CHAPTER

03 Surface Tension

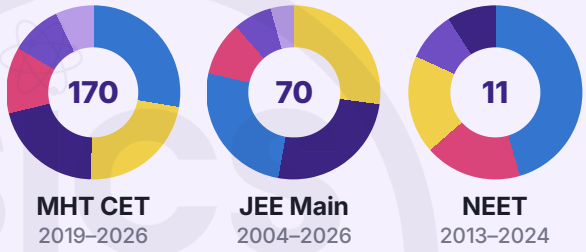
MHT CET · JEE · NEET Physics

PHYSICS CIRCLE

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EXAM WEIGHTAGE



	CET	JEE	NEET
Angle of Contact & Capillarity	47 28%	18 26%	5 45%
Excess Pressure: Drops & Bubbles	39 23%	19 27%	2 18%
Splitting & Merging of Drops	35 21%	18 26%	1 9%
Surface Energy & Work Done	21 12%	7 10%	2 18%
Force due to Surface Tension	16 9%	5 7%	1 9%
Molecular Theory & Factors	12 7%	3 4%	0 0%

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01 CONCEPT Molecular Theory & Factors

IN ONE LINE

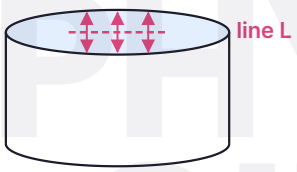
Surface molecules feel a net inward pull, so the surface behaves like a **stretched membrane** trying to shrink.

3.1.1 Intermolecular forces

Cohesive	Adhesive
same substance	different substances
two drops merge into one	water wets glass

- Their origin is electromagnetic. They do not obey the inverse square law.

3.1.2 What is surface tension?

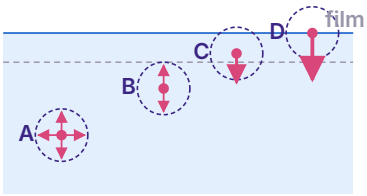


Force on either side of a line on the surface

$$T = \frac{F}{L}$$

- Force per unit length on either side of an imaginary line, along the surface and at right angles to the line.
- Unit: N m^{-1}, dyne cm^{-1}. Dimensions: $[MT^{-2}]$.
- A scalar, independent of the area of the surface.
- A small drop is spherical: least area for a given volume.

3.1.3 Molecular theory



Each circle is a sphere of influence

- **Molecular range**: the largest distance of attraction, about 10^{-9} m.
- **Sphere of influence**: sphere of that radius around a molecule.
- A, B (deep): pulled equally on all sides, net force zero.
- C (in the film): net downward force.
- D (on the surface): maximum downward force.
- Surface molecules have **maximum potential energy**, so the surface tends to shrink.

3.1.4 Effect of temperature

$$T_t = T_0(1 - \alpha t)$$

- T falls as temperature rises. Exception: molten copper and cadmium.
- At the critical temperature, T = 0.
- Hot soup tastes better.

3.1.5 Effect of impurities

Added	T
highly soluble (NaCl)	increases
sparingly soluble (phenol)	decreases
insoluble, soap, detergent	decreases

3.1.6 Everyday uses

- Soap lowers T of water: clothes clean easily, spraying is easier.
- Water does not wet grease: the angle of contact is obtuse.

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Solved Examples 01 Molecular Theory & Factors

SOLVED 1 MHT CET 2026 · 16 Apr · Shift 1

A liquid is at rest in a container. In a sphere of influence, the liquid molecule at its centre is

(a) attracted by other molecules in the sphere of influence
(b) attracted by other molecules outside sphere of influence
(c) repelled by other molecules outside the sphere of influence
(d) repelled by other molecules in the sphere of influence

STEP 1 Sphere of influence: radius = molecular range
STEP 2 Only molecules within this range act on the centre molecule
STEP 3 Attracted by molecules **in the sphere of influence**

Answer: **(a)**

SOLVED 2 MHT CET 2019 · 3 May · Shift 1

A molecule of water on the surface experiences a net

(a) downward resultant unbalanced adhesive force
(b) upward resultant unbalanced cohesive force
(c) downward resultant unbalanced cohesive force
(d) upward resultant unbalanced adhesive force

STEP 1 Upper half of its sphere has almost no water molecules
STEP 2 Attraction from like molecules below is not balanced
STEP 3 **Downward unbalanced cohesive force**

Answer: **(c)**

SOLVED 3 MHT CET 2024 · 16 May · Shift 2

On the surface of a liquid in equilibrium, molecules of the liquid possess

(a) maximum potential energy
(b) minimum potential energy
(c) maximum kinetic energy
(d) minimum kinetic energy

STEP 1 A molecule is pulled up to the surface against a net downward force
STEP 2 Work done is stored as potential energy
STEP 3 **Maximum potential energy**

Answer: **(a)**

SOLVED 4 MHT CET 2019 · 2 May · Shift 2

Which one of the following statements is correct?

(a) Surface energy is potential energy per unit length
(b) Surface tension is work done per unit area
(c) Surface tension is work done per unit length
(d) Surface energy is work done per unit force

STEP 1 $W = T \times \Delta A$
STEP 2 $T = \frac{W}{\Delta A}$
STEP 3 Surface tension is **work done per unit area**

Answer: **(b)**

SOLVED 5 MHT CET 2026 · 19 Apr · Shift 2

In most liquids, with rise in temperature, surface tension of liquid

(a) decreases
(b) increases
(c) remains unchanged
(d) first decreases and then increases

STEP 1 $T_t = T_0(1 - \alpha t)$
STEP 2 Cohesive forces weaken on heating
STEP 3 T **decreases**

Answer: **(a)**

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Solved Examples 01 Molecular Theory & Factors (contd.)

SOLVED 6 MHT CET 2023 · 10 May · Shift 2

At critical temperature, the surface tension of liquid is

(a) zero
(b) infinity
(c) unity
(d) same as that at any other temperature

STEP 1 At the critical temperature liquid and gas have equal intermolecular forces
STEP 2 No separate surface is left
STEP 3 T = **zero**

Answer: **(a)**

SOLVED 7 MHT CET 2026 · 19 May · Shift 2

Which is NOT TRUE? a. Soluble substance dissolved in water increases surface tension. b. Sparingly soluble substance mixed with water increases surface tension. c. Insoluble impurity added to water decreases surface tension. d. For molten copper or cadmium, surface tension increases with temperature.

