001

```
a   a   a   a   a
a   a   a   a   a
a   a   a   a   a
a   a   a   a   a
a   a   a   a   a
a   a   a   a   a
a   a   a   a   a
a a a a a
```

002

```
b   b   b   b   b
b   b   b   b   b
b   b   b   b   b
b   b   b   b   b
b   b   b   b   b
b   b   b   b   b
b   b   b   b   b
b b b b b
```

003

```
a b
a a a b a   a b a a b   a b a b a   b a a a b   b a b b b
a a a b a   b b a b a   a b b b b   a a b a a   b a a a b
a a b a b   a b b a a   a b a a a   b b a b a   b b b a b
b a a b a   b a b a a   b a b a b   b a a a b   a a a b b
```

004

```
c   c   c   c   c
c   c   c   c   c
c   c   c   c   c
c   c   c   c   c
c   c   c   c   c
c   c   c   c   c
c   c   c   c   c
c c c c c
```

005

```
d   d   d   d   d
```

```
d  d  d  d  d
d  d  d  d  d
d  d  d  d  d
d  d  d  d  d
d  d  d  d  d
d  d  d  d  d
d d d d
```

006

```
a b c d
b d b d b   b d c a c   c c d d d   a a b a c   a a b b d
c d c b a   c a d d b   c b a c b   c c b c a   c b c a d
a d a d a   c a a c c   d a d a c   b a d a c   b c c b c
c b c a d   b a d a d   a c b a b   c d a d a   c b a b c
```

007

```
e   e   e   e   e
e   e   e   e   e
e   e   e   e   e
e   e   e   e   e
e   e   e   e   e
e   e   e   e   e
e   e   e   e   e
e e e e
```

008

```
f   f   f   f   f
f   f   f   f   f
f   f   f   f   f
f   f   f   f   f
f   f   f   f   f
f   f   f   f   f
f   f   f   f   f
f f f f
```

009

```
a b c d e f
b d a f b   e d b c e   b c a f f   c e a e f   b b e b e
c e f e e   c d f f b   b a e f d   e e e c a   a e f a f
a a e a e   f a e d f   b a c e e   a f e f d   f d e a b
c a a e f   d f a c e   a e f a e   d f b a c   e e a f e
```

010

```
g   g   g   g   g
g   g   g   g   g
g   g   g   g   g
g   g   g   g   g
g   g   g   g   g
g   g   g   g   g
g   g   g   g   g
g g g g g
```

011

```
h   h   h   h   h
h   h   h   h   h
h   h   h   h   h
h   h   h   h   h
h   h   h   h   h
h   h   h   h   h
h   h   h   h   h
h h h h h
```

012

```
a b c d e f g h
c d f h a   b c g e g   g c c a a   e e g d h   e b c a g
c h h a b   g d f h e   a f a g e   c a g f e   a f d d g
c g c d d   a b f a f   f f a d d   h b a g b   c a g f e
a f d d g   c g c d b   a b f a f   c f a d d   h b a g b
```

013

```
i   i   i   i   i
i   i   i   i   i
i   i   i   i   i
i   i   i   i   i
i   i   i   i   i
i   i   i   i   i
i   i   i   i   i
i i i i i
```

014

```
j  j  j  j  j
j  j  j  j  j
j  j  j  j  j
j  j  j  j  j
j  j  j  j  j
j  j  j  j  j
j  j  j  j  j
j j j j j
```

015

```
a b c d e f g h i j
c j c i f  d a g e c  g i i f e  c i d c a  i b a j a
c j d g a  a a d g j  b a h e h  d i a j e  d h j c g
c a a b d  e f a d g  f b b a b  h i e d c  j c i f d
a g e c g  i i f e c  i d c a i  b a j a c  j d g a a
```

016

```
k  k  k  k  k
k  k  k  k  k
k  k  k  k  k
k  k  k  k  k
k  k  k  k  k
k  k  k  k  k
k  k  k  k  k
k k k k k
```

017

```
l  l  l  l  l
l  l  l  l  l
l  l  l  l  l
l  l  l  l  l
l  l  l  l  l
l  l  l  l  l
l  l  l  l  l
l l l l l
```

018

```
a b c d e f g h i j k l
d j j e c  f j a k d  g i f l j  b i h i c  a e i e k
h e b e h  i d c i c  i e a k h  g a h a a  k d k j j
k e l e h  a d d h d  c d h d l  b h i a f  j e a f j
a k d g i  f l j b i  h d c a e  g e k h e  b e h i d
```

019

```
m   m   m   m   m
m   m   m   m   m
m   m   m   m   m
m   m   m   m   m
m   m   m   m   m
m   m   m   m   m
m   m   m   m   m
m m m m
```

020

```
n   n   n   n   n
n   n   n   n   n
n   n   n   n   n
n   n   n   n   n
n   n   n   n   n
n   n   n   n   n
n   n   n   n   n
n n n n
```

021

```
a b c d e f g h i j k l m n
d n j l j  g h h b a  i m l g d  e l l d d  d b n l k
a j b l f  b e a b h  g d n i c  m n d d m  n l d i g
m e d k g  n a f l g  k g a n h  a m f g e  d k g n a
f l g k g  a n h m c  m n d d m  n l d i g  m a m f g
```

022

```
o   o   o   o   o
o   o   o   o   o
o   o   o   o   o
o   o   o   o   o
o   o   o   o   o
o   o   o   o   o
o   o   o   o   o
o o o o o
```

023

```
p   p   p   p   p
```

```
p  p  p  p  p
p  p  p  p  p
p  p  p  p  p
p  p  p  p  p
p  p  p  p  p
p  p  p  p  p
p  p  p  p
```

024

```
a b c d e f g h i j k l m n o p
e c k e c  h e a f m  k c c p l  g p a n f  h n c d k
h a b d d  j f m h m  d a o f m  e o n g l  c g j f b
o j o e f  i d c d l  n i a k i  n h e a g  d p j f d
e k l b e  h m n l p  c h n b p  p h a o l  m k a h j
```

025

```
q  q  q  q  q
q  q  q  q  q
q  q  q  q  q
q  q  q  q  q
q  q  q  q  q
q  q  q  q  q
q  q  q  q  q
q  q  q  q
```

026

```
r  r  r  r  r
r  r  r  r  r
r  r  r  r  r
r  r  r  r  r
r  r  r  r  r
r  r  r  r  r
r  r  r  r  r
r r r r
```

027

```
a b c d e f g h i j k l m n o p q r
f m n n r  k c g p c  i m b b p  c i g d h  l k e m e
q k m d k  f m l c a  m a h i a  d h h j a  r q c l o
d l n o a  h o e c c  d n m r g  f i h p f  d k c f l
i m b p i  m a f g q  f j l g r  h l b b q  g h n q o
```

```
028
```

```
s   s   s   s   s
s   s   s   s   s
s   s   s   s   s
s   s   s   s   s
s   s   s   s   s
s   s   s   s   s
s   s   s   s   s
s s s s s
```

```
029
```

```
t   t   t   t   t
t   t   t   t   t
t   t   t   t   t
t   t   t   t   t
t   t   t   t   t
t   t   t   t   t
t   t   t   t   t
t t t t
```

```
030
```

```
a b c d e f g h i j k l m n o p q r s t
f l e e m   n s q f d   i m n i d   b g m m k   p q r c a
h t j r c   r s j d f   g i n s t   g n a n m   j i b d t
q t n b f   a l k k o   p s c e e   o d n k j   n j f k l
b t l o k   k h d l q   d j r i l   h a m d l   i j c n q
```

```
031
```

```
u   u   u   u   u
u   u   u   u   u
u   u   u   u   u
u   u   u   u   u
u   u   u   u   u
u   u   u   u   u
u   u   u   u   u
u u u u u
```

```
032
```

```
v   v   v   v   v
```

```
v  v  v  v  v
v  v  v  v  v
v  v  v  v  v
v  v  v  v  v
v  v  v  v  v
v  v  v  v  v
v v v v
```

033

```
a b c d e f g h i j k l m n o p q r s t u v
g r e a t  g q d p t  s s k e t  t k i b m  v s f b p
g k e p b  k e g m k  s c m e l  h l b s m  d k r c t
g c a u q  q f e d f  q o e a a  n a t r m  u p n n r
k c a b c  b o s a q  e v i n t  m r u s k  f t o g u
```

034

```
w  w  w  w  w
w  w  w  w  w
w  w  w  w  w
w  w  w  w  w
w  w  w  w  w
w  w  w  w  w
w  w  w  w  w
w w w w
```

035

```
x  x  x  x  x
x  x  x  x  x
x  x  x  x  x
x  x  x  x  x
x  x  x  x  x
x  x  x  x  x
x  x  x  x  x
x x x x
```

036

```
g j b q r  l o m f g  q k k h x  o a q j p  c n h m g
s a t q k  d n e f p  i b b i t  g a p w w  x x h k n
n d u k j  p u g c r  c v u h v  a b b p l  v g e o e
q c j u f  g w g p p  h a e u v  x a w a q  t o i q d
```

037

```
y   y   y   y   y
y   y   y   y   y
y   y   y   y   y
y   y   y   y   y
y   y   y   y   y
y   y   y   y   y
y   y   y   y   y
y y y y y
```

038

```
z   z   z   z   z
z   z   z   z   z
z   z   z   z   z
z   z   z   z   z
z   z   z   z   z
z   z   z   z   z
z   z   z   z   z
z z z z z
```

039

```
a b c d e f g h i j k l m n o p q r s t u v w x y z
z e b r a  z e r o s  v y l a r  y l v b t  j u d x j
e f z v m  n l x y a  f h t k a  x r h d a  v n c k r
y a y c w  o y w h o  e y v m q  k e j y f  n u m j g
y z b w c  j l z c n  s o e y v  m q k j y  f n l x y
```

