

Process Control Event – 2007

The process control event for the 2007 Operations Challenge has significant changes to the scoring system. Instead of trying to attain the lowest score, the winner will be based on the highest score. Time taken by a team will only be half as important as getting correct answers. Teams should review these changes thoroughly as they could drastically change past test taking strategies.

Summary of changes from last year

- No penalties for unanswered questions or incorrect answers
- Credit only for correct answers
- Partial credit for work shown in operational scenarios
- Bonus points for finishing earlier than 20 minutes
- Penalty for time in excess of 20 minutes
- Teams can answer as many process scenarios as they desire
- Highest score wins the event

Be sure to read on for the exact details

Overview

The event consists of answering a number of multiple choice questions, some short math questions with multiple choice answers, and up to five operational type scenarios that have four to six questions each that may require considerable calculations. The event is timed, with a maximum of 25 minutes allowed for completion. The team can split up the test any way it chooses during the test. If a team completes the test before the end of the event, their actual time is recorded. The event should be viewed as an opportunity for a team to demonstrate their accumulated knowledge of wastewater treatment and skill in plant process control.

Grading

The tests will be graded as follows:

- multiple choice questions as: correct answer, incorrect answer, or no answer
- short math multiple choice questions as: correct, incorrect, or no answer as well as whether work is shown on test paper
- operational scenarios as: correct, incorrect, or no answer as well as whether work is shown on test paper.

Scoring

Scoring in the Process Control event consists of two components: time and correctness. The raw time is the actual time that a team requires to complete the test and return it to the judge at their table. The time allotted for the test is 25 minutes. All teams that have not finished the test before time runs out will receive a raw time of 25 minutes (1500 seconds). Raw time will be used to determine a time bonus, which is added to the correctness component of the score to calculate the final score.

If a team's raw time is greater than 20 minutes, they receive a time penalty equal to one half of the difference between their raw time and 20 minutes. As an example, if a team has a raw time of 23 minutes and 45 seconds, their time penalty is $(1425 \text{ seconds} - 1200 \text{ seconds})/2 = 112.5$ seconds. Since this is a penalty, 112.5 will be subtracted from their score.

If a team's raw time is between 15 and 20 minutes, they receive time bonus points equal to one half of the difference between their raw time and 20 minutes. As an example, if a team has a raw time of 16 minutes and 10 seconds, their time bonus is $(1200 \text{ seconds} - 970 \text{ seconds})/2 = 115$ seconds. Since this is a bonus, 115 will be added to their score.

There is no additional time bonus for finishing earlier than 15 minutes. If a team finishes earlier than 15 minutes their time bonus will be based on 15 minutes.

The correctness component of the score is based on the total of points awarded for correct answers and work shown. In the multiple choice and extended multiple choice sections, points are awarded only for correct answers, there are no penalties.

Points				
Test section	Correct answer	No answer	Incorrect answer	Correct answer AND showing work
Multiple choice	10	0	0	N/A
Extended multiple choice	25	0	0	N/A
Short math multiple choice	0	0	0	50/25*
Operational scenarios	0	60*	60*	120/60*

*partial credit for showing work as described below

Note that for scenario questions partial credit is possible, even if an incorrect or no answer is given.

For any math questions, there are no points for a correct answer unless at least some work is shown.

If a judge determines that a team member is not attempting to help with parts of the test, a xxx second penalty will be assessed for each non-participating team member.

A team's final score will be the sum of the time bonus (or penalty) and the points awarded for correct answers. The highest score will win the event.

Partial Credit and Showing Work

For any math section question, the team must write out the numbers used and show them in an equation form. Example:

$$16 \text{ mg/l} \times 8.34 \times 2.4 \text{ MGD} = 320 \text{ lbs}$$

Simply putting down numbers does not count. The equation used must also be relevant to the question. i.e. there will not be credit for writing down the lbs formula when the question is about detention time.

For the math and operational scenario questions, if the grader feels that the work shown demonstrates correct and significant, but incomplete, progress towards the answer the work shown may receive the partial credit listed in the table.

