ATENÇÃO: Este modelo é composto por um texto acadêmico e 10 questões.

Ele **NÃO** representa uma prova integral, apenas parte dela.

Centro Interdepartamental de Línguas
FFLCH • USP
desde 1991

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CENTRO DE LÍNGUAS – EXAME DE PROFICIÊNCIA EM LÍNGUA INGLESA IF

OUTUBRO / 2018

NOME:..

MESTRADO

- Duração da prova: 2h
- O uso de dicionário impresso é permitido.
- O aproveitamento mínimo para obter o conceito "Suficiente" é de 70%, o que equivale ao acerto de 14 (catorze) questões.
- Assinale apenas uma alternativa para cada questão.

O exame é composto pelos textos:
– *Is Hydrogen the Future of Nuclear Energy?*
– *Drop Impact Dynamics: Splashing, Spreading, Receding, Bouncing…*

PROVA B

DROP IMPACT DYNAMICS: SPLASHING, SPREADING, RECEDING, BOUNCING…

YARIN, A.L.
Disponível em: www fluid.annualreviews.org

Drop impacts on solid and liquid surfaces are a key element of a wide variety of phenomena encountered in technical applications, such as ink-jet printing, rapid spray cooling of hot surfaces (turbine blades, rolls in rolling mills for steel production, lasers, semiconductor chips, and electronic devices), annealing, quenching of aluminum alloys and steel, fire suppression by sprinklers, internal combustion engines (intake ducts of gasoline engines or piston bowls in direct-injection diesel engines), incinerators, spray painting and coating, plasma spraying, and crop spraying. Microfabrication of structured materials, solder bumps on printed circuit boards, and electric circuits in microelectronics produced by precision solder-drop dispensing, as well as liquid atomization and cleaning, and ice accumulation on power lines and aircraft also involve drop impacts. The latter are also important in criminal forensics, in development of nonwettable or fully wettable surfaces, in high-accuracy activation or passivation of substrates by microdrops, in transport of surface contaminants into bulk liquids, and in gas entrapment. Understanding the accompanying physical phenomena is of utmost importance in formulating reliable boundary conditions in numerical codes for spray simulation. Such large-scale and widespread natural phenomena as aeration of the surface layers of lakes, seas, and oceans depend on air bubble entrainment due to rain drop impacts. These impacts at ocean surfaces lead to formation of upward jets and secondary droplets, which evaporate and form salt crystals. The **latter** serve as nucleation sites in clouds, with the attendant relevance to meteorology. Erosion of soil, dispersal of spores and micro-organisms, and underwater noise during rains are three additional natural phenomena involving drop impact. Nail-like jets and bubbles are a familiar spectacle during rain falling on puddles and ponds.

Worthington (1908) was one of the first to investigate these impacts systematically and his book contains many fascinating photographs of the phenomena accompanying drop- and solid-ball impacts on deep liquid pools. In spite of its commonness, and of more than 100 years of research, the phenomenon is still far from being fully understood and continues to attract physicists, engineers, and mathematicians. It even attracts the general public and motivates potential customers, given the number of commercials based on drop impact scenes aired on television and shown on postcards.

The accompanying phenomena are extremely diverse, involved, and surprising. A drop may be spherical or elliptic (due to oscillations) at the moment of impact. It may impact on the free surface of a liquid in a deep pool, on a thin liquid film on a wall, or on a dry solid surface. The impact may be normal (perpendicular) or oblique, in air or in vacuum. The liquid may be Newtonian or non-Newtonian (e.g., a viscoelastic polymer or a surfactant solution). The liquids of the drop and pool/film may be miscible or immiscible. The solid surface may be hard or soft, rough or smooth, chemically homogeneous or heterogeneous. It may also be porous, flat or curved, at a temperature different from that of the drop or the same. On liquid surfaces, pre-existing or generated waves may affect the flow pattern. The impact may result in the drop spreading over the solid surface, receding, rebounding, or even levitating if the evaporation near a hot wall is sufficiently strong for the Leidenfrost effect. A crater **may** form in the liquid bulk in a pool and later on collapse, leading to formation of the so-called Worthington jet flowing out from its center and being subjected to capillary breakup. The impact on a liquid film may result in crown formation, propagation, and breakup, as well as in tiny bubble trapping, or—under certain conditions—noncoalescence and even rolling over the surface.