040

```
WA WA  Ms Ms  my my  AL AL  FL FL
DE DE  an an  go go  is is  DC DC
IL IL  to to  PM PM  be be  MD MD
is is  MD MD  in in  St St  ad ad
in in  my my  NM NM  Mr Mr  of of
it it  as as  at at  TV TV  SD SD
OK OK  NJ NJ  NJ NJ  me me  do do
ND ND  if if  WI WI  me me  ha ha
SC SC  or or  MI MI  NY NY  us us
or or  Dr Dr  NM NM  MD MD  MD MD
is is  do do  it it  TX TX  Mr Mr
my my  ND ND  of of  AK AK  Dr Dr
ND ND  re re  OK OK  NY NY  in in
```

```
NM NM  MT MT  FM FM  TV TV  St St
AK AK  WI WI  WA WA  FL FL  to to
ad ad  my my  by by  to to  ad ad
SC SC  NH NH  ad ad  pa pa  go go
AL AL  AC AC  PM PM  on on  on on
my my  if if  DC DC  ND ND  DC DC
UK UK  OK OK  pa pa  at at  am am
PM PM  re re  MD MD  is is  NH NH
we we  no no  Mr Mr  NY NY  go go
by by  AC AC  ha ha  it it  GM GM
TV TV  if if  GM GM  TV TV  FM FM
```

041

```
is is  at at  do do  us us  DE DE
NC NC  on on  MT MT  do do  on on
up up  AL AL  DC DC  TV TV  OK OK
Ms Ms  no no  hi hi  me me  MI MI
TX TX  up up  FM FM  to to  am am
DE DE  OK OK  FM FM  PM PM  WI WI
if if  no no  ha ha  my my  MT MT
at at  MT MT  FL FL  MD MD  UK UK
SD SD  OK OK  at at  is is  re re
hi hi  no no  MD MD  up up  NJ NJ
on on  TV TV  of of  SC SC  ad ad
GM GM  OK OK  TV TV  go go  by by
TV TV  Dr Dr  re re  go go  if if
WA WA  AK AK  Dr Dr  go go  of of
GM GM  AL AL  AK AK  or or  ad ad
SC SC  NC NC  ha ha  on on  ha ha
us us  NC NC  no no  MI MI  SC SC
WA WA  DC DC  TV TV  be be  AC AC
of of  on on  PM PM  up up  PM PM
SD SD  MT MT  we we  in in  us us
```

042

```
cub  cub   net  net   she  she   elm  elm   got  got
yea  yea   ran  ran   zig  zig   ohm  ohm   Rex  Rex
did  did   jam  jam   boo  boo   GMT  GMT   leg  leg
Kay  Kay   jar  jar   pea  pea   had  had   rip  rip
her  her   eve  eve   sir  sir   jay  jay   Jim  Jim
jab  jab   ice  ice   Amy  Amy   hip  hip   bet  bet
lit  lit   Gil  Gil   tin  tin   ant  ant   Amy  Amy
Kay  Kay   end  end   tin  tin   mix  mix   ale  ale
```

```
map   map    wax   wax    tie   tie    don   don    box   box
gel   gel    tap   tap    ale   ale    you   you    FCC   FCC
one   one    mew   mew    gum   gum    ion   ion    now   now
icy   icy    bop   bop    oar   oar    vet   vet    air   air
odd   odd    USA   USA    Ike   Ike    set   set    fed   fed
owl   owl    hug   hug    ham   ham    alp   alp    men   men
jay   jay    Joe   Joe    are   are    put   put    Lou   Lou
vee   vee    tow   tow    sir   sir    nor   nor    Feb   Feb
```

043

```
bet   bet    lee   lee    Tim   Tim    hoe   hoe    log   log
car   car    kid   kid    lip   lip    law   law    wet   wet
fur   fur    men   men    ape   ape    out   out    boy   boy
bed   bed    cub   cub    ACS   ACS    try   try    hop   hop
fin   fin    fed   fed    Roy   Roy    run   run    rip   rip
men   men    did   did    Rex   Rex    jar   jar    sir   sir
all   all    flu   flu    red   red    had   had    Sam   Sam
dub   dub    vee   vee    spy   spy    and   and    bit   bit
wet   wet    gum   gum    why   why    lad   lad    age   age
hub   hub    jet   jet    pea   pea    nut   nut    toe   toe
dim   dim    ion   ion    leg   leg    dad   dad    our   our
bag   bag    bid   bid    for   for    oak   oak    Dow   Dow
lad   lad    lot   lot    fan   fan    Gus   Gus    tap   tap
cub   cub    way   way    hen   hen    fat   fat    fan   fan
NYC   NYC    add   add    day   day
```

044

```
bus   bus    pod   pod    mad   mad    ray   ray    fin   fin
ion   ion    guy   guy    red   red    hum   hum    gin   gin
fry   fry    oaf   oaf    Jim   Jim    add   add    yea   yea
Len   Len    Pam   Pam    set   set    Los   Los    off   off
pow   pow    dug   dug    spy   spy    cam   cam    peg   peg
bud   bud    lab   lab    bud   bud    rat   rat    you   you
egg   egg    try   try    why   why    tax   tax    buy   buy
web   web    map   map    pop   pop    Ron   Ron    toe   toe
aim   aim    bug   bug    tin   tin    met   met    leg   leg
ACM   ACM    lad   lad    lad   lad    Ben   Ben    own   own
hey   hey    dim   dim    see   see    sad   sad    mop   mop
hop   hop    Tim   Tim    tad   tad    hat   hat    don   don
bun   bun    hey   hey    bun   bun    vat   vat    ore   ore
bin   bin    sir   sir    sea   sea    sub   sub    old   old
was   was    run   run    kid   kid    mop   mop    eve   eve
```

045

```
Mary Mary   bowl bowl   clad clad   gulf gulf   weak weak
Pete Pete   ammo ammo   gage gage   Ajax Ajax   each each
Kent Kent   east east   glad glad   step step   atom atom
aide aide   crab crab   acid acid   city city   blue blue
edge edge   dear dear   babe babe   Anna Anna   Asia Asia
coal coal   dash dash   Greg Greg   cola cola   Dave Dave
look look   skip skip   coal coal   wire wire   care care
bear bear   diet diet   look look   dime dime   deck deck
vent vent   text text   crow crow   vote vote   even even
seen seen   cafe cafe   loud loud   axle axle   stop stop
well well   void void   watt watt   Jose Jose   John John
fall fall   bell bell   Acts Acts   Jeff Jeff   boot boot
coat coat   bike bike   send send   cool cool   gage gage
plus plus   deep deep   also also   only only   five five
send send   bend bend   lend lend   mend mend   tend tend
```

046

```
one
1 1 1 1 1   1 1 1 1 1   1 1 1 1 1   1 1 1 1 1
1 1 1 1 1   1 1 1 1 1   1 1 1 1 1   1 1 1 1 1
1 1 1 1 1   1 1 1 1 1   1 1 1 1 1   1 1 1 1 1
1 1 1 1 1   1 1 1 1 1   1 1 1 1 1   1 1 1 1 1
1 1 1 1 1   1 1 1 1 1   1 1 1 1 1   1 1 1 1 1
1 1 1 1 1   1 1 1 1 1   1 1 1 1 1   1 1 1 1 1
```

047

```
k1oji k1lh  k1ts  ak1h  k1eec a1zp
a1fa  ag1n  a1pl  wh1z  wb1l  w1yx
k1dx  az1e  np1g  a1ruz nv1q  w1luo

w1tr  k1dut n1op  k1vq  w1jpk ko1d
w1ue  nl1f  w1yfu n1vcp a1jua k1zfg
k1rzz no1t  kw1m  kk1s  a1fg  kx1m

a1rl  kg1a  n1hw  k1qfa wx1f  a1au
kx1g  k1gns w1yen n1iph w1vjd n1lh
a1kfp kk1n  a1qe  nr1w  nd1f  kw1e
```

048

```
two
2 2 2 2 2   2 2 2 2 2   2 2 2 2 2   2 2 2 2 2
```

```
2 2 2 2 2   2 2 2 2 2   2 2 2 2 2   2 2 2 2 2
2 2 2 2 2   2 2 2 2 2   2 2 2 2 2   2 2 2 2 2
2 2 2 2 2   2 2 2 2 2   2 2 2 2 2   2 2 2 2 2
2 2 2 2 2   2 2 2 2 2   2 2 2 2 2   2 2 2 2 2
2 2 2 2 2   2 2 2 2 2   2 2 2 2 2   2 2 2 2 2
```

049

```
a2dqc n2rre n2acr n2xl  k2obn a2hye
w2yfy wx2g  wz2i  w2eh  k2evc n2ca
k2cl  k2kr  wy2s  n2av  wv2i  ng2c
a2gmv n2qze wq2v  aw2e  n2yud wl2p
n2omu kd2c  w2hy  a2ri  kt2z  k2ix
a2mjw a2hnz n2pjy a2rd  k2flu n2fms
w2dr  ai2n  k2qab nz2l  k2frz a2nnl
w2woy a2uwq as2c  n2sfg k2trl nt2b
```

```
1 1 2 1 2 2 1 2 1 2 2 2 1 1
```

050

```
three
3 3 3 3 3   3 3 3 3 3   3 3 3 3 3   3 3 3 3 3
3 3 3 3 3   3 3 3 3 3   3 3 3 3 3   3 3 3 3 3
3 3 3 3 3   3 3 3 3 3   3 3 3 3 3   3 3 3 3 3
3 3 3 3 3   3 3 3 3 3   3 3 3 3 3   3 3 3 3 3
3 3 3 3 3   3 3 3 3 3   3 3 3 3 3   3 3 3 3 3
3 3 3 3 3   3 3 3 3 3   3 3 3 3 3   3 3 3 3 3
```

