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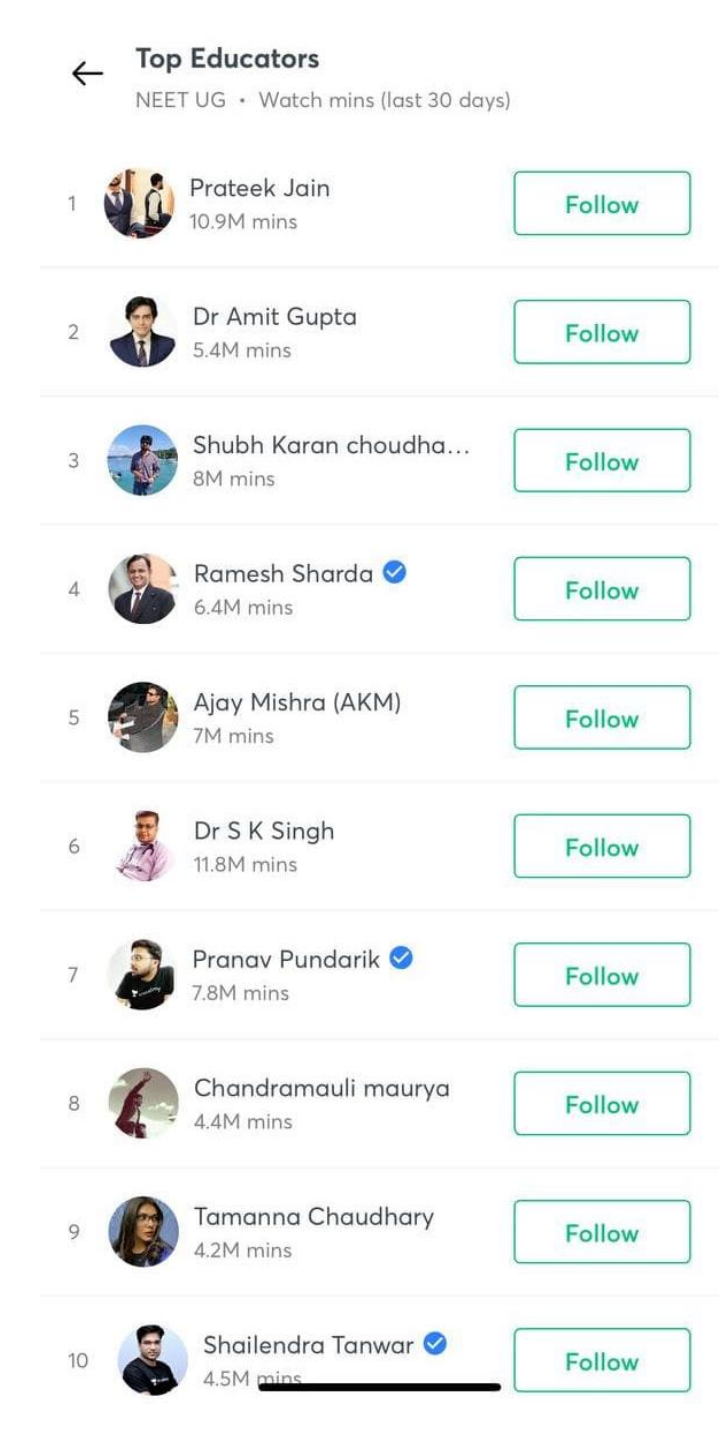

