FACULTY NOTES

The LTAs and Spinoffs are designed so that each professor can implement them in a way that is consistent with his/her teaching style and course objectives. This may range from using the materials as out-of-class projects with minimal in-class guidance to doing most of the work in class. The LTAs and Spinoffs are amenable to small group cooperative work and typically benefit from the use of some learning technology. Since the objective of the LTAs and Spinoffs is to support the specific academic goals you have set for your students, the Faculty Notes are not intended to be prescriptive. The purpose of the Faculty Notes is to provide information that assists you to take full advantage of the LTAs and Spinoffs. This includes suggestions for instruction as well as answers for the exercises.

FACULTY NOTES

SPINOFF 4A

Measuring Cracks in the Space Shuttle

Background Information
You might want to refer to the first three sections of the Faculty Notes for background information on the Kennedy Space Center, the Space Shuttle as well as Fracture Mechanics.

Goals:

The goals of this project are:
1. to offer students practice in measuring lengths in the metric system;
2. to evaluate square roots;
3. to compare results to a known specification;
4. to explore situations that depend on two different measurements and the results of holding one of the values constant; and
5. to complete multi-step processes.

Hints:

To maintain consistency in measurements and to provide measuring instruments for the students, students might be instructed to tear off the ruler that is printed on the bottom of the last page of the activity.

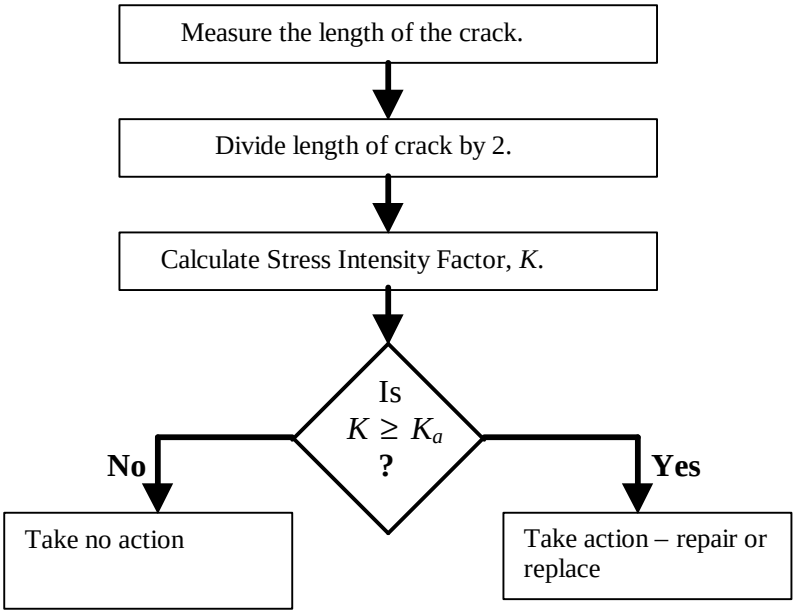
Although the length of the crack is measured normal to the stress (as discussed in the section, Background on Fracture Mechanics, located at the beginning of the Faculty Notes), for the purposes of this activity, students should just measure the length of the crack from end-to-end.

Solutions:

In-text question prior to exercises: What common and handy object can you use to estimate one centimeter?
Although answers will vary, many people use the width of the nail of their smallest finger.

1) 6 mm or 0.6 cm
2) 12 mm or 1.2 cm
3) 33 mm or 3.3 cm
4) 28 mm or 2.8 cm
5) 647 Mpa-$\sqrt{\text{mm}}$
6) 886 Mpa-$\sqrt{\text{mm}}$
7) 197 Mpa-$\sqrt{\text{mm}}$

Flowchart Answers



These following measurements were made from the original documents. As you know, copying alters slightly the size of the printed material. Therefore, your measurements may be slightly different from these.

8)	A) 22mm	B) a = 11 mm	C) 470 Mpa-$\sqrt{\text{mm}}$	D) Report, but no action
9)	A) 24 mm	B) a = 12 mm	C) 614 Mpa-$\sqrt{\text{mm}}$	D) Repair or replace
10)	A) 5 mm	B) a = 2.5 mm	C) 336 Mpa-$\sqrt{\text{mm}}$	D) Report, but no action
11)	A) 19 mm	B) a = 9.5 mm	C) 656 Mpa-$\sqrt{\text{mm}}$	D) Repair or replace
12)	A) 18 mm	B) a = 9 mm	C) 798 Mpa-$\sqrt{\text{mm}}$	D) Repair or replace
13)	A) 3 mm	B) a = 1.5 mm	C) 619 Mpa-$\sqrt{\text{mm}}$	D) Repair or replace
14)	A) 33 mm	B) a = 16.5 mm	C) 576 Mpa-$\sqrt{\text{mm}}$	D) Repair or replace
15)	A) 31 mm	B) a = 15.5 mm	C) 488 Mpa-$\sqrt{\text{mm}}$	D) Report, but no action

16) With the same s , the longer the crack, the larger the K.
17) The crack in Exercise 13 is much smaller than the crack in Exercise 15. However, because the stress in Exercise 13 is so much larger than the stress in Exercise 15, repair or replacement is required for the situation in Exercise 13.
18) It depends on the amount of stress.