051

```
nk3r  wj3q  wu3l  k3mz  a3bfx a3sh
at3y  n3cki kc3b  a3qw  w3lxp w3lva
k3kf  k3bgf n3czi a3rfa k3eo  n3vi
wv3q  k3kp  a3erv ko3f  ns3e  w3mln
kl3x  wj3u  wf3b  a3vek kt3j  nu3b
a3st  a3tx  a3lt  wt3r  wt3i  kq3h
n3vwm ku3r  w3fc  a3cyu n3rs  w3jf
kq3v  n3sw  k3ay  wu3e  a3pp  a3gh
```

```
1 2 3 2 1 3 3 1 1 2 1 3 3 2 2
```

052

```
four
4 4 4 4 4   4 4 4 4 4   4 4 4 4 4   4 4 4 4 4
4 4 4 4 4   4 4 4 4 4   4 4 4 4 4   4 4 4 4 4
4 4 4 4 4   4 4 4 4 4   4 4 4 4 4   4 4 4 4 4
4 4 4 4 4   4 4 4 4 4   4 4 4 4 4   4 4 4 4 4
4 4 4 4 4   4 4 4 4 4   4 4 4 4 4   4 4 4 4 4
4 4 4 4 4   4 4 4 4 4   4 4 4 4 4   4 4 4 4 4
```

053

```
n4rrx n4wb  k4ir  a4rl  ki4e
k4xv  w4ngg a4if  aq4w  w4ysh
nc4f  k4qat ay4h  n4bxb a4zg
k4hkp k4wx  n4sgn n4pu  ko4g
wd4k  nk4s  ne4c  wt4r  a4svx
kl4k  n4brv a4ldy w4auy k4kp
ns4w  an4p  a4mbr ki4n  ny4k
n4zd  a4nvv w4le  n4gr  k4ufq
```

```
1 2 3 4 1 1 2 4 3 4 2 1 3 2 1
```

054

```
five
5 5 5 5 5   5 5 5 5 5   5 5 5 5 5   5 5 5 5 5
5 5 5 5 5   5 5 5 5 5   5 5 5 5 5   5 5 5 5 5
5 5 5 5 5   5 5 5 5 5   5 5 5 5 5   5 5 5 5 5
5 5 5 5 5   5 5 5 5 5   5 5 5 5 5   5 5 5 5 5
5 5 5 5 5   5 5 5 5 5   5 5 5 5 5   5 5 5 5 5
5 5 5 5 5   5 5 5 5 5   5 5 5 5 5   5 5 5 5 5
```

055

```
au5n  w5vtc w5jqp wc5q  ax5y
n5pg  ww5x  w5hz  aa5c  wq5d
124 124 455 252 453 443 214 444 415 243 351 135 122 145 154 415 313
125 513 133 235 353 244 513 114 522 313 113 441 533 113 312 423 154
```

056

```
six
6 6 6 6 6   6 6 6 6 6   6 6 6 6 6   6 6 6 6 6
6 6 6 6 6   6 6 6 6 6   6 6 6 6 6   6 6 6 6 6
6 6 6 6 6   6 6 6 6 6   6 6 6 6 6   6 6 6 6 6
6 6 6 6 6   6 6 6 6 6   6 6 6 6 6   6 6 6 6 6
6 6 6 6 6   6 6 6 6 6   6 6 6 6 6   6 6 6 6 6
6 6 6 6 6   6 6 6 6 6   6 6 6 6 6   6 6 6 6 6
```

057

```
ng6g  na6t  nc6e  a6mgu k6mtq
a6syr a6kbl w6xr  a6hnl nf6q
n6vpx a6of  k6to  n6mzz n6zww
a6ga  nf6z  a6xts kx6r  w6oq
w6xoe w6ub  a6nj  w6no  n6qzx
wx6x  ne6b  n6mnj k6tn  k6fh
n6pqm n6trw a6wr  aw6c  n6wl
n6sr  n6wnc wk6v  w6wg  k6yh
1 2 3 4 5 6 153 253 155 624 341 632
```

058

```
seven
7 7 7 7 7  7 7 7 7 7  7 7 7 7 7  7 7 7 7 7
7 7 7 7 7  7 7 7 7 7  7 7 7 7 7  7 7 7 7 7
7 7 7 7 7  7 7 7 7 7  7 7 7 7 7  7 7 7 7 7
7 7 7 7 7  7 7 7 7 7  7 7 7 7 7  7 7 7 7 7
7 7 7 7 7  7 7 7 7 7  7 7 7 7 7  7 7 7 7 7
7 7 7 7 7  7 7 7 7 7  7 7 7 7 7  7 7 7 7 7
```

059

```
kq7l  a7dn  k7rl  k7bnm nl7o
wv7q  ko7m  w7kl  k7iim a7aon
k7dk  a7rv  k7uu  n7wvv w7yuc
n7jt  w7qsk km7q  wz7q  w7hju
ad7m  n7ui  k7rs  a7bag k7qy
n7fo  k7tlc a7zvm nm7p  n7cmc
wu7k  al7b  n7zam w7nmc k7taf
n7hhx a7qeo n7tu  a7ly  nw7b
a7yr  k7qh  wt7f  a7ewt k7cpz
kx7e  w7ml  ns7n  kb7c  a7uvy
```

060

```
eight
8 8 8 8 8  8 8 8 8 8  8 8 8 8 8  8 8 8 8 8
8 8 8 8 8  8 8 8 8 8  8 8 8 8 8  8 8 8 8 8
8 8 8 8 8  8 8 8 8 8  8 8 8 8 8  8 8 8 8 8
8 8 8 8 8  8 8 8 8 8  8 8 8 8 8  8 8 8 8 8
8 8 8 8 8  8 8 8 8 8  8 8 8 8 8  8 8 8 8 8
8 8 8 8 8  8 8 8 8 8  8 8 8 8 8  8 8 8 8 8
```

061

```
k8pul az8d   no8l   kv8s   w8bnh
a8khg a8rmq  wv8k   k8uab  n8xuw
at8i  k8js   nn8j   kk8j   wy8n
k8nk  kh8m   wq8y   kj8r   ao8a
n8zd  nv8m   a8we   nc8q   k8zqm
w8khr wj8z   k8uk   k8mi   k8hxt
aj8j  a8xmq  ky8z   k8xb   ko8i
np8i  n8sq   w8lcu  k8hjk  k8pm
n8ff  a8xj   ae8h   w8ub   ny8h
kj8m  wp8o   a8lhx  wg8s   a8nn
```

062

```
nine
9 9 9 9 9   9 9 9 9 9   9 9 9 9 9   9 9 9 9 9
9 9 9 9 9   9 9 9 9 9   9 9 9 9 9   9 9 9 9 9
9 9 9 9 9   9 9 9 9 9   9 9 9 9 9   9 9 9 9 9
9 9 9 9 9   9 9 9 9 9   9 9 9 9 9   9 9 9 9 9
9 9 9 9 9   9 9 9 9 9   9 9 9 9 9   9 9 9 9 9
9 9 9 9 9   9 9 9 9 9   9 9 9 9 9   9 9 9 9 9
```

063

```
kt9z   am9z   ny9t   a9mvc  n9zmj
ad9h   kk9t   k9pqi  wb9u   a9zr
n9xyk  w9ek   kp9x   w9vw   k9jn
a9xmb  nb9j   al9y   we9q   n9ktx
k9sa   wp9h   n9gy   a9zbz  a9oc
wx9u   w9ex   k9wur  np9h   n9gy
n9kx   a9hz   nz9a   kb9q   a9yhx
w9wso  nn9s   n9vuq  n9lqo  n9oih
k9kdl  nv9d   n9jp   a9bn   a9gna
w9qsl  w9db   w9sr   a9qom  a9omw
```

064

```
zero
0 0 0 0 0   0 0 0 0 0   0 0 0 0 0   0 0 0 0 0
0 0 0 0 0   0 0 0 0 0   0 0 0 0 0   0 0 0 0 0
0 0 0 0 0   0 0 0 0 0   0 0 0 0 0   0 0 0 0 0
0 0 0 0 0   0 0 0 0 0   0 0 0 0 0   0 0 0 0 0
0 0 0 0 0   0 0 0 0 0   0 0 0 0 0   0 0 0 0 0
0 0 0 0 0   0 0 0 0 0   0 0 0 0 0   0 0 0 0 0
```

065

```
kv0o  au0x  kl0r  w0ug  wc0e
a0nz  kj0i  n0eh  k0ho  n0rf
219 141 794 319 503 894 306 898 718 856 037 113 976 049 624 131 127
696 673 610 651 647 263 760 608 787 610 791 031 396 173 953 526 299
```

066

```
cq cq de wh8s wh8s k
cq cq de w9bcr w9bcr k
cq cq de n5sj n5sj k
cq cq de ky2y ky2y k
cq cq de n8hip n8hip k
cq cq de kr5c kr5c k
cq cq de k4gc k4gc k
cq cq de k7xx k7xx k
cq cq de kg7q kg7q k
cq cq de nc0r nc0r k
cq cq de ae6s ae6s k
cq cq de a3dm a3dm k
cq cq de n9cb n9cb k
cq cq de w6fbp w6fbp k
cq cq de k3fmh k3fmh k
cq cq de a5ozn a5ozn k
cq cq de n1dmi n1dmi k
```