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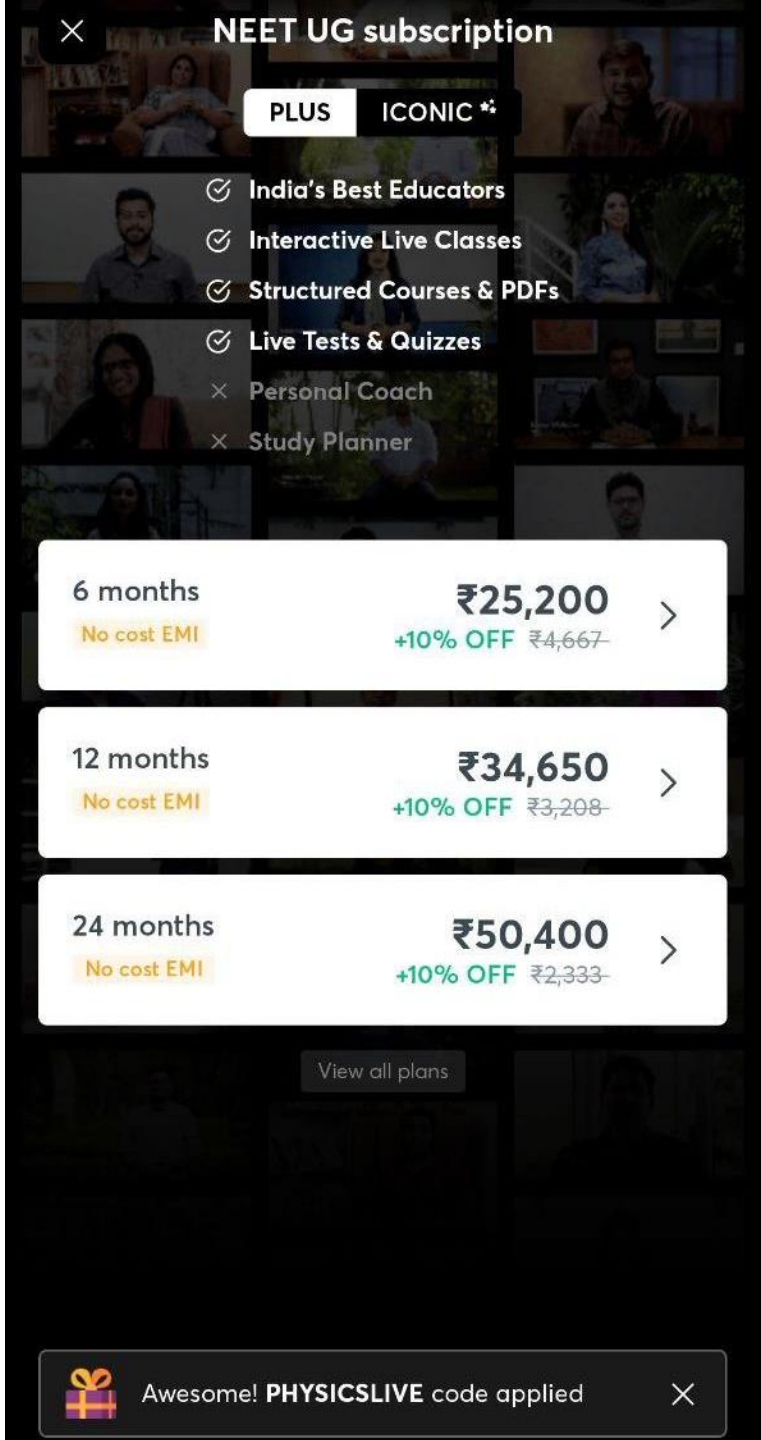

