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    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    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    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  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  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  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    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    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    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    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    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    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  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  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    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  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  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  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    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  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    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  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  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  x    x  x  x  x  x
```

036

```
a b c d e f g h i j k l m n o p q r s t u v w x
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    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    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
112 122 122 211 121 221 122 222 212 212 211 112 222 112 121 222 122
112 122 112 211 121 211 112 112 221 221 112 221 121 221 111 112 121
```

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
221 323 112 113 131 311 121 211 122 122 231 333 213 221 232 232 223
112 121 312 132 222 131 321 111 332 322 133 123 213 111 323 332 313
```

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
244 433 411 232 434 314 341 231 242 141 441 212 442 431 212 433 113
144 112 134 343 124 132 123 122 323 244 224 321 234 233 113 213 444
```

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
311 555 135 121 141 152 145 525 252 133 122 152 422 131 144 134 535
524 315 233 535 215 445 551 151 121 322 325 313 313 411 444 253 523
```

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
361 662 131 453 334 643 415 411 636 412 443 333 313 562 143 534 451
523 465 226 554 356 313 456 444 561 111 146 335 246 411 112 612 612
546 165 644 263 134 134 626 622 642 446 634 516 365 434 244 126 366
```

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

376 514 642 756 342 123 471 524 173 336 135 723 563 215 435 341 231
633 311 774 126 641 672 376 442 176 712 172 524 615 657 116 451 431
414 434 674 671 474 464 165 277 222 432 335 275 347 531 562 566 654
```

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
428 737 878 644 565 486 767 274 183 313 267 674 344 586 388 538 173
363 885 171 361 721 276 141 578 481 146 172 476 164 334 776 348 485
661 487 872 861 625 351 127 847 532 475 351 336 738 741 147 164 363
```

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
483 277 961 774 637 542 457 997 272 447 992 131 822 945 249 653 364
572 766 816 632 297 396 262 429 122 928 925 153 772 478 826 515 516
826 213 269 484 738 959 474 725 221 825 962 868 821 896 591 538 967
```

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
567 637 141 924 800 697 137 822 461 682 937 578 409 392 199 686 556
781 628 633 092 785 417 483 361 844 909 869 719 579 534 065 871 517
162 038 557 028 732 749 730 583 819 365 663 300 003 041 954 982 560
```

066

```
slant sign
/ / / / /  / / / / /  / / / / /  / / / / /  / / / / /  / / / / /

portable call signs using slant sign

k5jk/8  k8ilm/1  k1no/2  w6efj/7  na5n/6   kl7ak/0  w2rca/4
w9mb/3  k4jkb/0  kh4rc/2  n3cc/3  aa4ra/7  kc3pq/5

cq cq cq de wh8s wh8s wh8s k
cq cq cq de w9bcr w9bcr w9bcr k
cq cq cq de n5sj n5sj n5sj k
cq cq cq de ky2y/3 ky2y/3 ky2y/3 k
cq cq cq de n8hip n8hip n8hip k
cq cq cq de kr5c/6 kr5c/6 kr5c/6 k
cq cq cq de k4gc k4gc k4gc k
cq cq cq de k7xx/0 k7xx/0 k7xx/0 k
cq cq cq de kg7q kg7q kg7q k
cq cq cq de nc0r/9 nc0r/9 nc0r/9 k
cq cq cq de ae6s ae6s ae6s k
cq cq cq de a3dm/4 a3dm/4 a3dm/4 k
cq cq cq de n9cb n9cb n9cb k
cq cq cq de w6fbp w6fbp w6fbp k
cq cq cq de k3fmh/1 k3fmh/1 k3fmh/1 k
cq cq cq de a5ozn/5 a5ozn/5 a5ozn/5 k
cq cq cq de n1dmi/8 n1dmi/8 n1dmi/8 k
```

067

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

cq cq cq de wq8e wq8e wq8e k
wq8e wq8e de n5zre n5zre k

cq cq cq de w2grw w2grw w2grw k
w2grw w2grw de nc4p  nc4p  k

cq cq cq de kw5s kw5s kw5s k
kw5s kw5s de a6up  a6up  k

cq cq cq de w6mcz w6mcz w6mcz k
w6mcz w6mcz de k4rpg k4rpg k
```

```
cq cq cq de a9da a9da a9da k
a9da a9da de a6en a6en k

cq cq cq de w7lc w7lc w7lc k
w7lc w7lc de at1g at1g k

cq cq cq de kg8c kg8c kg8c k
kg8c 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 dipole.
ant hr is 3 el yagi 3 el yagi.
ant hr is inv vee inv vee.
ant hr is vertical vertical.
ant hr is vee beam vee beam.
ant hr is g5rv dipole g5rv beam.
ant hr is long wire long wire.
ant hr is rhombic rhombic.
ant hr is loop loop.
ant hr is 40m dipole up 10 mtrs  40m dipole up 10 mtrs.
```