Note that sometimes answers that are text rather than numbers may still require work to be shown. For example, if the correct answer for a problem is “the hydraulic loading rate is too high” then the work shown **must** include a calculation of the hydraulic loading rate.

Scope

The questions will cover the following areas of wastewater treatment as well as general topics such as: pumping, maintenance, laboratory, safety, flow measurement, and metering:

Process Areas	Example Systems
Preliminary Treatment	Screening Grit Removal Flow Equalization
Odor Control	Wet chemical scrubbing Chemical addition Biofilters
Primary Treatment	Primary Sedimentation Flow Equalization Clarification
Secondary Treatment Suspended Media	Activated Sludge Biological Nutrient Removal Clarification Sequencing Batch Reactors
Secondary Treatment Fixed Media	Trickling Filtration Biological Nutrient Removal
Advanced Treatment	Filtration Biological Nutrient Removal
Thickening	Gravity Belt Thickener Dissolved Air Flotation Gravity Thickening
Solids Stabilization Methods	Anaerobic Digestion Aerobic Digestion
Dewatering	Belt Filter Press Drying Beds Centrifuge Dewatering
Disinfection	Chlorination \ Dechlorination Ultraviolet Disinfection
Management and Support	Process Instrumentation Treatment Plant Security

Resources

The following references will be used in creating and grading the test questions:

- Water Environment Federation Manual of Practice 11
- The monthly *Water Environment & Technology Operations Forum* certification quiz
- The WEF/ABC study guide
- California State University Sacramento Operations of WWTPs volumes 1 & 2 and

Advanced Waste Treatment

- Collections Systems questions will be based on the Sacramento Manual, Operations and Maintenance of Wastewater Collections Systems.
- Manual on the Causes and Control of Activated Sludge Bulking and Foaming, Jenkins, Richards & Daigger

Questions on Operations Central Certification Quiz on the WEF website are recommended as resource study materials.

Additional general study material includes:

- EPA design manuals, which can be obtained at <http://www.epa.gov/ttbnrmrl>. Select *Browse* to see the full list of available documents. Only some are applicable to wastewater.
- Wastewater Engineering Treatment Disposal, and Reuse, Metcalf and Eddy, McGraw-Hill
- Note that these sources will NOT be used in creating or grading tests. They are listed for those interested in additional sources of wastewater knowledge.

Test Details

The same test is used for both Division 1 and Division 2.

The multiple choice test will consist of 48 questions with four possible answers each, fifteen multiple choice questions requiring a small amount of math, and 30 questions where each answer is chosen from a list of 20 possible answers (extended multiple choice).

Five process scenarios with four to six questions each are in the test. Teams may answer as many parts of any scenario that they desire. There is no required process scenario.

Formula sheets, reference books or any other material are not permitted.

Team members may talk among themselves but may not be disruptive. Teamwork in solving problems is encouraged. Also consider that other teams may overhear your discussions.

General Details

What will be supplied at the event: Answer sheet forms and scratch paper for calculations. We will also try to have a pencil sharpener available prior to the event but this is not guaranteed.

Competitors must supply their own No. 2 lead pencils and calculators (calculators cannot have programming or printout capability)

All four team members must be present before the start of the event.

If a team is disqualified from the event they will receive a score based on the maximum time and every question and work shown left blank.

The test will have equivalent metric units of measure supplied in addition to the standard U.S.

units. **(Teams must request a metric version by June 1, 2007)**

A Spanish version of the test will be available for those teams that cannot use the English version. **(Teams must request a Spanish version by June 1, 2007)**

Notes

The exact number of questions may change slightly between now and the event. The points may also be adjusted to ensure test balance.

The event committee will not have reference books available at the event; plan on bringing your own copies as needed. (No reference material can be used during the test)

Process Control Event committee members will be available to discuss scoring of test questions the morning after the event.

Comments

The changes to the scoring system this year are a shift from the previous penalty system for lack of knowledge to a reward system for demonstrating knowledge. We hope this presents a more positive atmosphere to the event.