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NEET
Physics DPP

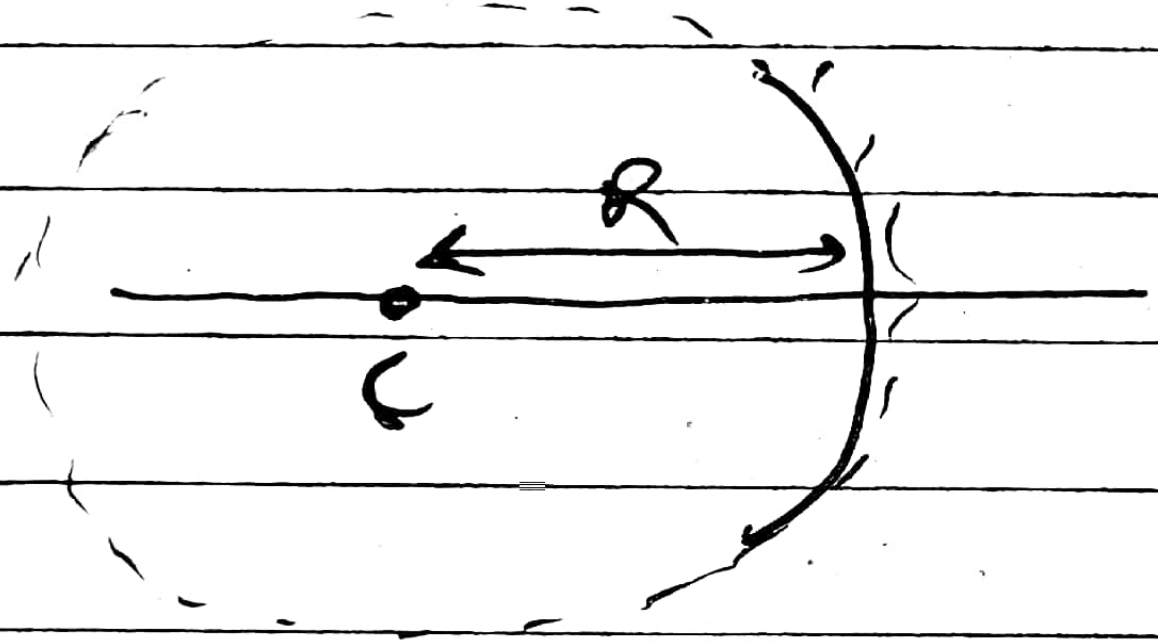
DPP-3 Spherical Mirrors

By PRATEEK JAIN SIR

Q) The centre of sphere of which the reflecting surface of a spherical mirror is a part is called?

(a) Pole
(b) Aperture
(c) Radius of curvature
(d) Centre of curvature

Ans. d



C = Centre of curvature.

Q) An object is placed 60 cm from a spherical convex mirror. If the mirror forms a virtual image 20 cm from the mirror, what's the magnitude of the mirror's radius of curvature?

(a) 120 cm
(b) 60 cm
(c) 30 cm
(d) 15 cm

Ans. b

$u = -60\,cm$.

$v = +20\,cm$.

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{20} + \frac{1}{-60} = \frac{1}{f} \Rightarrow \frac{1}{f} = \frac{60-20}{20\times 60}$$

$$\frac{1}{f} = \frac{40}{1200} \Rightarrow \boxed{f = +30\,cm}$$

$$\boxed{R = 2f = 60\,cm}$$

Q) The position of the image of 1 cm tall object which is placed 8 cm in front of a concave mirror of radius of curvature 24 cm is:

(a) 24 cm (b) 25 cm (c) 26 cm (d) 27 cm

Ans. a

Concave Mirror:

$|R| = 24\,cm.$

$f = -\left(\frac{R}{2}\right) = -\left(\frac{24}{2}\right)$

$f = -12\,cm$

$u = -8\,cm.$

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

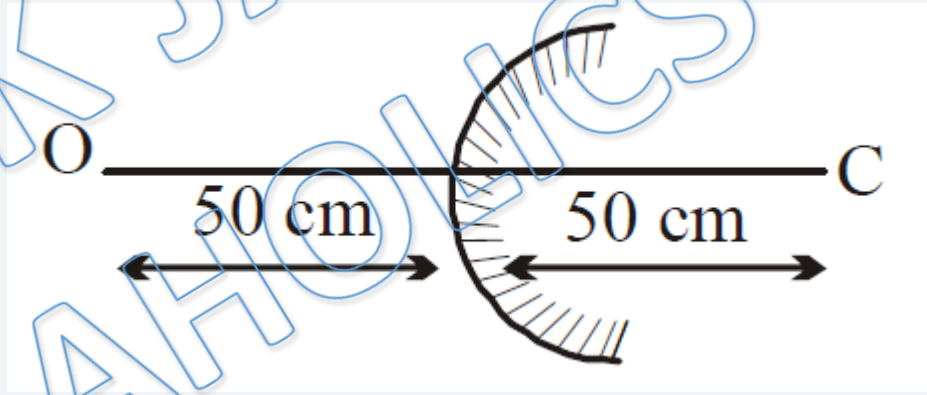
$\frac{1}{v} + \frac{1}{-8} = \frac{1}{-12}$

