

Conceptual Physics**NAME:**

Homework 2b: Solids Homeworks are due usually a day after the corresponding textbook part/lecture is completed. Due dates will be announced in class. Multiple-choice problems will all be marked. **USE** the answer table for these problems. The rest of the homeworks will be marked for apparent completeness and some full-answer problems will/may be marked in detail. Make the full-answer solutions sufficiently detailed that the grader can follow your reasoning. Solutions will be posted eventually after the due dates. The solutions are intended to be (but not necessarily are) super-perfect and often go beyond full answers. For an argument or discussion problem, there really is no single right answer. The instructor's answer reflects his long experience in physics, but there could be objections to his arguments, assumptions, nuances, style, facts, etc.

NAME:

Answer Table for the Multiple-Choice Questions

	a	b	c	d	e		a	b	c	d	e
1.	O	O	O	O	O	26.	O	O	O	O	O
2.	O	O	O	O	O	27.	O	O	O	O	O
3.	O	O	O	O	O	28.	O	O	O	O	O
4.	O	O	O	O	O	29.	O	O	O	O	O
5.	O	O	O	O	O	30.	O	O	O	O	O
6.	O	O	O	O	O	31.	O	O	O	O	O
7.	O	O	O	O	O	32.	O	O	O	O	O
8.	O	O	O	O	O	33.	O	O	O	O	O
9.	O	O	O	O	O	34.	O	O	O	O	O
10.	O	O	O	O	O	35.	O	O	O	O	O
11.	O	O	O	O	O	36.	O	O	O	O	O
12.	O	O	O	O	O	37.	O	O	O	O	O
13.	O	O	O	O	O	38.	O	O	O	O	O
14.	O	O	O	O	O	39.	O	O	O	O	O
15.	O	O	O	O	O	40.	O	O	O	O	O
16.	O	O	O	O	O	41.	O	O	O	O	O
17.	O	O	O	O	O	42.	O	O	O	O	O
18.	O	O	O	O	O	43.	O	O	O	O	O
19.	O	O	O	O	O	44.	O	O	O	O	O
20.	O	O	O	O	O	45.	O	O	O	O	O
21.	O	O	O	O	O	46.	O	O	O	O	O
22.	O	O	O	O	O	47.	O	O	O	O	O
23.	O	O	O	O	O	48.	O	O	O	O	O
24.	O	O	O	O	O	49.	O	O	O	O	O
25.	O	O	O	O	O	50.	O	O	O	O	O

004 qmult 00100 1 1 3 easy memory: solids definition

1. Solids are formed by atoms or molecules held together by:
- a) external pressure. b) non-rigid chemical bonds. c) rigid chemical bonds. d) gravity.
e) internal pressure.

SUGGESTED ANSWER: (c)

Wrong answers:

- a) A nonsense answer.

Redaction: Jeffery, 2012jan01

004 qmult 00230 1 1 1 easy memory: polycrystal

2. Most macroscopic samples of crystalline solids are _____: i.e., are fused small crystals (called _____) of order a few nanometers to a few millimeters in size scale. The boundaries of the _____ can be complex.
- a) polycrystalline; crystallites or grains b) monocrystalline; crystallites or grains
c) tricrystalline; crystallites or grains d) triglyceridic; tris or glys
e) polycrystalline; bitty crystals

SUGGESTED ANSWER: (a)

Wrong answers:

- e) Oh, c'mon.

Redaction: Jeffery, 2012jan01

004 qmult 00310 1 1 5 easy memory: density discussed

3. The quantity

$$\rho = M/V$$

for an object of mass M and volume V is its mean _____. A homogeneous substance has nearly uniform _____: i.e., the _____ of small samples above the atomic scale is nearly constant.

- a) enthalpy b) entropy c) temperature d) pressure e) density

SUGGESTED ANSWER: (e)

Wrong answers:

- a) Despite all my years in physics, I

Redaction: Jeffery, 2012jan01

004 qmult 00340 1 1 3 easy memory: density of liquid water

4. The density of liquid water at ordinary human-scale temperature and pressure conditions is nearly exactly:
- a) 1000 g/cm³. b) 1 kg/m³. c) 1 g/cm³. d) 22.59 g/cm³. e) 22.56 g/cm³.