(a) b (b) c
(c) a (d) d

STEP 1 Highly soluble (NaCl): T increases. a is true
STEP 2 Sparingly soluble (phenol): T decreases
STEP 3 Statement **b** is not true

Answer: **(a)**

SOLVED 8 MHT CET 2023 · 14 May · Shift 2

It is easier to spray water to which soap is added because addition of soap to water

(a) decreases surface tension of water
(b) increases surface tension of water
(c) makes surface tension of water zero
(d) increases its density

STEP 1 Spraying creates new surface area
STEP 2 Work = T × ΔA is smaller for smaller T
STEP 3 Soap **decreases surface tension**

Answer: **(a)**

SOLVED 9 JEE Main 2022 · 29 Jul · Shift 1

Assertion: Clothes containing oil or grease stains cannot be cleaned by water wash. Reason: The angle of contact between oil or grease and water is obtuse.

(a) Both true, R explains A
(b) Both true, R does not explain A
(c) A true, R false
(d) A false, R true

STEP 1 Grease spots cannot be removed by pure water
STEP 2 Obtuse angle means water does not wet grease
STEP 3 **Both true, R explains A**

Answer: **(a)**

SOLVED 10 MHT CET 2021 · 23 Sep · Shift 2

An ice cube of edge 1 cm melts in a gravity free container. The approximate surface area of water formed (a spherical drop) is

(a) $(36\pi)^{1/3}$ cm²
(b) $(24\pi)^{1/3}$ cm²
(c) $(28\pi)^{1/3}$ cm²
(d) $(12\pi)^{1/3}$ cm²

STEP 1 $\frac{4}{3}\pi r^3 = 1\ \text{cm}^3$ (no gravity: sphere)
STEP 2 $r = \left(\frac{3}{4\pi}\right)^{1/3}$
STEP 3 $4\pi r^2 = \mathbf{(36\pi)^{1/3}\ cm^2}$

Answer: **(a)**

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02 CONCEPT Force due to Surface Tension

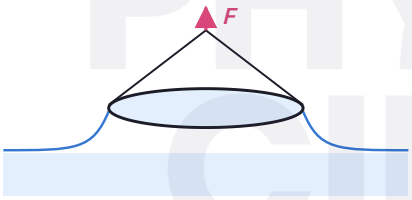
IN ONE LINE

Force = T × total length of contact with the liquid. Count **both sides** wherever the liquid touches both.

3.2.1 Force needed to lift a body

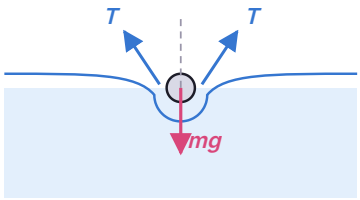
$$F = T \times (\text{length of contact}) + W$$

Body	Force
needle or wire, length l	2lT + W
thin ring, radius r	4πrT + W
hollow disc, r_1 and r_2	$2\pi(r_1 + r_2)T + W$
circular plate, radius r	2πrT + W
square frame, side l	8lT + W
square plate, side l	4lT + W



Lifting a ring out of the liquid

3.2.2 Floating needle, wire or coin



Vertical parts of T balance the weight

- A greased needle floats on water without breaking the surface.
- Wire of length L: $\pi r^2 L d g = 2LT$.

$$r_{max} = \sqrt{\left(\frac{2T}{\pi d g}\right)}$$

- Coin of radius r, thickness t: $\pi r^2 t \rho g = 2\pi r T$.

$$r_{max} = \frac{2T}{\rho g t}$$

- Disc with surface bent at θ to its edge: Weight = upthrust + 2πrT cos θ.

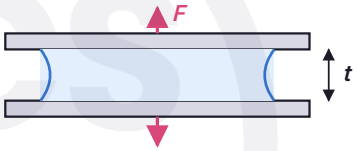
3.2.3 Soap film on a frame

- A film has **two** surfaces.
- Slider of length l supporting W: W = 2lT.
- A thread loop on a film turns circular when the film inside it is pierced.

3.2.4 Drop from a tube

$$W_{drop} = 2\pi r T$$

3.2.5 Water film between two plates

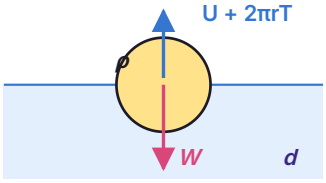


Plates are hard to pull apart

$$F = \frac{2AT}{t} = \frac{2A^2T}{V}$$

- t is the film thickness; volume V = At.

3.2.6 Drop half immersed



Weight = upthrust + surface tension force

$$\frac{4}{3}\pi r^3 \rho g = \frac{2}{3}\pi r^3 d g + 2\pi r T$$

$$r^2 = \frac{3T}{(2\rho - d)g}$$

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Solved Examples 02 Force due to Surface Tension

SOLVED 1 MHT CET 2026 · 15 Apr · Shift 2

A square frame of each side L is dipped in a soap solution and taken out. The force acting on the film formed is (T = surface tension)

(a) 4TL (b) 8TL
(c) 12TL (d) 16TL

STEP 1 Perimeter = 4L
STEP 2 A film has two surfaces
STEP 3 $F = 2 \times 4L \times T = \mathbf{8TL}$

Answer: **(b)**

SOLVED 2 MHT CET 2021 · 20 Sep · Shift 1

The force required to take away a flat circular plate of radius 2 cm from the surface of water is ($T = 70 \times 10^{-3}$ N m^{-1}, $\pi = \frac{22}{7}$)

(a) 4.4×10^{-4} N (b) 8.8×10^{-3} N
(c) 6.6×10^{-4} N (d) 11×10^{-3} N

STEP 1 Plate: contact along one circle
STEP 2 $F = 2\pi rT$
STEP 3 $= 2 \times (\frac{22}{7}) \times 0.02 \times 0.07 = \mathbf{8.8 \times 10^{-3}\ N}$

