knowledge and skills.	
(1) Scientific processes. The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	
(A) demonstrate safe practices during laboratory and field investigations; and	✓
(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.	✓
(2) Scientific processes. The student uses scientific methods during laboratory and field investigations. The student is expected to:	
(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;	✓
(B) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting equipment and technology;	✓
(C) collect data and make measurements with precision;	✓
(D) organize, analyze, evaluate, make inferences, and predict trends from data; and	✓
(E) communicate valid conclusions.	✓
(3) Scientific processes. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions. The student is expected to:	
(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;	✓
(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;	✓

**TTU: IPC 1B CBE, v.4.0**

**TEKS: §112.38. Integrated Physics and Chemistry (One-Half Credit)**

TEKS Requirement (Secondary)	TEKS Covered
(C) draw inferences based on data related to promotional materials for products and services;	✓
(D) evaluate the impact of research on scientific thought, society, and the environment;	✓
(E) describe connections between physics and chemistry and future careers; and	✓
(F) research and describe the history of physics and chemistry and contributions of scientists.	✓
(4) Science concepts. The student knows concepts of force and motion evident in everyday life. The student is expected to:	
(A) describe and calculate an object's motion in terms of position, displacement, speed, and acceleration;	✓
(B) measure and graph distance and speed as a function of time using moving toys;	✓
(C) investigate how an object's motion changes only when a net force is applied, including activities and equipment such as toy cars, vehicle restraints, sports activities, and classroom objects;	✓
(D) assess the relationship between force, mass, and acceleration, noting the relationship is independent of the nature of the force, using equipment such as dynamic carts, moving toys, vehicles, and falling objects;	✓
(E) apply the concept of conservation of momentum using action and reaction forces such as students on skateboards;	✓
(F) describe the gravitational attraction between objects of different masses at different distances, including satellites; and	✓
(G) examine electrical force as a universal force between any two charged objects and compare the relative strength of the electrical force and gravitational force.	✓
(5) Science concepts. The student recognizes multiple forms of energy and knows the impact of energy transfer and energy conservation in everyday life. The student is expected to:	
(A) recognize and demonstrate that objects and substances in motion have kinetic energy such as vibration of atoms, water flowing down a stream moving pebbles, and bowling balls knocking down pins;	✓
(B) demonstrate common forms of potential energy, including gravitational, elastic, and chemical, such as a ball on an inclined plane, springs, and batteries;	✓
(C) demonstrate that moving electric charges produce magnetic forces and moving magnets produce electric forces;	✓
(D) investigate the law of conservation of energy;	✓
(E) investigate and demonstrate the movement of thermal energy through solids, liquids, and gases by convection, conduction, and radiation such as in weather, living, and mechanical systems;	✓
(F) evaluate the transfer of electrical energy in series and parallel circuits and conductive materials;	✓
(G) explore the characteristics and behaviors of energy transferred by waves, including acoustic, seismic, light, and waves on water as they superpose on one another, bend around corners, reflect off surfaces, are absorbed by materials, and change direction when entering new materials;	✓
(H) analyze energy conversions such as those from radiant, nuclear, and geothermal sources; fossil fuels such as coal, gas, oil; and the movement of water or wind; and	✓
(I) critique the advantages and disadvantages of various energy sources and their impact on society and the environment.	✓
(6) Science concepts. The student knows that relationships exist between the structure and properties of matter. The student is expected to:	
(A) examine differences in physical properties of solids, liquids, and gases as explained by the arrangement and motion of atoms, ions, or molecules of the substances and the strength of the forces of attraction between those particles;	
(B) relate chemical properties of substances to the arrangement of their atoms or molecules;	
(C) analyze physical and chemical properties of elements and compounds such as color, density, viscosity, buoyancy, boiling point, freezing point, conductivity, and reactivity;	

**TTU: IPC 1B CBE, v.4.0**

**TEKS: §112.38. Integrated Physics and Chemistry (One-Half Credit)**

TEKS Requirement (Secondary)	TEKS Covered
(D) relate the physical and chemical behavior of an element, including bonding and classification, to its placement on the Periodic Table; and	
(E) relate the structure of water to its function as a solvent and investigate the properties of solutions and factors affecting gas and solid solubility, including nature of solute, temperature, pressure, pH, and concentration.	
(7) Science concepts. The student knows that changes in matter affect everyday life. The student is expected to:	
(A) investigate changes of state as it relates to the arrangement of particles of matter and energy transfer;	
(B) recognize that chemical changes can occur when substances react to form different substances and that these interactions are largely determined by the valence electrons;	
(C) demonstrate that mass is conserved when substances undergo chemical change and that the number and kind of atoms are the same in the reactants and products;	
(D) analyze energy changes that accompany chemical reactions such as those occurring in heat packs, cold packs, and glow sticks and classify them as exothermic or endothermic reactions;	
(E) describe types of nuclear reactions such as fission and fusion and their roles in applications such as medicine and energy production; and	
(F) research and describe the environmental and economic impact of the end-products of chemical reactions such as those that may result in acid rain, degradation of water and air quality, and ozone depletion.	
<i>Source: The provisions of this §112.38 adopted to be effective August 4, 2009, 34 TexReg 5063.</i>	