

# Unit 11 - Week 9: Evolution of Burning surface, Ignition System of Solid Propellant Grains, Types of Liquid Propellant Rocket Engine and Injection System

## Course outline

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## Week 9: Assignment

The due date for submitting this assignment has passed.  
As per our records you have not submitted this assignment.

**Due on 2019-10-02, 23:59 IST.**

1) Both casting and extrusion methods can be adopted for the production of case bonded solid propellant grain. Given statement is: **1 point**

- True  
 False

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
False

2) During the burning of a solid propellant, any point on the surface of grain regresses along the tangent surface at that point. Given statement is: **1 point**

- True  
 False

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
False

3) Sensitivity of chamber pressure to the grain temperature is greater as compared to the sensitivity of regression rate to propellant grain temperature. Given statement is: **1 point**

- True  
 False

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
True

4) With respect to the spray, larger Ohnesorge number indicates a greater influence of viscosity. Given statement is: **1 point**

- True  
 False

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
True

5) At higher Reynolds number, first and second wind induced atomization can be occurring at lower Ohnesorge number. Given statement is: **1 point**

- True  
 False

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
True

6) Non-impinging method of atomization in injectors can be used for hypergolic propellants. Given statement is: **1 point**

- True  
 False

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
False

7) Which of the following is not a function of injection system in a rocket engine: **1 point**

- Ensure good atomization and mixing in the combustion chamber  
 Provide cooling to the combustion chamber wall and injector face  
 Deliver the requisite flow rate of fuel and oxidizer  
 Control over the chamber pressure

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
Control over the chamber pressure

8) Which of the following statement is correct with respect to the atomization of liquid jet: **1 point**

- Atomization will take place when resistive forces are greater than the disruptive forces.  
 Atomization will take place when resistive forces are less than the disruptive forces.  
 Atomization will take when resistive forces are equal to the disruptive forces.  
 None of these

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
Atomization will take place when resistive forces are less than the disruptive forces.

9) Identify the correct statement with respect to the pyrotechnic and pyrogen igniter: **1 point**

- Ignition time for pyrotechnic is higher as compared to the pyrogen igniter.  
 Pyrotechnic igniter is used for large solid propellant rocket engines (SPRE) whereas pyrogen is used for small SPRE.  
 Performance can be closely controlled for pyrotechnic whereas it can be controlled moderately for pyrogen.  
 Thrust law depends on test chamber volume for pyrotechnic whereas it is independent for pyrogen.

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
Thrust law depends on test chamber volume for pyrotechnic whereas it is independent for pyrogen.

10) Which of the following sheet formation takes place in case of impinging atomizer: **1 point**

- Fan sheet  
 Conical sheet  
 Flat sheet  
 None of these

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
Fan sheet

11) Consider the following problem statement to answer questions 11-13 **2 points**

A designer has proposed to use propellant grain with rectangular cross section (0.6 m×0.4 m) with an outer diameter of 1.2 m and length of 2.0 m. The density of the propellant is 1350 kg/m<sup>3</sup>.

The sliver mass of the propellant grain is:

- 353 kg  
 473 kg  
 527 kg  
 621 kg

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
621 kg

12) The percentage of the sliver mass compared to the initial propellant mass at the end of its operation: **2 points**

- 8.9%  
 17.3%  
 25.8%  
 31.2%

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
25.8%

13) By restricting the fraction of sliver mass to 10%, can it be used for practical application? **1 point**

- Yes  
 No

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
No

14) A solid propellant rocket engine with chamber volume of 0.01 m<sup>3</sup> is at chamber pressure of 0.45 MPa. At the end of combustion, the entire chamber volume is filled with hot gases (M.wt=23 kg/kmol) having 8% of solid material in the combustion products and temperature of 2800 K. Determine the minimum amount of charge required for successful ignition: **2 points**

- 4.83 gm  
 2.36 gm  
 5.48 gm  
 3.67 gm

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
4.83 gm

15) Consider the following problem statement to answer questions 15-17: **1 point**

A liquid propellant at 40 cm/s is passing through an orifice with diameter of 2.5 mm. The density, viscosity and surface tension force of the liquid propellant are 680 kg/m<sup>3</sup>, 3.8×10<sup>-3</sup> Pa. s and 7×10<sup>-4</sup> N/m respectively.

Ohnesorge number of the liquid propellant is:

- 0.168  
 0.015  
 1.1×10<sup>-3</sup>  
 1.5×10<sup>-4</sup>

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
1.1×10<sup>-3</sup>

16) Reynolds number of the liquid propellant is: **1 point**

- 1.79×10<sup>4</sup>  
 1.52×10<sup>5</sup>  
 3.85×10<sup>3</sup>  
 4.42×10<sup>5</sup>

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
1.79×10<sup>4</sup>

17) In which of the following stage of atomization, the liquid is operating: **1 point**

- Rayleigh jet break-up  
 First wind induced break-up  
 Second wind induced break-up  
 Atomization

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
Second wind induced break-up