Answer: **(b)**

SOLVED 3 NEET 2024

A thin flat circular disc of radius 4.5 cm is placed gently over the surface of water. If surface tension of water is 0.07 N m^{-1}, the excess force required to take it away from the surface is

(a) 19.8 mN (b) 198 N
(c) 1.98 mN (d) 99 N

STEP 1 $F = 2\pi rT$
STEP 2 $= 2\pi \times 0.045 \times 0.07$
STEP 3 $= \mathbf{19.8\ mN}$

Answer: **(a)**

SOLVED 4 MHT CET 2021 · 22 Sep · Shift 2

A needle is 7 cm long. Assuming the needle is not wetted by water, what is the weight of the needle so that it floats? ($T = 70$ dyne cm^{-1}, $g = 980$ cm/s^2)

(a) 1 g wt (b) 5 g wt
(c) 3 g wt (d) 7 g wt

STEP 1 Two sides: $F = 2lT$
STEP 2 $F = 2 \times 7 \times 70 = 980$ dyne
STEP 3 980 dyne = **1 g wt**

Answer: **(a)**

SOLVED 5 MHT CET 2025 · 23 Apr · Shift 1

A disc of paper of radius R has a hole of radius r. It floats on a liquid of surface tension T. The force of surface tension on the disc is

(a) $2\pi T(R - r)$
(b) $2\pi T(R + r)$
(c) $3\pi TR$
(d) $4\pi T(R + r)$

STEP 1 Contact along both edges
STEP 2 Lengths: $2\pi R$ and $2\pi r$
STEP 3 $F = \mathbf{2\pi T(R + r)}$

Answer: **(b)**

SOLVED 6 MHT CET 2026 · 19 May · Shift 1

A metal wire of length L and density d rests horizontally on water. The maximum radius of the wire so that it does not sink is (T = surface tension)

(a) $\sqrt{(\frac{2dg}{\pi T})}$
(b) $\sqrt{(\frac{2T}{\pi dg})}$
(c) $\sqrt{(\frac{\pi dg}{2T})}$
(d) $\sqrt{(\frac{T}{\pi dg})}$

STEP 1 Weight = $\pi r^2 Ldg$
STEP 2 Balancing force = $2LT$
STEP 3 $r = \sqrt{(\frac{2T}{\pi dg})}$

Answer: **(b)**

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PHYSICS CIRCLE

SURFACE TENSION

ENERGY · EXCESS PRESSURE · CAPILLARITY

LEVEL 1 · EASY

Topic-wise Previous Year Questions

MHT CET · NEET · JEE Main

86	11	6
questions	concepts	topics

CONTENTS

01	Molecular Theory & Factors	Q 1–11	11 Qs
02	Force due to Surface Tension	Q 12–16	5 Qs
03	Surface Energy & Work Done	Q 17–20	4 Qs
04	Splitting & Merging of Drops	Q 21–36	16 Qs
05	Excess Pressure: Drops & Bubbles	Q 37–57	21 Qs
06	Angle of Contact & Capillarity	Q 58–86	29 Qs
	Answer key		

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TOPIC 01

Molecular Theory & Factors

11 PYQs · Easy 11 · Medium 0 · Difficult 0 | MHT CET 10 · NEET 0 · JEE 1

Concepts covered: Molecular theory & factors affecting surface tension (11)

LEVEL 1 · EASY 11 questions

1. In most liquids, with rise in temperature surface tension of liquid

MHT CET 2026 · 19 APR · SHIFT 2

(a) decreases
(b) increases
(c) remains unchanged
(d) first decreases and then increases

2. A liquid is at rest in a container. In a sphere of influence, the liquid molecule at its centre is

MHT CET 2026 · 16 APR · SHIFT 1

(a) attracted by other molecules in the sphere of influence.
(b) attracted by other molecules outside sphere of influence.
(c) repelled by other molecules outside the sphere of influence.
(d) repelled by other molecules in the sphere of influence.

3. On the surface of the liquid in equilibrium, molecules of the liquid possess

MHT CET 2024 · 16 MAY · SHIFT 2

(a) maximum potential energy.
(b) minimum potential energy.
(c) maximum kinetic energy.
(d) minimum kinetic energy.

4. In most liquids, with rise in temperature, surface tension of a liquid

MHT CET 2024 · 16 MAY · SHIFT 1

(a) first decreases and then increases.
(b) increases.
(c) decreases.
(d) remains unchanged.

5. It is easier to spray water to which soap is added because addition of soap to water

MHT CET 2023 · 14 MAY · SHIFT 2

(a) decreases surface tension of water
(b) increases surface tension of water.
(c) makes surface tension of water zero.
(d) increases its density.

6. The potential energy of a molecule on the surface of a liquid compared to the molecules inside the liquid is

MHT CET 2023 · 14 MAY · SHIFT 1

(a) zero (b) less (c) same (d) large

7. At critical temperature, the surface tension of liquid is

MHT CET 2023 · 10 MAY · SHIFT 2

(a) zero
(b) infinity
(c) unity
(d) same as that at any other temperature

8. The surface tension of most of the liquid decreases with rise in

MHT CET 2021 · 21 SEP · SHIFT 1

(a) viscosity of the liquid
(b) diameter of capillary
(c) temperature of the liquid
(d) density of the liquid

9. A molecule of water on the surface experiences a net

MHT CET 2019 · 3 MAY · SHIFT 1

(a) downward resultant unbalanced adhesive force
(b) upward resultant unbalanced cohesive force
(c) downward resultant unbalanced cohesive force
(d) upward resultant unbalanced adhesive force

10. Which one of the following statement is correct?

MHT CET 2019 · 2 MAY · SHIFT 2

(a) Surface energy is potential energy per unit length
(b) Surface tension is work done per unit area
(c) Surface tension is work done per unit length
(d) Surface energy is work done per unit force

11. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A): Clothes containing oil or grease stains cannot be cleaned by water wash. Reason (R): Because the angle of contact between the oil/grease and water is obtuse. In the light of the above statements, choose the correct answer from the option given below.