076

```
question mark

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

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

double dash or equal sign

= = = = =   = = = = =   = = = = =
= = = = =   = = = = =   = = = = =
= = = = =   = = = = =   = = = = =
= = = = =   = = = = =   = = = = =

name hr is chuck chuck = town of prescott prescott =
state is az az = wx is cold and windy =
```

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 = have 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 cq de k2lu k2lu k2lu k

k2lu 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 = 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 = 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 will sign wid u nw =
73 es gl bill = cu agn <sk> k7un de k2lu  ee

de k7un ok mary = tnx fer qso = 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 =
qth is atlanta ga = name is ed = so hw cpy? =
k0dx de w4rx k

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

de w4rx  solid cpy doug = 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 = 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 =
qth is honolulu hi = name is ted = so hw cpy?  kl7aa de kh6jl k

de kl7aa r ok ted es ge r = ur rst 589 589 =
qth fairbanks ak = 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 = well 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
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
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
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
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
```

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
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
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
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
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
```

085

```
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
```

086

```
3 . 14159 26535 89793 23846 26433 83279 50288 41971 69399
37510 58209 74944 59230 78164 06286 20899 86280 34825
34211 70679 82148 08651 32823 06647 09384 46095 50582
23172 53594 08128 48111 74502 84102 70193 85211 05559
64462 29489 54930 38196 44288 10975 66593 34461 28475
64823 37867 83165 27120 19091 45648 56692 34603 48610
45432 66482 13393 60726 02491 41273 72458 70066 06315
58817 48815 20920 96282 92540 91715 36436 78925 90360
01133 05305 48820 46652 13841 46951 94151 16094 33057
27036 57595 91953 09218 61173 81932 61179 31051 18548
07446 23799 62749 56735 18857 52724 89122 79381 83011
94912 98336 73362 44065 66430 86021 39494 63952 24737
19070 21798 60943 70277 05392 17176 29317 67523 84674
81846 76694 05132 00056 81271 45263 56082 77857 71342
75778 96091 73637 17872 14684 40901 22495 34301 46549
58537 10507 92279 68925 89235 42019 95611 21290 21960
86403 44181 59813 62977 47713 09960 51870 72113 49999
99837 29780 49951 05973 17328 16096 31859 50244 59455
34690 83026 42522 30825 33446 85035 26193 11881 71010
00313 78387 52886 58753 32083 81420 61717 76691 47303
59825 34904 28755 46873 11595 62863 88235 37875 93751
95778 18577 80532 17122 68066 13001 92787 66111 95909
```

087

```
slant sign
/ / / / /  / / / / /  / / / / /  / / / / /  / / / / /  / / / / /
```

```
portable call signs using slant sign

k5jk/8  k8ilm/1  k1no/2  w6efj/7  na5n/6   kl7ak/0  w2rca/4
w9mb/3  k4jkb/0  kh4rc/2  n3cc/3  aa4ra/7  kc3pq/5
```

088

```
lt371 i6bhb 3y7yl .zoei rrd/6 t13ks umzk8 2jf8d 9yqnb e2z1l dorp3
dnuzy h8su8 tpvev jgrk3 cj.na nso06 jjej0 qihdz ds,c7 l.7hl q,wki
lab99 zvdnt 1r8bp 4w57x 0.91m vh.6u l,knr m1ht2 nh,w3 zwuas i2fn,
mv1,y 9boev v3315 /jrxd memi3 uowba flqx5 zyq/6 r,8j. /c,ik j4d..
t3yz. utau/ x7ldp 7,igm eznh2 7osl1 dw.a/ b8rs/ nr7te dgvz8 uik16
```

089

```
l.ntw hg1q8 zhaba l4wc7 7.ryg 0smpn 3/2/. 26mfb izo/5 rlds5 91d1z
hv6xr y.etg an/,x mj.sc dp5xs mcepo qnvuf 56uz/ 02i.m fyn4h nrvkz
./vsa kej/b 5tvh, ,b.hp gsakf 4e0gb b/aba stl6d tf5t1 v7ip3 ay2mg
fvpxb qn19f q2c4b 52fco 5wn,n cd504 9l1zl slb.u ayfj0 qffo/ /vtmc
rk6hw ogw7b mv2l9 ak5vn sohd3 1ubqf e2wjd 8xi3v 4ce.y 3qa73 e59bk
```

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 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

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

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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
VVV 228 A K3WU 71 EPA
VVV 196 A VE7IN 61 BC
VVV 780 B W1BIH 30 CT
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122

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

128

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.