The outcome of drop impact depends on the impact velocity, its direction relative to the surface, drop size, the properties of the liquid (its density, viscosity, viscoelasticity, and some other non-Newtonian effects for rheologically complex fluids), the surface or interfacial tension, the roughness and wettability of the solid surface, the nonisothermal effects (e.g., solidification and evaporation), and air entrapment. In very strong impacts, liquid compressibility is also a factor. By contrast, following the impact of solid balls and projectiles onto armor plates in the hypervelocity range, the solid materials flow like fluids, and the influence of their elasticity, yield stress and plasticity is negligible compared to inertial effects. As a result, phenomena such as frontal ejecta and crater formation in solid-solid impacts are reminiscent of those characteristic of liquid drop impact (i.e., splashing and crown formation), which led Worthington to call the former "permanent splashes." In cosmic-scale impacts of asteroids (a spectacular example of which is the Arizona Meteor Crater), material vaporization becomes a dominant factor.

- As questões de 01 a 10 referem-se ao texto ***Drop Impact Dynamics: Splashing, Spreading, Receding, Bouncing…***

1. Assinale a alternativa que **NÃO** apresente uma aplicação técnica advinda do fenômeno do impacto da gota

a) impressora a jato de tinta.
b) motores de combustão interna.
c) extintor de incêndio.
d) pintura por pulverização.

2. Qual aplicação técnica dos impactos da gota a criminalística utiliza?

a) microfabricação de materiais estruturados.
b) pontos de solda em circuito impresso.
c) circuitos elétricos em microeletrônica.
d) acumulação de gelo nas linhas de força.

3. A aeração das camadas superficiais de lagos, mares e oceanos depende

a) especificamente da área.
b) indiretamente do impacto da queda da chuva.
c) apenas do arrastamento do ar realizado pelas ondas.
d) unicamente do fenômeno natural de acumulação de camadas.

4. O termo ***latter*** no trecho "*These impacts at ocean surfaces lead to formation of upward jets and secondary droplets, which evaporate and form salt crystals. The* ***latter*** *serve as nucleation sites in clouds, with the attendant relevance to meteorology.*" refere-se a

a) ocean.
b) jets.
c) salt crystals.
d) clouds.

5. De acordo com o texto, Worthington

a) publicou fotografias do fenômeno do impacto de gotas e bolas sólidas em uma piscina.

b) investigou o fenômeno natural da cristalização do sal nas gotas.
c) sistematizou todos os fenômenos estritamente relacionados com os jatos.
d) descobriu como a água se comporta quando relacionada a baixas temperaturas.

6. O fenômeno pesquisado por Worthington

a) tem menos de 100 anos de pesquisa.
b) possui pouca relevância no meio acadêmico hoje em dia.
c) não foi totalmente compreendido ainda.
d) é utilizado apenas pela mídia.

7. No momento de impacto a gota pode mudar de forma devido à(s)

a) oscilações.
b) velocidade.
c) superfície de contato.
d) temperatura.

8. Assinale a alternativa que apresente um dos resultados de uma gota cair em uma superfície sólida.

a) ondas.
b) espalhamento.
c) evaporação.
d) deslizamento.

9. Na frase: "*A crater* ***may*** *form in the liquid bulk in a pool and later on collapse*." O termo destacado indica

a) certeza.
b) impossibilidade.
c) probabilidade.
d) obrigação.

10. O autor aponta diversos fatores para ter o resultado do impacto da gota, mas um deles ocorre em impactos muito fortes, que é a

a) tensão de superfície.
b) compressibilidade de líquido.
c) molhabilidade da superfície.
d) evaporação.

GABARITO

1. C
2. D
3. B
4. C
5. A
6. C
7. A
8. B
9. C
10. B