JEE MAIN 2022 · 29 JUL · SHIFT 1

(a) Both (A) and (R) are true and (R) is the correct explanation of (A)
(b) Both (A) and (R) are true but (R) is not the correct explanation of (A)
(c) (A) is true but (R) is false
(d) (A) is false but (R) is true

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TOPIC 02

Force due to Surface Tension

5 PYQs · Easy 5 · Medium 0 · Difficult 0 | MHT CET 3 · NEET 1 · JEE 1

Concepts covered: Force due to surface tension (5)

LEVEL 1 · EASY 5 questions

12. A square frame of each side L is dipped in a soap and taken out, the force acting on the film formed is (T = surface tension of soap solution)

MHT CET 2026 · 15 APR · SHIFT 2

(a) $4TL$ (b) $8TL$ (c) $12TL$ (d) $16TL$

13. The force required to take away a flat circular plate of radius $2\,\text{cm}$ from the surface of water is [Surface tension of water $= 70 \times 10^{-3}\text{Nm}^{-1}$, $\pi = \frac{22}{7}$]

MHT CET 2021 · 20 SEP · SHIFT 1

(a) 4.4×10^{-4} N (b) 8.8×10^{-3} N
(c) 6.6×10^{-4} N (d) 11×10^{-3} N

14. A square frame of each side L is dipped in a soap and taken out. The force acting on the film formed is (T = surface tension of soap solution)

MHT CET 2020 · 16 OCT · SHIFT 2

(a) $8TL$ (b) $2TL$
(c) $R = \left(R_1^3 + R_2^3\right)^{1/3}$ (d) 12 TL

15. A thin flat circular disc of radius $4.5\,\text{cm}$ is placed gently over the surface of water. If surface tension of water is $0.07\,\text{N m}^{-1}$, then the excess force required to take it away from the surface is

NEET 2024

(a) 19.8 mN (b) 198 N (c) 1.98 mN (d) 99 N

16. A thin liquid film formed between a U-shaped wire and a light slider supports a weight of 1.5×10^{-2} N (see figure). The length of the slider is 30 cm and its weight negligible. The surface tension of the liquid film is

AIEEE 2012



(a) 0.0125 Nm^{-1} (b) 0.1 Nm^{-1}
(c) 0.05 Nm^{-1} (d) 0.025 Nm^{-1}

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TOPIC 03

Surface Energy & Work Done

4 PYQs · Easy 4 · Medium 0 · Difficult 0 | MHT CET 4 · NEET 0 · JEE 0

Concepts covered: Blowing a soap bubble (2) · Soap film on a frame (2)

LEVEL 1 · EASY 4 questions

◆ Blowing a soap bubble 2 Qs

17. A soap bubble of radius $\frac{1}{\sqrt{\pi}}$ cm is expanded to radius $\frac{3}{\sqrt{\pi}}$ cm. Surface tension of soap is 25 dyne/cm. The work done during expansion in erg is

MHT CET 2026 · 17 APR · SHIFT 1

(a) 800 (b) 1200 (c) 1600 (d) 2400

18. Work done in increasing the size of a soap bubble from radius of 3 cm to 5 cm in millijoule is nearly (surface tension of soap $= 0.03\ \mathrm{Nm}^{-1}$)

MHT CET 2021 · 23 SEP · SHIFT 1

(a) 0.4π (b) 0.2π (c) 4π (d) 2π

◆ Soap film on a frame 2 Qs

19. Consider a soap film on a rectangular frame of wire of area $3 \times 3\ \mathrm{cm}^2$. If the area of the soap film is increased to $5 \times 5\ \mathrm{cm}^2$, the work done in the process will be (surface tension of soap is $2.5 \times 10^{-2}\ \mathrm{N/m}$)

MHT CET 2023 · 12 MAY · SHIFT 1

(a) 9×10^{-6} J (b) 16×10^{-6} J
(c) 40×10^{-6} J (d) 80×10^{-6} J

20. If the surface tension of a soap is $3 \times 10^{-2}\ \mathrm{N/m}$ then the work done in forming a soap film of $20\ \mathrm{cm} \times 5\ \mathrm{cm}$ will be

MHT CET 2020 · 19 OCT · SHIFT 2

(a) 6×10^{-2} J (b) 6 J
(c) 6×10^{-4} J (d) 6×10^{-3} J

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TOPIC 04

Splitting & Merging of Drops

16 PYQs · Easy 16 · Medium 0 · Difficult 0 | MHT CET 11 · NEET 0 · JEE 5

Concepts covered: Splitting a drop (7) · Merging drops (9)

LEVEL 1 · EASY 16 questions

◆ Splitting a drop 7 Qs

21. The energy needed for breaking a liquid drop of radius 'R' into 'n' droplets each of radius 'r' is [T = surface tension of the liquid]

MHT CET 2026 · 19 APR · SHIFT 2

(a) $4\pi TR^2\left[\frac{R}{r}-1\right]$ (b) $4\pi TR\left[\frac{R}{r}-1\right]$

(c) $4\pi T\left[\frac{R^2}{r^2}-1\right]$ (d) $4\pi T\left[1+\frac{R^3}{r}\right]$

22. A liquid drop having surface energy E is sprayed into 512 droplets of the same size. Then the final surface energy is

MHT CET 2026 · 11 APR · SHIFT 2

(a) $4E$ (b) $8E$ (c) $2E$ (d) E

23. A liquid drop having surface energy E is sprayed into 512 droplets of same size. The final surface energy is

MHT CET 2025 · 20 APR · SHIFT 2

(a) 12 E (b) 4 E (c) 8 E (d) 6 E

24. The surface energy of a liquid drop is ' V '. It is sprayed into 1000 equal droplets. The surface energy of all the droplets is

MHT CET 2025 · 20 APR · SHIFT 1

(a) V (b) 10 V (c) 100 V (d) 1000 V

25. A liquid drop having surface energy E is spread into 729 droplets of same size. The final surface energy of the droplets is