067

```
cq cq de k3vg k3vg k
k3vg de av6d av6d k

cq cq de wq8e wq8e  k
wq8e de n5zre n5zre k

cq cq de w2grw w2grw k
w2grw de nc4p  nc4p  k

cq cq de kw5s  kw5s  k
kw5s de a6up  a6up  k

cq cq de w6mcz w6mcz k
w6mcz de k4rpg k4rpg k

cq cq de a9da  a9da  k
```

```
a9da de a6en  a6en  k

cq cq de w7lc  w7lc  k
w7lc de at1g  at1g  k

cq cq de kg8c  kg8c k
kg8c de w3xzv w3xzv k
```

068

```
comma
```

```
, , , , ,   , , , , ,   , , , , ,
, , , , ,   , , , , ,   , , , , ,
, , , , ,   , , , , ,   , , , , ,
, , , , ,   , , , , ,   , , , , ,
, , , , ,   , , , , ,   , , , , ,
```

069

```
period
```

```
. . . . .   . . . . .   . . . . .
. . . . .   . . . . .   . . . . .
. . . . .   . . . . .   . . . . .
. . . . .   . . . . .   . . . . .
. . . . .   . . . . .   . . . . .
```

070

```
qth hr is wink, tx.
qth hr is dallas, tx.
qth hr is houston, tx.
qth hr is detroit, mi.
qth hr is seattle, wa.
qth hr is boston, ma.
qth hr is miami, fl.
qth hr is miami, oh.
qth hr is denver, co.
qth hr is las vegas, nv.
qth hr is
paris, france.
qth hr is
phoenix, az.
```

071

```
name hr is carol carol.
name hr is steve steve.
name hr is bob bob.
name hr is chuck chuck.
name hr is doug doug.
name hr is harry harry.
name hr is eve eve.
name hr is harv harv.
name hr is ben ben.
name hr is ken ken.
name hr is
ralph ralph.
name hr is
jeff jeff.
```

072

```
rig hr is tentec tentec.
rig hr is yaesu yaesu.
rig hr is kenwood kenwood.
rig hr is knwd knwd.
rig hr is elecraft elecraft.
rig hr is heathkit heathkit.
rig hr is norcal norcal.
rig hr is homebrew homebrew.
rig hr is hb hb.
rig hr is collins collins.
```

073

```
wx hr is clear clear.
wx hr is cloudy cloudy.
wx hr is cldy cldy.
wx hr is rainy rainy.
wx hr is snowing snowing.
wx hr is windy windy.
wx hr is cold cold.
wx hr is dry dry.
wx hr is hot hot.
wx hr is wet es cold.
wx hr is hot es dry.
```

074

```
ur rst is 599 599.
ur rst is 579 579.
ur rst is 569 569.
ur rst is 559 559.
ur rst is 339 339.
ur rst is 589 589.
ur rst is 579 579 wid qsb.
ur rst is 559 559 wid qrm.
ur rst is 559 559 wid qrn fm local storm.
```

075

```
ant hr is dipole.
ant hr is 3 el yagi.
ant hr is inv vee.
ant hr is vertical.
ant hr is vee beam.
ant hr is g5rv dipole.
ant hr is long wire.
ant hr is rhombic.
ant hr is loop.
ant hr is 40m dipole up 10 mtrs.
```

076

```
question mark

? ? ? ? ?   ? ? ? ? ?   ? ? ? ? ?
? ? ? ? ?   ? ? ? ? ?   ? ? ? ? ?
? ? ? ? ?   ? ? ? ? ?   ? ? ? ? ?
? ? ? ? ?   ? ? ? ? ?   ? ? ? ? ?

who?  who?  what?  what?  where?  where?
when?  when?  why?  why?  how?  how?
```

077

```
cq cq cq de k7qo k7qo k7qo k

cq cq cq de k7qo k7qo k7qo k

k7qo k7qo de kl7ja kl7ja k

kl7ja kl7ja de k7qo  r  tu fer call om.
ur rst is 589 589 hr in prescott, az  prescott, az.
```

name hr is chuck chuck. so hw cpy? kl7ja de k7qo k

k7qo de kl7ja r tu chuck fer report fm az.
ur rst is 559 559 hr in juno, ak juno, ak.
name is leo leo. so bk to u chuck. k7qo de kl7ja k

kl7ja de k7qo fb leo and tnx fer sig rpt fm ak.
wx hr is cool and windy. temp is 52 f 52 f.
rig is tentec corsair 1 running 5w to a vee beam up 10 mtrs.
hw is signal holding leo? kl7ja de k7qo k

k7qo de kl7ja fb agn chuck. wx hr is cold and snowing.
temp is 10 f 10 f wid 1 meter of snow and more falling.
rig is elecraft k2 running 5w to a 3 element yagi at 15 mtrs.
band sounds like it is closing so will say 73 fer now. 73
gl es gn fm ak. c u agn chuck. <sk> k7qo de kl7ja ee

kl7ja de k7qo fb leo and tnx fer qso. ur my first kl7 on
this band so qsl sure via buro. 73 gl es gn fm az. cul <sk> kl7ja de k7qo ee

078

cq cq de k2lu k2lu k

k2lu de k7un k7un k

k7un de k2lu tu fer call   ur rst 559 559
in albany ny name is mary so hw? k7un de k2lu k

de k7un r ok mary es ga   ur rst 599 599
qth reno nv es name is bill
bk to u mary k2lu de k7un k

de k2lu solid cpy bill es tnx fer report
rig is tentec corsair running abt 50 wts   ant is
dipole up at 55 ft   wx is clear es temp abt 60 deg f
bk to u bill k7un de k2lu k

de k7un ok mary fb on all   rig is norcal 40a
runs abt 2 wts to a long wire at 45 ft   wx is
cldy es 50 deg bk to u mary
k2lu de k7un k

r r fb agn bill dinner about ready so must run
so wl sign wid u nw 73
es gl bill es cu agn <sk> k7un de k2lu ee

```
de k7un ok mary
tnx fer qso es c u agn  gl es 73
<sk> k2lu de k7un  ee
```

079

```
cq de w4rx w4rx k

w4rx de k0dx k0dx k

k0dx de w4rx tu fer call   ur rst 579
in atlanta ga  name is ed  so hw?  k0dx de w4rx k

de k0dx r ok ed es gm   ur rst 599 599
qth st louis mo  es name is doug
bk to u ed  w4rx de k0dx k

de w4rx  solid cpy doug es tnx fer report
rig is yaesu ft1000mp running abt 100 wts   ant is
yagi up at 55 ft   wx is clear es abt 75 f
bk to u doug  k0dx de w4rx k

de k0dx ok ed fb on all   rig is kenwood ts840s
runs abt 75 wts to a vertical wx is
cldy es 60 deg  bk to u ed
w4rx de k0dx k

r r  fb agn doug  wl time to get to wrk
so fer nw  73 doug bcnu <sk> k0dx de w4rx  ee

de k0dx ok ed
tnx ed   cul 73 gl
<sk> w4rx de k0dx  ee
```

080

```
cq de kh6jl kh6jl k

kh6jl de kl7aa kl7aa k

kl7aa de kh6jl tu fer call   ur rst 569
in honolulu hi  name is ted  so hw?  kl7aa de kh6jl k

de kl7aa r ok ted es ge   ur rst 589 589
```

```
qth fairbanks ak   es name is henry
bk to u ted   kh6jl de kl7aa k

de kh6jl   solid cpy henry es tnx
rig is homebrew running abt 3 wts    ant is
3 el beam up at 55 ft    wx is clear es abt 75 f
bk to u henry   kl7aa de kh6jl k

de kl7aa ok ted fb on all    rig is kenwood ts940s
runs abt 75 wts to a 4 el yagi at 100 ft   wx is
cldy es 30 deg   bk to u ted
kh6jl de kl7aa k

r r   fb agn henry   wl time to get some sleep
so fer nw   73 henry bcnu <sk> kl7aa de kh6jl   ee

de kl7aa ok ted   tnx cul 73 gl
<sk> kh6jl de kl7aa   ee
```

081

```
cq de k1es k1es k

k1es de k3az k3az k

k3az de k1es tu fer call    ur rst 549
in bangor me   name is jim   so hw?   k3az de k1es k

de k3az r ok jim es gm    ur rst 579 579
qth baltimore md   es name is larry
bk to u jim   k1es de k3az k

de k1es   solid cpy larry es tnx
rig is collins running abt 90 wts    ant is
dipole up at 25 ft    wx is clr es 40 f
bk to u larry   k3az de k1es k

de k3az ok jim fb on all    using drake tr7
runs abt 85 wts to a vert gnd mntd  wx is
clr es 34 deg   bk to u jim
k1es de k3az k

r r   fb agn larry   wl time to wrk sked wid friend
so fer nw   73 larry bcnu <sk> k3az de k1es   ee

de k3az ok jim   tnx cul 73 gl
```

```
<sk> k1es de k3az  ee
```

082

```
cq cq de aa5uu aa5uu k

aa5uu de xe1cc xe1cc k

xe1cc de aa5uu tu fer call   ur rst 559
in albuquerque nm  name is lisa  so hw nw?  xe1cc de aa5uu k

de xe1cc r ok lisa es gm   ur rst 579 579
qth cancun mexico  es name is jose
bk to u lisa  aa5uu de xe1cc k

de aa5uu  solid cpy jose es tnx
rig is heathkit hw16 running abt 75 wts   ant is
dipole up at 40 ft   wx is clr es 45 f
bk to u jose  xe1cc de aa5uu k

de xe1cc ok lisa fb on all   using collins s line
runs abt 85 wts to a dipole  wx is
clr es 84 deg  bk to u lisa
aa5uu de xe1cc k

r r  fb agn jose  wl time to wrk i am a pilot for airline
age is 38  so fer nw  73 es 88  jose bcnu <sk> xe1cc de aa5uu  ee

de xe1cc ok lisa  gracias cul 73 gl
<sk> aa5uu de xe1cc  ee
```