SUGGESTED ANSWER: (c)

Wrong answers:

- a) Right value for kg/m³.
d) This for osmium.

Redaction: Jeffery, 2012jan01

004 qmult 00400 1 4 2 easy deducto-memory: elasticity defined

5. "Let's play *Jeopardy!* For \$100, the answer is: It is the property of a material that causes the material to return to its original shape after being deformed by an applied external force (which in this context is called a stress). The relative deformation is called strain."

What is _____, Alex?

- a) plasticity b) elasticity c) masticity d) tricity e) squishiness

SUGGESTED ANSWER: (b)

Wrong answers:

- a) As Lurch would say AAAARGH.

Redaction: Jeffery, 2012jan01

004 qmult 00420 1 1 4 easy memory: Hooke's law force and SHM

6. For a material to be elastic, it must have internal restoring force on every physical bit of the sample. A restoring force is one that drives a bit back to its equilibrium position where the bit has no net internal force on it and, in particular, the restoring force is zero. For small displacements from equilibrium, the restoring force in almost all cases is linear displacement. For example for a 1-dimensional cases, linear restoring force is

$$F = -kx .$$

where $x = 0$ is the equilibrium and k is a constant. This force law is called Hooke's law. A object acted only by the Hooke's law force exhibits:

- a) square wave motion. b) zero motion in all cases. c) irregular oscillations.
d) simple harmonic motion. e) aperiodic motion.

SUGGESTED ANSWER: (d)

Wrong answers:

- a) Well no.

Redaction: Jeffery, 2012jan01

004 qmult 00500 1 1 4 easy memory: tension, compression, shearing

7. The stretching deformation of a body is _____ (which is a word actually more often used to mean the restoring force magnitude of a body in _____), the squeezing deformation of a body is _____, and the deformation of parallel layers of body sliding relative to each other is _____. These three categories of deformation are the usual ones in physics for analyzing deformation.

- a) tension; shearing; compression b) stretch; squish; slide
c) compression; tension; shearing d) tension; compression; shearing e) slide; stretch; squish

SUGGESTED ANSWER: (d)

Wrong answers:

- b) The words make sense.

Redaction: Jeffery, 2012jan01

004 qmult 00550 1 1 3 easy memory: neutral layer

8. When a beam is bent, the convex side has parallel layers in tension and the concave side has parallel layers in compression. By continuity between the tensed and compressed layers there must be a layer that neither tensed nor compressed although it is under a shearing strain. This layer is called the:

- a) neutral zone. b) twilight zone. c) neutral layer. d) untensed-uncompressed layer.
e) cake layer.

SUGGESTED ANSWER: (c)

Wrong answers:

- e) And eat it too.

Redaction: Jeffery, 2012jan01

004 qmult 00630 1 1 2 easy memory: catenary arch

9. The maximum strength shape for an arch that has to support its own weight is a _____—a word apparently coined by Thomas Jefferson (1743–1826). This shape is also that of a rope or chain hanging from two points.

- a) catenation b) catenary c) catena d) cantina e) Cat-Astrophe

SUGGESTED ANSWER: (b)

Wrong answers:

- c) Latin for chain and the source for catenary.
- e) It would be a Cat-Astrophe as Catwoman used to say.

Redaction: Jeffery, 2012jan01

004 qmult 00700 1 1 3 easy memory: isometric scaling and square-cube law

10. Isometric scaling (or just scaling for short) is when every length element of an object is varied by the same factor. Results that follow for isometric scaling of an object are

$$A \propto \ell^2, \quad V \propto \ell^3, \quad V^2 \propto A^3, \quad V \propto A^{3/2},$$

where ℓ is any length element, A is surface area, and V is volume. The first two formula collectively and the latter two individually are all formulations of:

- a) Kleiber's law.
- b) the inverse-square law.
- c) the square-cube law.
- d) Hooke's law.
- e) Gresham's law.

SUGGESTED ANSWER: (c)

Wrong answers:

- a) Metabolic rate is proportional to body mass to the 3/4 power.
- e) "Bad money drives out good."

Redaction: Jeffery, 2012jan01