MHT CET 2025 · 20 APR · SHIFT 1

(a) 6 E (b) 9 E (c) E (d) 3 E

26. A liquid drop having surface energy ' E ' is spread into 512 droplets of same size. The final surface energy of the droplets is

MHT CET 2024 · 16 MAY · SHIFT 2

(a) 2 E (b) 4 E (c) 8 E (d) 12 E

27. The surface energy of a liquid drop is 'U'. It splits up into 512 equal droplets. The surface energy becomes

MHT CET 2021 · 20 SEP · SHIFT 2

(a) 8 U (b) 6 U (c) 4 U (d) 2 U

◆ Merging drops 9 Qs

28. 729 water droplets of equal radii combine to form a big drop. The ratio of final surface energy to the total initial surface energy is

MHT CET 2026 · 20 MAY · SHIFT 1

(a) 729 : 1 (b) 8 : 1 (c) 1 : 81 (d) 1 : 9

29. One thousand small water drops of equal radii combine to form a big drop. The ratio of final surface energy to the total initial surface energy is

MHT CET 2026 · 16 APR · SHIFT 2

(a) 1 : 1 (b) 1 : 10 (c) 1 : 100 (d) 1 : 1000

30. 1000 small water drops of equal size combine to form a big drop. The ratio of final surface energy to the total initial surface energy is

MHT CET 2023 · 14 MAY · SHIFT 2

(a) 10 : 1 (b) 1 : 10 (c) 1000 : 1 (d) 1 : 1000

31. Eight small drops of mercury each of radius 'r', coalesce to form a large single drop. The ratio of total surface energy before and after the change is

MHT CET 2023 · 12 MAY · SHIFT 2

(a) 2: 1 (b) 1: 1 (c) 1: 4 (d) 1: 8

32. Eight mercury drops, each of radius r, coalesce to form a bigger drop. The surface energy released in this process is ____ - (S is the surface tension of mercury).

JEE MAIN 2026 · 5 APR · SHIFT 2

(a) $8\pi r^2$ S (b) $16\pi r^2 S$ (c) $64\pi r^2 S$ (d) $4\pi r^2$ S

33. A big drop is formed by coalescing 1000 small droplets of water. The surface energy will become:

JEE MAIN 2024 · 1 FEB · SHIFT 2

(a) $\frac{1}{100}$ th (b) $\frac{1}{10}$ th

(c) 100 times (d) 10 times

34. Two small drops of mercury each of radius R coalesce to form a single large drop. The ratio of total surface energy before and after the change is:

JEE MAIN 2021 · 20 JUL · SHIFT 2

(a) $2^{\frac{1}{3}}:1$ (b) $1:2^{\frac{1}{3}}$ (c) 2: 1 (d) 1: 2

35. A big drop is formed by coalescing 1000 small droplets of water. The ratio of surface energy of 1000 droplets to that of energy of big drop is $\frac{10}{x}$. The value of x is _____.

JEE MAIN 2024 · 6 APR · SHIFT 1 *(Numerical)*

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36. A big drop is formed by coalescing 1000 small identical drops of water. If E_1 be the total surface energy of 1000 small drops of water and E_2 be the surface energy of single big drop of water, then $E_1 : E_2$ is $x : 1$ where $x =$ _____.

JEE MAIN 2024 · 30 JAN · SHIFT 2 ***(Numerical)***

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TOPIC 05

Excess Pressure: Drops & Bubbles

21 PYQs · Easy 21 · Medium 0 · Difficult 0 | MHT CET 14 · NEET 2 · JEE 5

Concepts covered: Excess pressure in a drop or bubble (17) · Bubbles combining or in contact (4)

LEVEL 1 · EASY 21 questions

◆ Excess pressure in a drop or bubble 17 Qs

37. A water drop is divided into 8 equal droplets. The pressure difference between the inner and outer side of the big drop will be

MHT CET 2026 · 15 MAY · SHIFT 1

(a) same as for smaller droplet
(b) half of that for smaller droplet
(c) $1^{th}\left(\frac{1}{4}\right)$ of that for smaller droplet
(d) twice that for smaller droplet

38. The excess pressure inside a soap bubble of radius 2.5 cm is 48 dyne/cm^2. The surface tension of soap in dyne /cm is

MHT CET 2026 · 20 APR · SHIFT 1

(a) 25 (b) 30 (c) 35 (d) 40

39. If the shape of the liquid surface is curved, then

MHT CET 2026 · 18 APR · SHIFT 2

(a) the pressure on convex side is equal to atmosphereic pressure.
(b) the pressure on the convex side is equal to pressure on concave side.
(c) the pressure on the concave side is greater than that on the convex side.
(d) the pressure on the concave side is lesser than that on the convex side.

40. Two soap bubbles, A and B, have radii in the ratio 3 : 2. The excess pressure inside the bubble A to that of B is in the ratio

MHT CET 2026 · 17 APR · SHIFT 2

(a) 2 : 3 (b) 3 : 2 (c) 1 : 5 (d) 4 : 9

41. A water drop is divided into 8 equal droplets. The pressure difference between the inner and outer side of the big drop will be

MHT CET 2024 · 16 MAY · SHIFT 2

(a) same as the smaller droplet.
(b) half of that for smaller droplet
(c) $\left(\frac{1}{4}\right)^{\text{th}}$ of that for smaller droplet.
(d) twice that for smaller droplet

42. What should be the diameter of a soap bubble, in order that the excess pressure inside it is 25.6 Nm^{-2}? [surface tension of soap $= 3 \cdot 2 \times 10^{-2}$ Nm^{-2}]

MHT CET 2023 · 11 MAY · SHIFT 2

(a) 2 cm (b) 1.5 cm (c) 1 cm (d) 0.5 cm

43. The excess pressure inside a soap bubble of radius 2 cm is 50 dyne/cm^2. The surface tension is

MHT CET 2022 · 11 AUG · SHIFT 2

(a) 50 dyne/cm (b) 60 dyne/cm
(c) 75 dyne/cm (d) 25 dyne/cm

44. A big water drop is divided into 8 equal droplets. ΔP_s and ΔP_B be the excess pressure inside a smaller and bigger drop respectively. The relation between ΔP_s and ΔP_B is