$\frac{1}{v} = \frac{1}{8} - \frac{1}{12} = \frac{3}{24} - \frac{2}{24}$

$\frac{1}{v} = \frac{1}{24}$

$\boxed{v = 24\,cm}$

Q) There is a convex mirror of radius 50 cm. The image of a point at a distance 50 cm from the pole of mirror on its axis will be formed at :



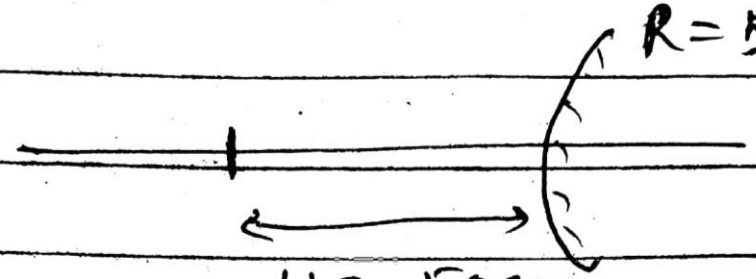
(a) infinity

(b) pole

(c) focus

(d) 16.67 cm behind the mirror

Ans. d



$$f = \frac{R}{2} = \frac{50}{2} = 25\,cm.$$

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} + \frac{1}{-50} = \frac{1}{25}$$

$$\frac{1}{v} = \frac{1}{25} + \frac{1}{50}$$

$$\frac{1}{v} = \frac{3}{50}$$

$$v = \frac{50}{3}\,cm.$$

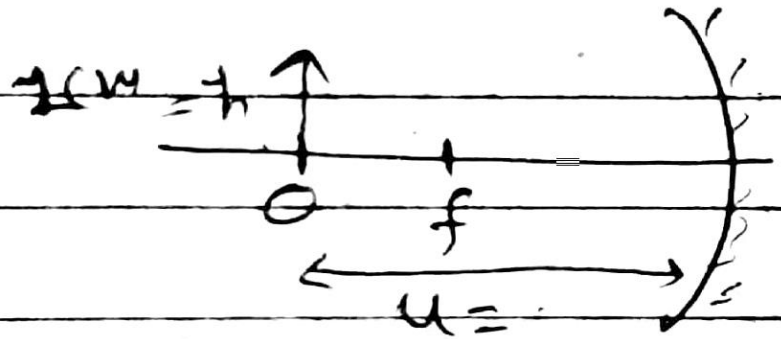
$$\boxed{v = 16.67\,cm}$$

Q) An object of length 1 cm is placed at a distance of 15 cm from a concave mirror of focal length 10 cm. The nature and size of the image are

(a) real, inverted, 1.0 cm (b) real, inverted, 2.0 cm

(c) virtual, erect, 0.5 cm (d) virtual, erect, 1.0 cm

Ans. b



$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} + \frac{1}{-15} = \frac{1}{-10}$$

$$f = -10\text{cm}.$$

$$\frac{1}{v} = \frac{1}{-10} + \frac{1}{15}$$

$$\frac{1}{v} = -\frac{3}{30} + \frac{2}{30}$$

$$\boxed{v = -30\text{cm}} \quad (\text{R.I})$$

$(\because v = -ve)$

Now, $m = \frac{-v}{u}$

$$m = -\left(\frac{-30}{-15}\right)$$

$$\boxed{m = -2}$$

(Inverted and) $\left|\frac{h_I}{h_O}\right| = 2 \Rightarrow \boxed{h_I = 2\text{cm}}$

Q) The relation between the linear magnification m, the object distance u and the focal length f for a spherical mirror is