130

Sprat is one of the smaller sea fish in the herring family. Sprat grow to 20 centimeters long. They live in European coastal waters from the Baltic and North seas to the Mediterranean and Black seas. They have a flattened body with a saw-toothed edge along the belly. Sprat are important food fish. They are eaten fresh or smoked. Some are canned in oil as brisling sardines. Others are processed for oil and fish meal.

131

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.

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 9.46 trillion kilometers.

Astronomers classify Sirius as a binary star because it has a companion star, Sirius B. 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.

132

What is a solstice?

In simple terms, the solstice is the date at which the sun appears directly overhead at noon the furthest north, the tropic of Cancer, and the furthest south, the tropic of Capricorn, during the year. The summer and winter solstices mark the beginnings of those astronomical seasons. Between these two latitudes are found the Tropics. Summer officially starts with the solstice on about the 21st of June, when the sun is furthest north. Yet the warmest part of the year over most of the United States does not occur until mid-July. Similarly the warmest part of the day is usually several hours after noon, when the sun is highest in the sky. The lag is due to the time required for ground and water to heat up. The longest day of the year occurs at the summer solstice in the Northern Hemisphere. On this day, north of the Arctic circle in Alaska there is continuous 24-hour sunshine. Along the U.S.-Canadian border the sun appears for 16.25 hours, and in southern Texas and Florida, 13.75 hours of sunshine are all that is available. The winter solstice is about 22 December. It is the shortest day of the year in the Northern Hemisphere. It is also the first day of the Southern Hemisphere summer, and on this day the atmosphere above the South Pole receives more light from the sun than any other place in the world, yet the temperature averages only about minus lO degrees F.

133

Who invented the barometer?

The barometer, which measures the pressure exerted by the mass of the atmosphere, was first devised in 1644 by Evangelista Torricelli, a student of Calileo, who had noted that a column of water in a tube could not be made to stand to a height greater than 34 feet. Torricelli experimented with fluids of different densities, including sea water, honey, and finally mercury, a liquid metal 14 times heavier than water. The mercury tube, when plugged at one end, filled with mercury, and placed upright with the open end in a container of more mercury, would only stand to a height of about 30 inches, or about 1/14th that of the water column. The mercury column was being held up by the

pressure exerted on the reservoir of mercury by the atmosphere. Thus, the barometer was perfected. This instrument allows the continuous measurement of atmospheric pressure, which rises and falls with the passage of traveling weather disturbances in which the weight of the air column overhead is alternately heavier or lighter. Torricelli put it more elegantly, We live submerged at the bottom of an ocean of elementary air, which is known by incontestable experiments to have weight.

What is the highest barometer reading ever measured?

Siberia has justly earned its reputation for cold. But cold air is also dense, and therefore the atmosphere weighs more and the barometer soars to the upper end of the scale. On New Years Eve of 1968, in Agata, Siberia, the hammer really fell. During a deep cold wave, the barometer set an all time record for the Eastern Hemisphere, peaking at 32.01 inches.

134

What is terminal velocity?

Terminal velocity is the maximum speed that a person or object can achieve while falling toward the Earth. The term is used in skydiving as the top speed a person achieves during a fall. Without air resistance, a person would theoretically fall faster and faster, accelerating at a rate of 9.8 meters per second squared until he strikes the Earth. But in reality, there is a rather large air resistant force when jumping from an airplane. Terminal velocity occurs when the air resistant force upward on the diver equals the downward force of gravity acting on the diver.
When the two forces are equal, the person stops accelerating and falls to the Earth at a constant velocity.

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Why do ocean waves break as they approach the beach?

Ocean waves rarely break before they come in contact with a cliff or mountainside shoreline. Ocean waves only seem to

break as they approach a gradual decrease in depths, such as beaches. A shoreline with a gradual decrease in depth will produce a more spectacular break than a wave that encounters a steep decrease in depth.