083

```
e f j a n x m p r v j b x i m v o k v u v b h s u f p h p l f w s c u
v p q a v f y x m f e v z u m c c d w n e v v i r o h y j w l m h h m
x i p o r q a v o k e z k t m o m a k u r t o l y o x y f m p o z b i
b s e o a s q k b y e d m j m k v a q b a s k z a m d d r x n s o q o
q f c y a m o m f w e n m n k c j x j m y y p v l i b c v a y z x r g
```

084

```
a l v x c u p g z w f p t b n e j z o a p w o x b p p r e a e d z s x
h b h z a e a r g z w t n s f u z p s l w n s r l k c y e o r f q y w
d p m w u v i e u z v v b f q q p e t i d g k v x n a z g a y x y j d
n w x z u k j x f q t w u s y u l d l f y u v m b c j c l a k b t b u
x f d e x s n h d e j e n s s g q u a l q z r g e j t n a f e n t u j
```

085

```
e p h l f f w f r p p z q k w b w s j r y f y f z t n p r y k p q e m
w x r z q l r z v b u o m n y q d o v s l l f v b m x q t u g c o h s
p f v o c q n x s z g r e i l d s a v f a a s i m g c d l p f t w p c
x z q o j h h z s p q v y m b t r n b j f e g y y q s j z t e g x k v
n q x z k n n f u w k f p h n n d i u t i n n m c k y b b r x w m t y
```

086

```
e b g l c k w n q n w y t i f h j j l h n f c l t z h h z m z x d v k
y r i i a y z g s y g r t k l y y e k n h o q v o k b g l g w v c m c
e b b q b o w k f n e h x p r h f b h h x x o z n j r q w x r y d v d
l l z n m p f s i m a b b w v w s p r m u j e i l m d e v u i z d k d
v w f g w q o w c n v l c m t y u u a f w g l f p m i f f c q y g s g
```

087

```
2 8 8 0 9   3 8 7 3 1   5 1 4 1 2   6 3 7 9 2   4 4 0 6 5   2 3 9 2 3   5 5 6 1 3
6 5 1 1 9   2 8 7 4 7   8 6 6 2 2   7 2 8 9 0   1 4 9 5 4   3 9 1 9 7   2 4 9 1 0
3 0 9 6 9   3 6 3 5 4   5 4 2 4 4   2 0 6 2 0   6 6 6 3 4   8 9 3 2 4   1 1 8 6 5
4 8 6 4 0   4 1 6 5 1   2 6 6 5 7   0 1 3 4 3   0 8 4 3 8   3 3 6 4 9   1 3 8 3 0
0 5 3 4 3   8 3 7 2 8   7 5 9 0 4   3 3 2 3 2   8 6 2 5 5   6 5 8 0 4   7 9 3 7 3
```

088

```
2 8 2 9 0 3 4 6 9 9 5 2 3 9 9 6 2 1 9 4 8 4 9 4 2 0 0 7 3 6 5 7 2 5 8
9 7 3 3 4 8 9 9 8 1 5 6 0 5 0 3 1 7 1 1 9 1 6 6 7 7 2 7 3 3 9 6 4 2 6
9 1 7 3 3 8 5 3 3 4 9 1 3 5 2 8 8 4 1 7 0 6 4 4 3 4 4 6 2 2 1 1 8 2 6
0 4 6 7 7 6 0 1 0 4 3 7 3 6 3 8 4 9 6 4 5 7 7 1 0 2 8 3 5 6 1 0 8 6 3
8 7 0 5 7 8 1 9 0 0 9 8 8 2 4 6 8 3 2 9 0 0 8 7 9 9 5 9 3 3 1 6 6 1 5
```

089

```
2 9 3 9 7 7 1 3 0 6 1 4 2 2 2 1 3 8 6 5 1 9 1 3 4 9 1 9 3 3 8 5 9 9 2
9 6 3 6 9 5 9 1 0 8 1 7 0 1 4 9 2 3 1 4 7 3 8 5 6 4 7 1 0 0 8 6 8 9 5
8 2 8 2 2 3 5 1 9 7 3 6 2 8 1 0 9 1 6 8 9 0 4 8 6 5 8 1 0 6 3 6 2 8 5
3 5 2 2 5 5 8 0 0 0 3 8 1 8 9 9 3 1 0 1 0 1 6 5 0 8 3 9 9 6 9 3 9 9 8
2 4 0 4 4 5 6 6 7 4 0 3 7 3 0 4 1 2 0 4 9 6 1 5 0 4 0 6 5 6 8 4 7 9 7
```

090

```
dash or hyphen
- - - - -   - - - - -
```

```
- - - - -  - - - - -
```

colon
```
: : : : :  : : : : :
: : : : :  : : : : :
```

semicolon
```
; ; ; ; ;  ; ; ; ;
; ; ; ; ;  ; ; ; ; ;
```

left parenthesis
```
( ( ( ( (  ( ( ( ( (
( ( ( ( (  ( ( ( ( (
```

right parenthesis
```
) ) ) ) )  ) ) ) ) )
) ) ) ) )  ) ) ) ) )
```

double quotation mark
```
" " " " "  " " " " "
" " " " "  " " " " "
```

dollar sign
```
$ $ $ $ $  $ $ $ $
$ $ $ $ $  $ $ $ $
```

equal sign or double dash
```
= = = = =  = = = = =
= = = = =  = = = = =
```

091

Kilometer, pronounced KIHL uh mee tuhr or kuh LAHM uh tuhr,
is a unit of distance in the metric system. The word is
also spelled kilometre. Its symbol is km.
One kilometer equals 1,000 meters, a distance of about
five-eighths of a mile.

092

Fort originally was a fortified building or place that
provided defense against attack. On the American frontier,
many forts also served as trading posts. Many cities that
grew up around forts bear their names, including Fort Wayne, IN.
The term fort now applies to permanent United States Army posts.

093

Fathom, pronounced FATH uhm, is a unit of length
used to measure ropes or cables and the depths of water.
One fathom is equal to 1.8 meters.
Navigators mark a rope in fathoms and drop it into the
water to measure the depth.
Sailors of average height often measured fathoms roughly
by extending both arms and measuring the rope from
fingertip to fingertip.

094

Logbook is the official or legal written record of
the events that take place during a ships voyage. The log
may be written up once a day by the captain of the ship, or
it may be written by the officer in charge of each watch.
It includes a record of the ships course and speed, the weather,
and any ships or lands sighted. It also includes mention of any
sickness, death, or crime on board ship, and of any other unusual event.

095

Mauna Kea, pronounced MOW nuh KAY uh, is a volcano on the
island of Hawaii. Its peak rises 4,205 meters above sea
level and 10,203 meters above the base of the mountain on
the floor of the Pacific Ocean. Its rise from base to peak
is the greatest in the world. This distance is 1,356 meters
longer than the rise from sea level to the peak of Mount Everest.
The name Mauna Kea means white mountain.

096

Watt is a unit of power in the metric system.
Power is the rate of producing or using energy.
The symbol for the watt is a capital W.
The watt is commonly used to measure electric power, even in countries that
have not adopted the metric system. An electric device uses 1 watt when
1 volt of electric potential drives 1 ampere of current through it.
The number on a light bulb shows its power requirement in watts.
For example, a light bulb operating at 100 volts and using 2 amperes
consumes 200 watts. Often, power is measured in kilowatts. One
kilowatt equals 1,000 watts. The watt also is used to measure mechanical
power. A machine requires a power of 1 watt if it uses 1 joule of energy
in 1 second. The watt was named for the Scottish engineer and
inventor James Watt.

097

Zenith, pronounced ZEE nihth, in astronomy, is any point directly above
a person on the earth. Zeniths lie on the celestial sphere, which can
be pictured as an imaginary sphere that encloses the universe.
A point directly below a person on the earth is called a nadir.
Astronomers speak of two kinds of zeniths, astronomical zeniths and
 geocentric zeniths. An astronomical zenith is determined by gravity.
It is any point where an extended plumb line would intersect the celestial
sphere. A geocentric zenith is determined by geometry. It is any point
where a line drawn from the earths center through a person on its surface
would intersect the celestial sphere. The angular distance of a star or
other celestial body from a zenith is called the zenith distance.
This information can be used to describe the position of such an object.

098

Tugboat, also called tug, is a small, powerful boat that
maneuvers large vessels. Tugs that are used in harbors
can tow large ocean liners or freighters and aid all types
of vessels in entering or leaving their anchoring places.
They can tow from the front or side, or push from the back.
Tugs measure from 65 to more than 250 feet (20 to 76 meters) long.
They are driven by engines with 2,000 to 22,000 horsepower
(1,500 to 16,400 kilowatts). The largest tugboats are the
oceangoing tugs, which rescue or assist ships at sea. Tugs
used on inland lakes and rivers tow or push long lines of barges
loaded with heavy cargoes. Modern tugs can push 40 or more barges at once.

099

Teflon is a trade name for polytetrafluoroethylene,
a type of synthetic (artificially made) material that
is used in cookware, insulation, and many other products.
Teflon is manufactured by the DuPont Company, and the name
Teflon is a registered trademark of DuPont. Roy J. Plunkett,
an American chemist, invented this material in 1938.

Teflon is a polymer, a substance consisting of long, chainlike
molecules. Each molecule is made up of a chain of tens of
thousands of carbon atoms, with each carbon atom also connected
to two fluorine atoms. Teflon is inert - that is, it does not
react with most other chemicals. It also resists moisture and
remains stable in extreme heat and cold. Teflon feels slippery
to the touch, and adhesive materials will not stick to it.