(a) $m = \frac{f-u}{f}$

(b) $m = \frac{f}{f-u}$

(c) $m = \frac{f+u}{f}$

(d) $m = \frac{f}{f+u}$

Ans. b

$$m = -\frac{v}{u}$$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

[Multiply eq^n by 'u']

$$\Rightarrow \frac{u}{f} = \frac{u}{v} + 1$$

$$\Rightarrow \frac{u}{v} = \frac{u}{f} - 1 \Rightarrow \frac{u}{v} = \frac{u-f}{f}$$

$$\Rightarrow \frac{v}{u} = \frac{f}{u-f} \Rightarrow \frac{-v}{u} = \frac{f}{f-u}$$

$$\Rightarrow \boxed{m = \frac{-v}{u} = \frac{f}{f-u}}$$

Q) The focal length of a concave mirror is 30cm. Find the distance of the object from the pole in front of the mirror, so that the image is real and three times the size of the object?

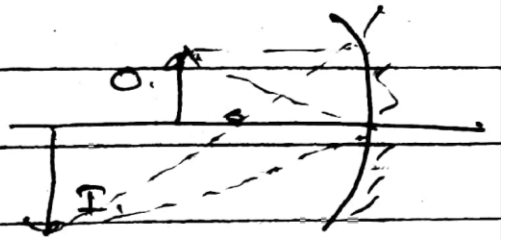
(a) 40cm
(b) 30cm
(c) 50cm
(d) None of these

Ans. a

Concave mirror!

$f = -30\,cm.$

$|m| = 3$



for real Image.

$m = -3$

$\frac{-v}{u} = -3$

$\boxed{v = 3u}$

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$\frac{1}{3u} + \frac{1}{u} = \frac{1}{-30}$

$\frac{4}{3u} = -\frac{1}{30}$

$\frac{3u}{4} = -30$

$\boxed{u = -40cm}$

$\boxed{|u| = 40cm}$

Q) A Convex mirror of focal length f forms an image which is $\frac{1}{n}$ times the object. The distance of the object from the mirror is:

(a) $(n-1)f$

(b) $\frac{(n-1)}{n}f$

(c) $\frac{(n+1)}{n}f$

(d) $(n+1)f$

Ans. a

focal length = f

$$m = \frac{1}{n}$$

$$-\frac{v}{u} = \frac{1}{n}$$

$$v = -\frac{u}{n}$$

⇒ Now

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{\left(\frac{-u}{n}\right)} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{-n}{u} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1-n}{u} = \frac{1}{f}$$

$$u = (1-n)f$$

or $u = -(n-1)f$

distance $= |u| = |-(n-1)f|$

$= (n-1)f$

Q) The focal length of concave mirror is 50cm. Where an object be placed in front of the mirror so that its image is two times and inverted?

(a) 70cm (b) 50cm

(c) 75cm (d) 60cm

Ans. c

Concave Mirror: $f = -50cm$

$m = -2$ (∵ inverted image)

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$m = -\frac{v}{u} = -2$$

$$v = 2u$$

$$\frac{1}{2u} + \frac{1}{u} = \frac{1}{-50}$$

$$\frac{3}{2u} = \frac{-1}{50} \Rightarrow$$

$$u = -75\,cm$$

$$|u| = 75\,cm$$

Q) An object (0.40m height) is placed in front of a concave mirror of focal length 0.60 m. A sharp image forms on a screen placed 0.90 m in front of the mirror. What is the height of the image formed by the mirror?

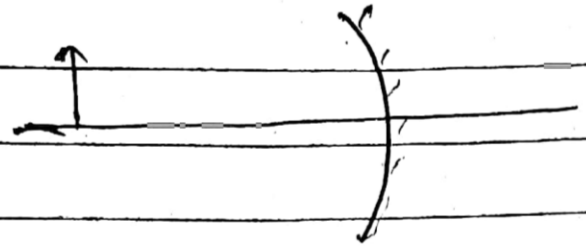
(a) 0.020m

(b) -2m

(c) -0.20m

(d) 20m

Ans. c



$f = -0.60\ m,$

$h_o = 0.40\ m,$

$v = -0.90\ m,$

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{-0.9} + \frac{1}{u} = \frac{1}{-0.6}$$