MHT CET 2021 · 21 SEP · SHIFT 2

(a) $\Delta P_B = \Delta P_S$ (b) $\Delta P_B = \frac{1}{2}\Delta P_S$
(c) $\Delta P_B = \frac{1}{4}\Delta P_S$ (d) $\Delta P_B = 2\Delta P_S$

45. What should be the radius of water drop so that excess pressure inside it is 72 Nm^{-2}? (The surface tension of water 7.2×10^{-2} Nm^{-1})

MHT CET 2021 · 20 SEP · SHIFT 2

(a) 1 mm (b) 2 mm (c) 8 mm (d) 4 mm

46. Air is pushed in a soap bubble to increase its radius from 'R' to '2R'. In this case, the pressure inside the bubble

MHT CET 2021 · 20 SEP · SHIFT 1

(a) does not change (b) decrease
(c) becomes zero (d) increases

47. The excess of pressure, due to surface tension, on a spherical liquid drop of radius ' R ' is proportional to

MHT CET 2019 · 2 MAY · SHIFT 2

(a) R^{-1} (b) R (c) R^{-2} (d) R^2

48. If a soap bubble expands, the pressure inside the bubble

NEET 2022 · PHASE 1

(a) Decreases
(b) Increases
(c) Remains the same
(d) Is equal to the atmospheric pressure

49. A soap bubble, having radius of 1 mm, is blown from a detergent having a surface tension of 2.5 × 10–2 N/m. The pressure inside the bubble equals the pressure at a point Z0 below the free surface of water in a container. Taking g = 10 m/s2, density of water = 103 kg/m3, the value of Z0 is:

NEET 2019

(a) 1 cm (b) 10 cm (c) 100 cm (d) 0.5 cm

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50. The excess pressure inside a soap bubble is thrice the excess pressure inside a second soap bubble. The ratio between the volume of the first and the second bubble is:

JEE MAIN 2024 · 9 APR · SHIFT 2

(a) 1 : 9 (b) 1 : 27 (c) 1 : 81 (d) 1 : 3

51. Pressure inside a soap bubble is greater than the pressure outside by an amount: (given: R = Radius of bubble, S = Surface tension of bubble)

JEE MAIN 2024 · 6 APR · SHIFT 2

(a) $\frac{S}{R}$ (b) $\frac{4\,\mathrm{S}}{\mathrm{R}}$ (c) $\frac{4\mathrm{R}}{\mathrm{S}}$ (d) $\frac{2S}{R}$

52. Pressure inside two soap bubbles are 1.01 and 1.02 atmosphere, respectively. The ratio of their volumes is:

JEE MAIN 2020 · 3 SEP · SHIFT 1

(a) 4: 1 (b) 8: 1 (c) 2: 1 (d) 0.8: 1

53. The excess pressure inside a liquid drop is 500 $\mathrm{Nm^{-}2}$. If the radius of the drop is 2 mm, the surface tension of liquid is $\mathrm{x} \times 10^{-}3\ \mathrm{Nm}^{-}1$. The value of x is _____.

JEE MAIN 2022 · 30 JUN · SHIFT 1 *(Numerical)*

◆ Bubbles combining or in contact 4 Qs

54. Under isothermal conditions, a single drop of radius R is formed from two mercury drops of radii R_1 and R_2. After combination, the relation between R, R_1 and R_2 is

MHT CET 2026 · 19 MAY · SHIFT 1

(a) $R = \frac{R_1 + R_2}{2}$ (b) $R^3 = R_1^3 + R_2^3$

(c) $R^2 = R_1^2 + R_2^2$ (d) $R = R_1 + R_2$

55. Let R_1, R_2 and R_3 be the radii of three mercury drops. A big mercury drop is formed from them under isothermal conditions. The radius of the resultant drop is

MHT CET 2025 · 26 APR · SHIFT 1

(a) $\left(R_1^3 + R_2^3 + R_3^3\right)^{\frac{1}{3}}$ (b) $\left(R_1^2 + R_2^3 - R_3^3\right)^{\frac{1}{3}}$

(c) $\left(R_1^3 + R_2^3 + R_3^3\right)$ (d) $\left(R_1 + R_2 + R_3\right)^3$

56. Let 'R_1' and 'R_2' are radii of two mercury drops. A big mercury drop is formed from them under isothermal conditions. The radius of the resultant drop is

MHT CET 2021 · 20 SEP · SHIFT 1

(a) $\sqrt{\mathrm{R}_1^2 + \mathrm{R}_2^2}$ (b) $\left(\mathrm{R}_1^3 + \mathrm{R}_2^3\right)^{\frac{1}{3}}$

(c) $\sqrt{\mathrm{R}_1^2 - \mathrm{R}_2^2}$ (d) $\frac{\mathrm{R}_1 + \mathrm{R}_2}{2}$

57. If two soap bubbles of different radii are connected by a tube

AIEEE 2004

(a) air flows from the smaller bubble to the bigger

(b) air flows from bigger bubble to the smaller bubble till the sizes are interchanged

(c) air flows from the bigger bubble to the smaller bubble till the sizes become equal

(d) there is no flow of air.

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TOPIC 06

Angle of Contact & Capillarity

29 PYQs · Easy 29 · Medium 0 · Difficult 0 | MHT CET 21 · NEET 2 · JEE 6

Concepts covered: Angle of contact & meniscus (8) · Capillary rise: h and r (19) · Capillary in changed g (moon, lift, mine) (2)

LEVEL 1 · EASY 29 questions

◆ Angle of contact & meniscus 8 Qs

58. The height of the liquid column raised in a capillary tube of certain radius when dipped in liquid A vertically is 5 cm. If the same tube is dipped in similar way in another liquid B of surface tension and density double the values of liquid A, the height of liquid column raised in liquid B is (Assume that angle of contact for both the liquids is almost same)

MHT CET 2026 · 12 MAY · SHIFT 2

(a) 0.20 m (b) 0.10 m (c) 0.05 m (d) 0.50 m

59. The liquid (mercury) meniscus in capillary tube will be convex if the angle of contact is

MHT CET 2025 · 5 MAY · SHIFT 2

(a) greater than 90° (b) less than 90°
(c) equal to 90° (d) equal to 0°

60. Two capillary tubes of same diameter are kept vertically in two liquids whose densities are in the ratio 4 : 3. If their surface tensions are in the ratio 6 : 5 , the ratio of heights $\left(\frac{h_1}{h_2}\right)$ of liquids in the two capillary tubes is (Their angle of contacts are same)

MHT CET 2025 · 21 APR · SHIFT 2

(a) $\frac{10}{7}$ (b) $\frac{9}{10}$ (c) $\frac{10}{9}$ (d) $\frac{1}{2}$

61. A capillary tube stands with its lower end dipped into liquid for which the angle of contact is 90°. The liquid will

MHT CET 2024 · 11 MAY · SHIFT 2

(a) neither rise nor fall.
(b) get depressed only.
(c) rise only.
(d) rise upto the top of the tube.