100

Quart is a unit of volume and capacity for both dry
and liquid substances in the inch-pound system of measurement.
This system is used in the United States. The liquid quart
equals 1/4 of a gallon and contains 57.750 cubic inches.
It equals 0.946 liter in the metric system. The dry quart
equals 1/32 of a bushel and contains 67.200 cubic inches. It
equals 1.101 liters. Quarts are divided into two pints. The
imperial quart was once used in Britain and such countries as
Canada and New Zealand. But it has been replaced with metric
units of measurement. The imperial quart contains 69.355 cubic
inches, or 1.137 liters.

101

Kakapo is a rare New Zealand parrot.
It now survives only in beech forests in Fiordland
and Stewart Island, off the coast of the South Island of
New Zealand. Some kakapos have also been released on
Little Barrier Island, near Auckland, in an effort to save
the birds from extinction.

The bird is about 60 centimeters long. Its plumage is green
with black and brown bars. It cannot fly like most other birds
but must leap from a high point and glide. It normally travels
along the ground, clearing tracks through the bush, low scrub, and grass.

Kakapos eat berries, fern roots, and lizards.
The birds nest in large natural crevices or in burrows.
Female kakapos usually lay from two to four white eggs.

102

Mint is a place where coins are made.
In the United States and most other countries, only the government
may mint coins. American mints are supervised by the United States
Mint, a division of the Department of the Treasury. Mints now
operate in Denver, Philadelphia, San Francisco, and West Point, N.Y.
They make only coins. The Bureau of Engraving and Printing in Washington,
D.C., makes paper money. U.S. mints make half dollars, quarters, dimes,
nickels, and cents for general circulation. They also make commemorative
coins for special occasions and gold and silver bullion coins for investors.
Historians believe the world's first mint was founded during the 600s B.C.
in Lydia, now a part of Turkey. Ancient Mediterranean civilizations,

including Greece and Rome, used coins in commerce. The use of coins
gradually spread throughout Europe and Asia. The first mint in the
United States was established in Boston in 1652. It produced coins
under the authority of the General Court of the Massachusetts Bay Colony.
The Articles of Confederation of 1781 gave both the U.S. Congress and
the individual states authority to mint money and regulate its value.
The first federal mint opened in Philadelphia in 1792 and is still in
operation.

103

Photon, pronounced FOH tahn, is the elementary particle that makes up
light and all other forms of electromagnetic radiation.
Like all particles, photons have properties of waves, including
frequency and wavelength. But photons have no mass and no electric charge.
The speed at which photons travel in a vacuum is the speed of light.
The exchange of photons between electrically charged particles transmits
the electromagnetic force, one of the four fundamental forces.
In 1900, the German physicist Max Planck showed that the energy of a
photon (then called a radiation quantum) is proportional to the frequency
of its light. The German-born physicist Albert Einstein carried
Planck's discovery further. In 1905, Einstein used the idea of photons
to explain the ability of light to knock electrons out of atoms - a
phenomenon known as the photoelectric effect.
His predictions about photons, which were later confirmed by experiment,
contributed much to the development of the quantum theory.

104

Summer is the warmest season of the year. The Northern Hemisphere,
the northern half of the earth, has summer weather during late June,
July, August, and early September. Summerlike days sometimes occur
in mid-autumn. In the Southern Hemisphere, summer lasts from late
December until early March. For dates of the first day of summer and
details about the position of the earth and sun, see season.

In summer, warm southern winds carry moisture north from the Gulf of Mexico
to central and eastern North America. They can bring warm, humid weather to
much of the region east of the Rocky Mountains and as far north as Canada.
Thunderstorms often develop in and along the northern boundary of this warm,
moist air. The highest summer temperatures usually occur in the middle of the continent

105

Talc is a soft mineral found in flat smooth layers of rock, and in
compact masses. It is so soft that it can be scratched with the
fingernail, and it feels soapy or greasy. Talc is translucent,
which means that it will allow light to go through, yet is not transparent.
Talc is white, greenish, or dark gray. Steatite, soapstone, is a compact
talc. Talc has many commercial uses. It is sold in slabs or in powdered
form. Slabs are used to line furnaces and heating stoves, and for
electric insulation, because talc is a poor conductor of heat and
electricity. It is ground up to make talcum powder.
Powdered talc is also used in crayons, paint, paper, and soap.
The leading talc-producing nations include China, Finland, India, and
the United States. Montana, New York, Texas, and Vermont are
important talc-producing states.

106

Putty is a filler material that is soft
when applied but slowly hardens. It is
used to fill knotholes, cracks, and other
defects in wood surfaces before the surfaces
are painted. Putty is also placed around the
edges of panes of glass to seal them in a
window sash or door.

The most common putty is a mixture of powdered
natural chalk, called whiting, and linseed oil
to which a small proportion of coloring agents
may be added. Putty hardens because some of
the oil combines with oxygen from the air and
the rest of the oil soaks into the wood.

Some projects require special, more elastic putty.
This type of putty is made from vegetable oil,
nondrying oils, driers that make the putty harden,
synthetic fibers, a powdered limestone filler,
and a coloring agent.

107

Joule, pronounced jool or pronounced jowl, a unit in the metric
system of measurement, is used to measure work or energy. Its
symbol is a capital J. One joule is the amount of work done when
a force of 1 newton acts on an object that moves 1 meter in the
direction of the force.

The joule is used to measure all forms of energy, including heat,
electrical energy, and mechanical energy. One joule equals about
0.239 calorie. A calorie is the amount of energy needed to raise
the temperature of 1 gram of water by 1 Celsius degree. One joule
of energy per second is required to pass an electric current of 1 ampere
through 1 ohm resistance. One joule per second equals one watt,
a unit of electric and mechanical power.

In the inch-pound system of measurement customarily used in the United
States, work or energy is measured in foot-pounds. One joule equals
about 0.738 foot-pound. The joule was named for the British physicist James P. Joule.

108

Hardness is the ability of a material to scratch a mark on
other substances or to resist being scratched by them.
Scientists measure the hardness of a material by comparing it
with a table of 10 well-known minerals. The minerals are
arranged in order from 1 to 10. Each mineral in the table
scratches the ones with lower numbers, and can be scratched
by all those with higher numbers.
The standard "scale of hardness" follows: (1) talc, (2) gypsum,
(3) calcite, (4) fluorite, (5) apatite, (6) feldspar, (7) quartz,
(8) topaz, (9) corundum, (10) diamond.

To test another substance, you match it against the minerals of
the hardness scale. You can get an approximate idea of the
hardness of a mineral by using your fingernail, a copper coin,
a piece of window glass, or a knife blade. The hardness of these
materials is as follows: fingernail, 2 to 2 1/2; copper coin, 2 1/2 to 3;
window glass, 5 to 5 1/2; and knife blade, 5 1/2.

When materials must be accurately tested, as in the manufacture of
tools and gears, machinists use an instrument called a sclerometer.
This device registers the force required to dent or scratch the
material with a diamond or borazon, the hardest substances known.

109

Vanilla is the name of a group of climbing orchids.
The vanilla extract that is used to flavor chocolate, ice
cream, pastry, and candy comes from these plants.
The vanilla vine has been cultivated in Mexico for hundreds of years.
This type of vanilla has been introduced into other tropical areas.
Comoros, Indonesia, Madagascar, and Reunion produce much of the worlds supply.

Another species grows on the island of Tahiti in the South Pacific.
The vanilla vine has little rootlets by which the plant attaches itself
to trees. The cultivated plant lives about 10 years. It produces its
first crop after three years.
The plant produces a fruit in the shape of a cylindrical pod, bean, that
measures from 13 to 25 centimeters long.
The fruit has an oily black pulp that contains many tiny black seeds.
The pods are gathered when they are a yellow-green in color.
Then the curing, or drying, process takes place.
This process shrinks the bean and turns it a rich, chocolate-brown color.
The process also gives the bean the flavor and aroma of vanilla as we know it.
Vanilla extract is prepared by a complicated and expensive process.
The beans are chopped into small pieces and then percolated with alcohol and water.
Food scientists have developed artificial vanilla flavors because of the high
cost of vanilla.

110

The several kinds of clay tile are made in much the same way.
Thin sheets of clay are pressed or molded to shape, and fired in
kilns in the same process as is used for making brick.
The tile may be left in its rough state.
It may also be given a smooth surface, called glazing, by dipping
or spraying the tile with a material that joins with the clay.
Other ways include throwing salt into the kiln or treating the clay
with a chemical wash.
Tile pipe is used for sewage-disposal systems and for draining fields
of excess water.
A continuous tile line is formed by fitting together short sections,
each of which has one end enlarged to form a bell into which the small
end of the next section fits.
Drain tiles are laid with uncemented butt ends through which the drainage
 water may seep. Sewer pipes are laid with tight cement joints.
Finer grades of clay are used in making tiles for roofs, for walls, and for floors.
Roofing tiles are made in various shapes and colors.
Hollow clay tile blocks are used in load-bearing walls and partitions.
Home builders use decorative tiles for interior floors and walls.
They obtain artistic effects by using tiles of different colors.
Mosaics are small, unglazed tiles that are combined to form a design in colors.
Glazed tiles are popular for the walls of kitchens and bathrooms.
Encaustic tiling is the trade name for decorative tiles used in such a way that
there is a background of one color and a pattern of another, contrasting color.
Floor tiles are made of rubber, linoleum, terrazzo, cork, asphalt, plastic, and
terra cotta and other ceramics.
Acoustic ceiling tiles are made of cork granules, wood fiber, and mineral fiber.

111

Scissors. A pair of scissors is really two knife blades joined
together to form a double lever. Each blade operates as a lever
of the first class. A pin or bolt holds the blades together and
acts as their common fulcrum or support. The user squeezes the
open scissors handles together to apply pressure against both
sides of the material, which then is cut.