The reason waves break has to do with the velocity of the wave and the depth of the water. An ocean wave with a large velocity has a long wavelength and large amplitude. As the wave moves toward the beach, it wants to continue traveling at a constant velocity. Unfortunately for the wave, as the ocean depth begins to decrease, the bottom of the wave gradually encounters more and more friction, causing the lower section of the wave to travel slower than the upper section of the wave. As the lower section decreases its velocity, the inertia of the crest carries it over the trough. When there is not enough water underneath it to support the crest, the wave breaks.

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What is radar?

Radar, a frequency band on the electromagnetic spectrum, is an acronym for radio detection and ranging. Radar involves emitting electromagnetic waves and calculating the time, frequency, and directional changes of the reflected waves to locate the position and speed of an object. Radar is used in many different arenas, but was first used for military purposes to locate ships and planes when visibility was poor.

Who developed radar?

In 1935, Robert Watson-Watt, a Scottish physicist, created the first radar defense system for the British military. Although the British government originally asked for a device that would fry Nazi pilots in their cockpits, Watson-Watt explained that this was not possible, but a reliable early warning signaling system might be feasible with the technology of the early 1930s. Watson-Watt used the information and breakthroughs from such physicists as Hertz and Marconi, the inventors of the first radio transmitter and antenna, to develop a British radar network that could detect enemy planes 100 miles off the coast of England.

Ironically, Watson-Watt became a deserving victim of his own technology nineteen years later. According to Canadian police, Watson-Watt had been speeding on a stretch of Canadian road, and was detected by a police radar gun. Watson-Watt willingly paid the fine and drove away.

137

Why do people hear ringing after leaving a loud rock concert?

After leaving loud rock concerts, many concert-goers often complain of ringing in their ears. The ringing sound is a result of the destruction of the cilia by the high volume sounds. Resonating objects often end up damaged or destroyed. Cilia resonate when a sound reaches the hair's natural frequency. If the sound is extremely loud and goes on for some period of time, it can cause destructive resonance to the cilia and kill it. the ringing sensation is actually the cilia dying. Usually the ringing is gone the day after the concert, but permanent damage has already been done, because those hair cells will never grow back. Although the effects of such hearing loss may take many years and repeated exposure to loud sounds to become apparent, they can nonetheless become very devastating.

What are the best ways to protect ones ears at loud rock concerts?

The first protection against damage to the cilia cells is to increase the distance from your ears to the speakers. The inverse square law dictates that the intensity of a sound is inversely proportional to the distance squared. In plain English, the farther away one is from the speakers, the lower the intensity of the sound. By simply doubling the distance, the intensity becomes one fourth of what it was originally.

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Who was the first physicist to make a serious effort to measure the speed of light?

Light travels at a very high speed and therefore can be extremely difficult to measure. Prior to 1600, most people

believed that light traveled instantaneously. However, Galileo felt that there had to be some finite speed of light and attempted to measure it by gauging the amount of time it took for a distant light to reach his eyes. To perform this experiment, Galileo had an assistant with a lamp stand a great distance away from him. Galileo instructed the assistant to uncover his lamp immediately when the helper saw Galileo uncover his own lamp. By measuring the time it would take the light to travel from Galileo and back again from the assistant, Galileo felt that he could measure the speed of light.
His experiment failed because there was no possible way for him to measure such a short period of time. Galileo walked away from the experiment without a number for the speed of light, but with a deep appreciation for how fast light actually does travel.

139

A FUNDAMENTAL FACT about English is that what is acceptable in speech is not always acceptable in writing. When we speak, our listeners understand that we are composing our sentences on the spur of the moment, and they are fairly tolerant of deviations from Standard English.
There is, however, little acceptable variation in the grammar of written English. When writing violates grammatical rules, the violations distract the reader's attention from the content of the writing. Unfair as it may seem, readers often judge the value of what we have to say by the grammar we use in expressing it. Grammar is, then, one of the basic tools of writers, and writers, like all other craftsmen, should know how to use their tools.
Fortunately, most of the grammatical rules of written English are identical to the grammatical rules of spoken English. As native speakers of English, we know these rules intuitively and do not need to memorize them the way we memorize the grammatical rules of a foreign language. Normally, problems arise only in those instances where acceptable written English differs from acceptable spoken English.