62. By adding soluble impurity in a liquid, angle of contact

MHT CET 2023 · 14 MAY · SHIFT 1

(a) decreases
(b) increases
(c) remains unchanged
(d) first increases and then decreases

63. The height of liquid column raised in a capillary tube of certain radius when dipped in liquid 'A' vertically is 5 cm. If the tube is dipped in a similar manner in another liquid 'B' of surface tension and density double the values of liquid 'A', the height of liquid column raised in liquid 'B' would be (Assume angle of contact same)

MHT CET 2023 · 10 MAY · SHIFT 1

(a) 0.20 m (b) 0.5 m (c) 0.05 m (d) 0.10 m

64. A liquid does not wet the solid surface if angle of contact is

NEET 2020 · PHASE 2

(a) zero (b) equal to 45°
(c) equal to 60° (d) greater than 90°

65. The wettability of a surface by a liquid depends primarily on

NEET 2013

(a) density
(b) angle of contact between the surface and the liquid
(c) viscosity
(d) surface tension

◆ Capillary rise: h and r 19 Qs

66. Water rises to a height of 2.2 cm in glass capillary tube. The height to which water will rise in another capillary having one-fourth area of cross-section as that of the first is.

MHT CET 2026 · 20 MAY · SHIFT 1

(a) 4.2 cm (b) 4.4 cm (c) 3.4 cm (d) 5.2 cm

67. Water rises up to a height h in a capillary tube on the surface of the earth. The value of h will increase, if the experimental set up is kept in (g = acceleration due to gravity)

MHT CET 2026 · 14 MAY · SHIFT 1

(a) a lift going upward with a certain acceleration
(b) accelerating train
(c) a satellite rotating close to earth
(d) a lift going down with acceleration less than 'g'

68. If we dip capillary tubes of different radii r_n in water and the water rises to different heights h_n in them, then ($n = 1, 2, 3$ .....)

MHT CET 2026 · 20 APR · SHIFT 2

(a) $\frac{}{r_n^2} = {}^{h_n}$ constant (b) $\frac{}{r_n} = {}^{h_n}$ constant
(c) $h_n r_n^2 =$ constant (d) $h_n r_n =$ constant

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69. In a capillary tube of area of cross-section 'a' water rises to height 'h'. To what height will water rise in a capillary tube of area of cross-section $4a$?

MHT CET 2026 · 17 APR · SHIFT 1

(a) $\frac{h}{4}$ (b) $\frac{h}{2}$ (c) $2h$ (d) $4h$

70. Water rises to a height 3 cm in a capillary tube. If cross-sectional area of capillary tube is reduced to $1/3^{rd}$ of its initial area then water will rise to a height of

MHT CET 2026 · 15 APR · SHIFT 1

(a) $3\sqrt{3}$ cm (b) $\sqrt{3}$ cm (c) 9 cm (d) 3 cm

71. In a capillary tube of area of cross-section 'a' water rises to height ' h '. To what height will water rise in a capillary tube of area of cross-section $4a$?

MHT CET 2025 · 25 APR · SHIFT 1

(a) 4 h (b) 2 h (c) $\frac{h}{2}$ (d) $\frac{h}{4}$

72. A liquid rises to a height of 2.4 cm in a glass capillary P. Another glass capillary Q having diameter 80% of capillary P is immersed in the same liquid. The rise of liquid in capillary Q is

MHT CET 2025 · 19 APR · SHIFT 1

(a) 2.4 cm (b) 3.4 cm (c) 3 cm (d) 2.5 cm

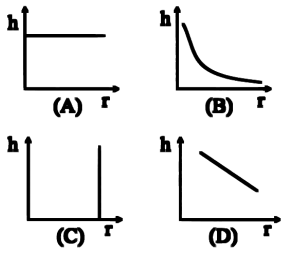
73. Two capillary tubes A and B of the same internal diameter are kept vertically in two different liquids whose densities are in the ratio $4:3$. If the surface tensions of these two liquids are in the ratio $6:5$, then the ratio of rise of liquid in capillary A to that in B is (assume their angles of contact are nearly equal)

MHT CET 2024 · 15 MAY · SHIFT 1

(a) 10 : 9 (b) 9 : 10 (c) 7 : 10 (d) 10 : 7

74. Identify the correct figure which shows the relation between the height of water column in a capillary tube and the capillary radius.

MHT CET 2024 · 4 MAY · SHIFT 2



(a) (B) (b) (D) (c) (A) (d) (C)

75. Water rises to a height of 2 cm in a capillary tube. If cross-sectional area of the tube is reduced to $\frac{1}{16}^{\text{th}}$ of initial area then water will rise to a height of

MHT CET 2021 · 23 SEP · SHIFT 1

(a) 4 cm (b) 8 cm (c) 12 cm (d) 16 cm

76. In a capillary tube having area of cross-section A, water rises to a height 'h'. If cross-sectional area is reduced to $\frac{4}{9}$, the rise of water in the capillary tube is

MHT CET 2021 · 21 SEP · SHIFT 2

(a) 3h (b) 9h (c) h (d) 6h

77. Water rises upto a height h in a capillary tube on the surface of the earth. The value of h will increase, if the experimental setup is kept in [g = acceleration due to gravity]

MHT CET 2020 · 19 OCT · SHIFT 2

(a) a lift going upward with a certain acceleration
(b) accelerating train
(c) a satellite rotating close to earth
(d) a lift going down with acceleration $a < g$

78. Two capillary tubes of different diameters are dipped in water. The rise of water is

MHT CET 2019 · 2 MAY · SHIFT 1

(a) zero in both the tubes.
(b) same in both the tubes.
(c) more in the tube of larger diameter.
(d) more in the tube of smaller diameter.