To most people, scissors and shears refer to the same instrument.
But, in the hardware trade, shears refers to scissors with blades
more than 15 centimeters long. The handles of scissors usually
have rings of equal size. Most shears have a larger ring on one
handle for the four fingers of the cutting hand. The thumb of
the cutting hand fits through the other ring. Scissors and shears
range in size from tiny manicuring scissors to giant,
power-operated shears that cut scrap metal for steel-mill furnaces.
Pinking shears, or pinking scissors, have sawtooth edges. They are
used to give cloth a scalloped edge, which keeps the material from raveling.

Scissors developed shortly after people learned how to make knives.
Sharp, sturdy scissors were developed in the late 1200's.

112

Rake is a machine used to gather mowed hay and place it
in long piles called windrows. The windrows are then
gathered by a hay loader or baler. The first rakes were
wooden hand rakes. People still use hand rakes to rake leaves
from lawns. Modern rakes are usually pulled by, or mounted on,
a tractor. Rakes can also be used to gather straw, green forage, and seed crops.

The dump rake consists of curved steel teeth mounted on an axle between
two wheels. The teeth slide over the ground and rake hay as the machine
moves forward. The operator dumps the hay in a windrow by pulling a lever
that causes the teeth to lift from the ground.

The side-delivery rake leaves the hay in a continuous windrow at the side
of the vehicle carrying the rake. In one type of side-delivery rake, the
teeth are attached to cylinders that roll along at an angle to the direction
traveled. The teeth just clear the ground as the cylinder rotates. As the
machine moves ahead, the teeth brush the hay to the side, leaving it in a
windrow. A dual rake consists of two side-delivery rakes, which deposit two
windrows together at one time.

The finger-wheel rake consists of several wheels with spikes on the rim.
The wheels are set at an angle to the direction traveled, and move the
hay sideways to form a windrow. The drag-type rake has no moving parts.
It has curved fingers that move the hay to one side, much as a snowplow moves snow.

| 113 |

Canada's westernmost Prairie Province gained large revenues
from its oil resources in 1976. It set aside some of these
funds for future generations by establishing the Alberta Heritage
Savings Trust Fund, a $1.5-billion public endowment. The act
authorizing the fund provided that 30 per cent of oil royalties
would be paid into it annually.

The Progressive Conservatives dominated the 75-seat Legislative
Assembly, holding 69 seats. There were also 4 Social Credit members,
1 New Democratic Party representative, and 1 Independent. The Assembly
passed 58 bills during its 51-day session, including a measure creating
a home-mortgage corporation and a plan to reorganize provincial courts.
A $2.9-billion budget presented on March 19 called for a 7.7 per cent
increase in expenditures, modest when compared to the 25 per cent growth
each year over the previous five years. There were no tax increases,
retaining Alberta's distinction of having the lowest provincial taxes in Canada.

A new policy for exploiting Alberta's billions of tons of coal - half Canada's
reserves - was announced in June. A complicated formula will net the province
much larger revenues from future coal royalties. The $2-billion Syncrude Canada,
Limited, plant on the Athabaska tar sands passed the halfway point in construction.

| 114 |

Cardboard is a popular name for any stiff
paper or paperboard that is more than 0.1524
millimeter thick. It usually does not mean
paper used for special purposes, such as
wallboard or corrugated boxboard. Papermakers
use various names for different kinds of
cardboard. The name may be based on the raw
material used, such as strawboard or newsboard.
It may indicate useful characteristics, such as
bending board. Or it may designate the final use,
such as poster board or shoe board. A familiar
type of cardboard, called bristol board, is used
for such products as index cards and postal cards.
Manufacturers make cardboard by pasting several

layers of paper together or by pressing layers
of wet pulp together. They often coat cardboard
for decoration or to improve the surface of the
cardboard for printing.

115

Water plant, also called aquatic plant or hydrophyte, is a
name used for any plant that is specially adapted to live in
water. Many botanists also consider the term water plant to
include those plants that grow in water-saturated soils.

Water plants may be rooted in the mud and have their leaves and
blossoms above or at the surface of the water. Some kinds grow
completely underwater. Submerged water plants often have air bladders
or large air pores in their stems and leaves that help the plants stand
upright or stay afloat. Some of the best-known water plants are water
lilies, sedges, and cattails. These plants often grow in lakes and ponds.
Some biologists consider certain types of algae to be water plants. However,
most scientists do not include algae in the plant kingdom. They classify
algae in the kingdoms Protista and Prokaryotae.

116

Hexagon, pronounced HEHK suh gahn, is a plane figure that has
six sides. It is a type of polygon. The sides of a hexagon meet
at points called vertices, forming six interior angles. The sum of
a hexagon's interior angles is always 720 degrees. A hexagon is said
to be regular if all its sides and angles are equal. Each angle of a
regular hexagon measures 120 degrees. The area of a regular hexagon
equals one-half the product of its perimeter and its apothem, which is
the distance from the center of a regular polygon to the midpoint of
one of its sides.

117

Krypton, pronounced KRIHP tahn, is a chemical element that
makes up only about one-millionth of the earths atmosphere.
The British chemists Sir William Ramsay and Morris W. Travers
discovered it in 1898.
It was named krypton for the Greek word which means the hidden one.
Most fluorescent lamps are filled with a mixture of krypton and argon.
Krypton is also used in certain electronic tubes, and in luminous sign
tubes where a greenish-yellow color is desired.

Krypton is a colorless, odorless, tasteless gas.
It does not react readily with other substances and is classed as a noble gas.
Its symbol is Kr.
The element has the atomic number 36, and an atomic weight of 83.80.

118

Live oak is a beautiful evergreen oak that grows chiefly along the
southeastern coast of the United States. It is also found in dry
parts of Texas. The tree grows about 50 feet (15 meters) high.
Its horizontal limbs form a wide-spreading, dense head. The dark,
glossy, oblong leaves may be 2 to 5 inches (5 to 13 centimeters) long.
The live oak is a favorite tree for lawns and streets because it resists
damage from storms, insects, and diseases. It is the state tree of Georgia.

Scientific Classification. The live oak is a member of the beech family,
Fagaceae. It is classified as Quercus virginiana.

119

Integer, pronounced IHN tuh juhr, is a number. The most
familiar integers are the counting numbers, such as 1, 7,
28, and 105. The complete set of integers also includes zero
and such numbers as -1, -7, -28, and -105. For every positive
integer, there is a corresponding negative integer that, when added
to the positive integer, gives a sum of zero. For example, 5 + (-5) = 0.
Integers can be added, subtracted, multiplied, and divided.

Most mathematics involves the use of integers, and some mathematical
calculations would be impossible without them. Integers also help
describe certain everyday situations. For example, temperatures can
be above or below zero.

120

Keck Observatory is an astronomical observatory
on Mauna Kea, a mountain on the island of Hawaii.
The observatory consists of two identical
telescopes, Keck I and Keck II, which are the
largest optical telescopes in the world.
Keck I was completed in 1992 and Keck II in 1996.
The California Association for
Research in Astronomy, which is a partnership of
the University of California

and the California Institute of Technology,
operates the observatory.
The facilitys full name is the W. M. Keck
Observatory.
Keck I and II collect and focus visible light
waves and infrared waves from objects in space.
One use of the telescopes is to analyze
radiation coming to Earth from the farthest
known galaxies. Astronomers can use the
information gathered to determine a galaxys
distance, size, age, and other characteristics.
Keck I and II are reflecting telescopes - that is,
they use a large mirror to collect and focus
light. The light-gathering mirror is a segmented
mirror that consists of 36 smaller mirrors
mounted together. The segments form a reflecting
surface 10 meters in diameter.
An electronic sensing system holds the segments
in place. If a segment gets out of position,
sensors on its edges activate pistons in the support
structure that move the segment.

121

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VVV 12 A K5KJ 66 NTX
VVV 1062 B K5GN 72 STX
VVV 378 A KX1E 56 ME
VVV 346 B WA8CDU 66 MI
VVV 11 A W0OF 48 IA
VVV 951 M N4TO 60 WCF
VVV 289 A NI6W 79 NV
VVV 155 A WO7Y 60 ID
VVV 608 B WC4E 84 NFL
VVV 250 B N9RV 67 IN
VVV 275 B K7JJ 54 SDG
VVV 727 B WB8BMV 68 NC
VVV 155 A AA3LX 94 WPA
VVV 54 A KB9AMG 88 WI
VVV 121 A KB5IXI 89 MS
VVV 678 A KI4SN 77 NC
VVV 186 A W8DHG 48 OH
VVV 192 B AB5QY 92 NTX
VVV 22 A VE3WG 65 ON
VVV 32 U N1AU 55 EMA
VVV 105 Q AB5OU 54 NM
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VVV 228 A K3WU 71 EPA
VVV 196 A VE7IN 61 BC
VVV 780 B W1BIH 30 CT
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122

The right parenthesis is (. (((((
The left parenthesis is).)))))

Abacus, pronounced AB uh kuhs, is an ancient device used in China and other
countries to perform arithmetic problems. It can be used to add, subtract,
multiply, and divide, and to calculate square roots and cube roots. The
abacus consists of a frame containing columns of beads. The beads, which
represent numbers, are strung on wires or narrow wooden rods attached to
the frame.
The abacus was used by the ancient Greeks and Romans. The Chinese abacus is
called suanpan, which means counting, or reckoning, board. A typical Chinese
abacus has columns of beads separated by a crossbar. Each column has two beads
above the crossbar and five below it. Each upper bead represents five units,
and each lower bead equals one unit.
The first column on the right is the ones column. The second column is the
tens column. The third column is the hundreds, and so on. The ones column
represents numbers from one to nine. Each bead below the crossbar has a value
of one (or 1), and each bead above the crossbar has a value of 5 ones (or 5).
The tens column represents numbers from 10 to 90.
Each lower bead in the tens column represents 1 ten (or 10), and each upper
bead represents 5 tens (or 50). A number is represented on the abacus by
moving the appropriate beads to the crossbar.