$$\frac{1}{u} = \frac{1}{0.9} - \frac{1}{0.6}$$

$$\frac{1}{u} = \frac{0.6 - 0.9}{0.9 \times 0.6}$$

$$u = \frac{0.9 \times 0.6^2}{-0.3}$$

$$\boxed{u = -1.8\ m}$$

$$\boxed{u = -1.8\ m}$$

$$m = \frac{-v}{u} = \frac{h_I}{h_o}$$

$$h_I = -\frac{v}{u} h_o$$

$$= -\left(\frac{-0.9}{-1.8}\right)(0.40)$$

$$= -\left(\frac{1}{2}\right)(0.40)$$

$$\boxed{h_I = -0.20\ m.}$$

Q) A candle is placed in front of a convex mirror of focal length 8.0cm. The mirror forms a virtual image 3.0cm behind it. Find magnification of the candle's image produced by the mirror?

(a) 0.63

(b) 1.63

(c) 1

(d) 2

Ans. a

Convex Mirror:

$f = +8$ cm.

for virtual image

$V = +3$ cm.

$$\frac{1}{V} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{3} + \frac{1}{u} = \frac{1}{8}$$

$$\frac{1}{u} = \frac{1}{8} - \frac{1}{3}$$

$$\frac{1}{u} = \frac{3-8}{3\times 8} = \frac{-5}{3\times 8}$$

$$u = -\frac{24}{5}$$

$$m = -\frac{V}{u} = +\left(\frac{3}{24/5}\right)$$

$$m = +\left(\frac{5\times 3}{24}\right)$$

$$m = 0.625$$

$$m \simeq 0.63$$

Q) If a man's face is 30 cm in front of a concave shaving mirror creating an upright image 1.5 times as large as the object, what is the magnitude of mirror's focal length?

(a) 12 cm

(b) 18cm

(c) 90 cm

(d) 20 cm

Ans. c

Concave Mirror:

$u = -30\ cm.$

$m = +1.5$

$-\frac{v}{u} = +1.5$

$-v = 1.5u$

$-v = 1.5(-30)$

$\boxed{v = +45\ cm}$

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$\frac{1}{f} = \frac{1}{45} + \frac{1}{-30} = \frac{1}{45} - \frac{1}{30}$

$\frac{1}{f} = \frac{30-45}{30\times45} = \frac{-15}{30\times45}$

$f = -\frac{30\times45}{15}$

$f = -90\ cm.$

$\boxed{|f| = 90\ cm}$

Q) A concave mirror having a radius of curvature 40 cm is placed in front of an illuminated point source at a distance of 30 cm from it. Find the location of the image?

(a) 60 cm from the mirror in front of the mirror

(b) 60 cm from the mirror behind the mirror

(c) 30 cm from the mirror on the side of the object

(d) 30 cm from the mirror behind the mirror

Ans. a

Concave mirror:

$|R| = 40\,cm.$

$\therefore f = -20\,cm.$

$u = -30\,cm.$

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} + \frac{1}{-30} = \frac{1}{-20}$$

$$\frac{1}{v} = \frac{1}{30} - \frac{1}{20} = \frac{2}{60} - \frac{3}{60}$$

$$\frac{1}{v} = -\frac{1}{60}$$

$$\boxed{v = -60\,cm}$$

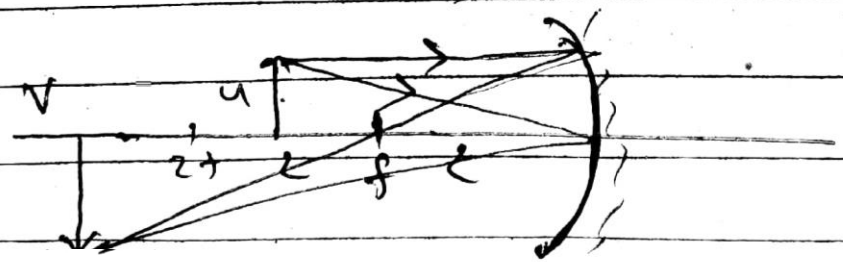


Image is in front of the mirror

Chalo Niklo