79. Given below are two statements:

Statement I: When a capillary tube is dipped into a liquid, the liquid neither rises nor falls in the capillary. The contact angle may be 0°.

Statement II: The contact angle between a solid and a liquid is a property of the material of the solid and liquid as well.

In the light of the above statement, choose the correct answer from the options given below.

JEE MAIN 2024 · 5 APR · SHIFT 1

(a) Statement I is true and Statement II is false
(b) Statement I is false but Statement II is true
(c) Both Statement I and Statement II are true
(d) Both Statement I and Statement II are false

80. Given below are two statements:

Statement I: The contact angle between a solid and a liquid is a property of the material of the solid and liquid as well.

Statement II: The rise of a liquid in a capillary tube does not depend on the inner radius of the tube. In the light of the above statements, choose the correct answer from the options given below:

JEE MAIN 2024 · 4 APR · SHIFT 2

(a) Both Statement I and Statement II are false.
(b) Both Statement I and Statement II are true.
(c) Statement I is false but Statement II is true.
(d) Statement I is true but Statement II is false.

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81. Given below are two statements:

Statement I: If a capillary tube is immersed first in cold water and then in hot water, the height of capillary rise will be smaller in hot water.

Statement II: If a capillary tube is immersed first in cold water and then in hot water, the height of capillary rise will be smaller in cold water.

In the light of the above statements, choose the most appropriate from the options given below

JEE MAIN 2024 · 29 JAN · SHIFT 1

(a) Both Statement I and Statement II are false
(b) Both Statement I and Statement II are true
(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true

82. The height of liquid column raised in a capillary tube of certain radius when dipped in liquid A vertically is, 5 cm. If the tube is dipped in a similar manner in another liquid B of surface tension and density double the values of liquid A, the height of liquid column raised in liquid B would be _____ m.

JEE MAIN 2023 · 30 JAN · SHIFT 1

(a) 0.05 (b) 0.20 (c) 0.5 (d) 0.10

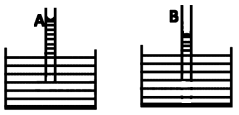
83. Wax is coated on the inner wall of a capillary tube and the tube is then dipped in water. Then, compared to the unwaxed capillary, the angle of contact θ and the height h upto which water rises change. These changes are:

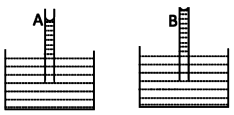
JEE MAIN 2013 · 23 APR · SHIFT 1

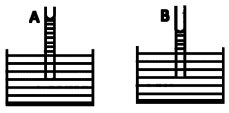
(a) θ increases and h also increases
(b) θ decreases and h also decreases
(c) θ increases and h decreases
(d) θ decreases and h increases

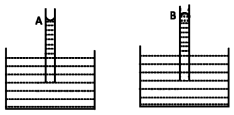
84. A capillary tube (A) is dipped in water. Another identical tube (B) is dipped in a soap-water solution. Which of the following shows the relative nature of the liquid columns in the two tubes?

AIEEE 2008

(a) 

(b) 

(c) 

(d) 

◆ Capillary in changed g (moon, lift, mine) 2 Qs

85. A capillary tube is taken from the earth to the surface of the moon. The rise of the liquid column on the moon (acceleration due to gravity on earth is 6 times that of the moon) is

MHT CET 2026 · 15 MAY · SHIFT 2

(a) 6 times that of earth's surface
(b) $\frac{1}{6}$ that on the earth's surface
(c) equal to that on the earth's surface
(d) zero

86. A capillary tube is taken from earth's surface to moon's surface. The rise of liquid column on the moon's surface is (acceleration due to gravity on the earth's surface is six times that of moon's surface)

MHT CET 2025 · 22 APR · SHIFT 1

(a) zero.
(b) six times that on the earth's surface.
(c) equal to that on the earth's surface.
(d) $\left(\frac{1}{6}\right)^{\text{th}}$ that on the earth's surface.

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ANSWER KEY

Shaded by level: **Easy**

01 Molecular Theory & Factors

1. (a)	2. (a)	3. (a)	4. (c)	5. (a)	6. (d)	7. (a)	8. (c)	9. (c)	10. (b)
11. (a)									

02 Force due to Surface Tension

12. (b)	13. (b)	14. (a)	15. (a)	16. (d)					

03 Surface Energy & Work Done

17. (c)	18. (a)	19. (d)	20. (c)						

04 Splitting & Merging of Drops

21. (a)	22. (b)	23. (c)	24. (b)	25. (b)	26. (c)	27. (a)	28. (d)	29. (b)	30. (b)
31. (a)	32. (b)	33. (b)	34. (a)	35. 1	36. 10				

05 Excess Pressure: Drops & Bubbles

37. (b)	38. (b)	39. (c)	40. (a)	41. (b)	42. (c)	43. (d)	44. (b)	45. (b)	46. (b)
47. (a)	48. (a)	49. (a)	50. (b)	51. (b)	52. (b)	53. 500	54. (b)	55. (a)	56. (b)
57. (a)									

06 Angle of Contact & Capillarity

58. (c)	59. (a)	60. (b)	61. (a)	62. (a)	63. (c)	64. (d)	65. (b)	66. (b)	67. (d)
68. (d)	69. (b)	70. (a)	71. (c)	72. (c)	73. (b)	74. (b)	75. (b)	76. (a)	77. (d)
78. (d)	79. (b)	80. (d)	81. (c)	82. (a)	83. (c)	84. (c)	85. (a)	86. (b)	

Note: *"Bonus" = no option is correct as the question is printed (dropped in the official key). Numerical questions show the numerical answer.*

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