123

Almond, pronounced AH muhnd or pronounced AHL muhnd, is a delicious nut.
The nuts are the seeds of the beautiful almond tree.
Each nut grows in a thin, smooth shell that looks somewhat like a peach stone.
A dry, leathery hull covers the shell.
The hull splits open when the nut is ripe.

Some almond trees produce sweet nuts; others have bitter ones.
Sweet almonds are a popular delicacy when toasted, salted, and eaten whole,
or added to candies and rich pastries.
Bitter almonds are not edible.
Trees that produce them are grown only for oil, although oil is also extracted
from the sweet nuts.
Oil of bitter almonds contains the poisonous hydrocyanic (prussic) acid.
After the acid is removed, the oil is used in flavoring extracts.

The almond tree is native to southwestern Asia.
But today it is widely grown in the countries that border the Mediterranean Sea.
The trees also thrive in California, where commercial groves produce large annual
crops of almond nuts.

Almond trees are well-proportioned and may grow 12 meters high.
They have long, pointed leaves that curl, and showy pink blossoms that may be
3.8 centimeters across.
The blossoms open early in spring, long before the leaves appear.
For this reason, almonds are grown commercially only in regions that do not
have early spring frosts.

124

Sonar, pronounced SOH nahr, is a device that uses sound energy to
locate objects - measure their distance, direction, and speed. Even
produce pictures of them. The word sonar comes from sound navigation and ranging.

People associate the word sonar with devices that detect submarines and other
underwater objects. Sonar works well underwater, where sound travels quickly
and efficiently over long distances and where radar does not work.
However, certain sonar devices operate in the air.
For example, some burglar alarms use airborne waves of ultrasound, sound whose
pitch is too high for people to hear, to detect movement.

Dolphins and some bats use a natural sonar technique called echolocation.
This technique helps them locate food, avoid obstacles, and communicate.

How sonar works. There are two types of sonar. Active and passive.
Active sonar uses a transmitter, a device that converts electrical energy to
sound energy, to send out sound waves.
Transmitters used underwater can produce a sharp pinging sound.
The sound waves travel through the water until they strike an object.
The object reflects them in various directions.
Some of the reflected waves return to the sonar, where they strike a receiver.
The receiver converts the sound back into electrical signals.
In modern sonars, a computer analyzes these signals to perform the sonars job,
such as locating the object or determining the object's distance from the sonar.

A sonar determines distances by measuring the time taken for a sound wave to
travel from the transmitter, reflect from the object, and travel to the receiver.
This method of finding distance is called echo ranging.

125

Umbrella is a device that protects people from rain and sun. It
consists of a circular piece of fabric stretched on a frame attached to a
central handle. The frame can be folded when it is not needed.

Umbrellas were originally used as sunshades. In many cultures, they were
a symbol of rank. In ancient Egypt and Babylonia, for example, only royalty
and nobility were permitted to have umbrellas.

Umbrellas were first widely used against rain during the 1700's, when heavy
umbrellas made of wood and oilcloth became common in Europe. During the 1800's,
light, decorative sunshades called parasols became fashionable among women
throughout Europe and the United States. Many of these umbrellas had whalebone
or metal frames and fine silk coverings edged with lace and fringe. They were
popular until about the 1920's.

Today, umbrellas are used primarily as protection against rain or snow. Most
umbrellas are made with metal or plastic frames and covered with plain or
patterned fabric or clear plastic. They come in a wide variety of colors.
Many umbrellas fold up to fit in purses and briefcases.

126

Bleach is any substance that lightens, brightens, or removes the
color from a material. Manufacturers bleach textiles, paper, and
 other materials to whiten them or to prepare them to be dyed.
Homemakers use laundry bleach to brighten clothes. People also use
some bleaches as disinfectants. There are two main kinds of bleaches,
chemical and optical. Chemical bleaches act on the colored molecules
that give a material its color.
The bleaches make these molecules colorless or nearly colorless.
The most widely used chemical bleaches include chlorine bleaches and
oxygen bleaches. Many household and industrial bleaches are chlorine
bleaches, which remove the color from most textiles, wood pulp, pottery,
and other materials.

Oxygen bleaches are milder than chlorine ones. People use hydrogen
peroxide and other oxygen bleaches to lighten hair and to brighten colored
fabrics and other materials that might be harmed by chlorine bleaches.
Other chemical bleaches include certain sulfur compounds.
These compounds are used to bleach some wools, silks, and various types of
manufactured fibers. Optical bleaches mask yellow discoloration in a material.
These bleaches, commonly called fabric brighteners, absorb ultraviolet light
and change it to blue light. The combination of the blue light and the
yellow discoloration produces white light that makes the material seem brighter.

127

Eclipse is the darkening of a heavenly body. It occurs when the
shadow of one object in space falls on another object or when
one object moves in front of another to block its light. A
solar eclipse takes place when the sun appears to become dark as
the moon passes between the sun and the earth. A lunar eclipse occurs
when the moon darkens as it passes through the earth's shadow.

Heavenly bodies other than the earth and the moon also can eclipse
each other. The planet Jupiter sometimes blocks sunlight from its moons.
Likewise, Jupiter's moons sometimes cast shadows on the planet. Sometimes
the moon or some other heavenly body blocks light from a planet or a distant
star. Astronomers use the term occultation for this blocking action.
Astronomers also refer to a certain kind of variable star as an eclipsing binary.
An eclipsing binary consists of two stars that revolve around each other so
that each periodically blocks the light from the other.

When eclipses occur. The earth and the moon always cast shadows into space,
and the moon orbits the earth about once every month. But an eclipse – either
solar or lunar – does not occur every month. The moon's orbit is tilted
about 5 degrees to the earth's orbit around the sun. For this reason,
the moon's shadow generally misses the earth, and so a solar eclipse does not occur.
Likewise, the moon most often escapes being eclipsed by passing above or below
the shadow of the earth. Thus, a solar or a lunar eclipse can occur only when
the earth, sun, and moon are in nearly a straight line.

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Dew is the name given to the glistening beads of water that often
appear on blades of grass, leaves, and car tops early on clear mornings.
Dew forms when air near the ground cools to the point where it cannot
hold all its water vapor. The excess water vapor then condenses
(changes to liquid) on objects near the ground.

During the day, objects absorb heat from the sun. At night, they
lose this heat through a process known as thermal radiation. As
objects near the ground cool, the temperature of the air immediately
surrounding them is also reduced. Colder air cannot hold as much
water vapor as warmer air can. If the air continues to cool, it
will eventually reach the dew point. The dew point is the temperature
at which the air contains as much water vapor as it possibly can hold.
If the air cools further, some of the vapor condenses on the nearest
available surface.

Dew forms best on calm, clear nights. When the wind is blowing, air
cannot stay in contact with cool objects as long and it needs more
time to cool to the dew point. When it is cloudy, objects cool more
slowly because the clouds radiate heat back to earth. Dew also
forms better when the humidity is high.

Dew evaporates as the sun rises. The sunshine heats the ground,
which in turn warms the air. This warmer air is able to hold
more water vapor, and dew evaporates into this air.

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Liquid is one of the three basic states in which matter exists.
The other two states are gaseous and solid. A liquid is similar
to a gas because its molecules are not fixed to each other in any
particular way. Liquids and gases are both called fluids because they
can flow to fit the shape of any container in which they are put. A
liquid is unlike a gas and similar to a solid because it has a definite
volume, and its molecules are only slightly compressible. A liquid
always seeks its own level. If a liquid is put in a container with
several arms, it will rise to the same level in all the arms.

A thin layer on the surface of a liquid has a tension caused by molecular
action, and acts like a skin. This is called surface tension. Because
of surface tension, a greased needle will rest on the surface of water without sinking.

The molecules of a liquid often have a greater attraction for other
substances than they have for each other. For this reason, they will
rise in narrow tubes above their own level. This action is called capillarity.
Plants draw water by capillary action.

If liquids are heated beyond a certain point, they vaporize (change
into gas). Water changes into steam when it boils. If liquids are cooled
below a certain point, they change into solids. Water freezes into ice.
Different liquids have different freezing and boiling points. Substances
that are normally gases can be cooled and compressed into a liquid state.
Some normally solid substances can be heated until they turn into liquids.
For more information, see the articles on GAS, SOLID, and WATER.

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Sprat is one of the smaller sea fish in the herring family. Sprat grow to 8 inches (20

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Sirius, pronounced SIHR ee uhs, also called the Dog Star,
is the brightest star that can be seen from the earth at
night. Sirius has a diameter more than twice as large as that
of the sun, and it gives off nearly 30 times as much light.
It is a star of the first magnitude (see STAR [Brightness)]).

Sirius forms part of Canis Major, a constellation in the sky of
the Southern Hemisphere. Sirius is one of the stars nearest the
earth. It is about nine light-years away. A light-year, the
distance that light travels in a year, equals about 5.88 trillion
miles (9.46 trillion kilometers).

Astronomers classify Sirius as a binary star because it has
a companion star, Sirius B (see BINARY STAR). Sirius B is
a white dwarf, an extremely dense star that can be as small
as the earth. It consists of matter that is 4 million times
as dense as water. If matter from Sirius B were brought to
the earth's surface, it would weigh approximately 120,000 tons
per cubic foot (4,000,000 metric tons per cubic meter). Because
of its tremendous density, Sirius B exerts a strong gravitational
pull on Sirius. This powerful gravitational force causes Sirius
to move in a wavy line as it travels through space. Sirius and
Sirius B make a complete orbit around each other about every 50 years.