In a discussion of almost any subject, it is necessary to use a certain amount of technical terminology. When we talk about automobiles, we use the technical term muffler as a kind of shorthand for a device to deaden the noise of escaping gases from an internal-combustion engine. The

sports announcer who says They are going to try for a field goal is using the technical term field goal to avoid having to say They are going to try to earn three points by place kicking or drop kicking the ball over the crossbar between their opponents goal posts. Similarly, in a discussion of a sentence, it is, of course, possible to say The word used to define the action does not have the right form to match the form of the word used to indicate what is being talked about. But it is much more efficient to say The verb does not agree with the subject", the words verb, agree, and subject are all technical terms with specific meanings that make discussion of grammar both easier and clearer. Thus, although it may seem tiresome to have to learn or relearn a certain amount of grammatical terminology, in the long run it will save you much time and frustration.

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Sentence Patterns

The basic unit of the written language is the sentence. A sentence is a group of words that includes a subject and a predicate and that is not dependent upon any other group of words. In short, a sentence can stand alone as a single utterance. The subject of a sentence is what or who is talked about, and the predicate is what is said about or asked about the subject. In many but not all sentences, the subject is the first word in the sentence.

Elsa bought some green paint yesterday.

Last week Peter was sick.

Because of budget cuts, the library will close.

Did you feed the dog?

The predicate of a sentence must contain a verb phrase. A verb phrase is a word or words that express an action done by the subject or a state of existence of the subject. Although the word phrase is commonly thought of as referring to two or more words, the term verb phrase can be used for single words as well. As the fourth sentence below illustrates, the parts of a verb phrase are sometimes

separated by other elements of the sentence.

Elsa bought some green paint.

Last week Peter was sick.

Because of budget cuts, the library will close.

Did you feed the dog?

All complete sentences contain a subject and a verb phrase.

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Verbs

Verbs are traditionally defined as words that express an action, an occurrence, or a state of existence. This definition by meaning is not always satisfactory, because other parts of speech, such as nouns, also express action or existence. But verbs can also be identified by their inflections and by their functions.

Characteristics

Verbs are characterized by inflections for tense, person, voice, and mood, and by their function in a sentence as the main element of the predicate.

Inflections Verbs have five forms, an infinitive and four inflected forms. The infinitive is either the base form of the verb, carry, or the base form preceded by to, to carry. The four inflected forms are 1. third-person singular present tense, 2. past tense, 3. present participle, also called progressive participle, and 4. past participle.

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Adjectives

Adjectives are traditionally defined as words that modify nouns or pronouns by defining, describing, limiting, or qualifying those nouns or pronouns. Many adjectives also can be identified by their inflections or by their

positions in sentences.

Characteristics

Some adjectives have inflections showing comparative and superlative degrees. Adjectives are also identified by the positions they take as modifiers of nouns or noun substitutes.

Inflections

Many adjectives can be inflected to show comparison. The three degrees of comparison are positive, comparative, and superlative.
The positive degree of an adjective has no ending, the comparative ending is -er, and the superlative ending is -est.

POSITIVE COMPARATIVE SUPERLATIVE

fine finer finest

poor poorer poorest

A few adjectives have irregular inflections.

POSITIVE COMPARATIVE SUPERLATIVE

good better best

bad worse worst

a little less least

many/much more most

far farther/further farthest/furthest

old older/elder oldest/eldest

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Periods

Use a Period . At the end of most sentences, After
abbreviations and initials, In dramatic, poetic, and
Biblical citations.

The period is the most important mark of punctuation in
English because it separates one sentence from another, and
sentences are the basic units of writing. In addition to
its structural use as ending punctuation for sentences, the
period has a number of conventional uses.

As Ending Punctuation

Every sentence or deliberate sentence fragment should end
with a mark of punctuation. The most common mark for ending
sentences is the period, or stop or full stop, as it is
sometimes called.

After Complete Sentences

Periods are used at the end of
declarative sentences, indirect questions, and polite
commands or requests, even though these commands may have
the word order of a question.

DECLARATIVE SENTENCES

All cows eat grass.

During the battle, General Wolfe was mortally wounded.

POLITE REQUESTS

I asked how I could remove airplane glue from my clothes.

People have often wondered whether there is life on other planets.

Please turn down your radio.

Would you kindly refund my money as guaranteed.

Periods are also used after deliberate or conventionally acceptable sentence
fragments.

Yes.
Good night.

Better late than never.
So much for rose petals.

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Question Marks

Use a Question Mark ? After direct questions. After doubtful figures.

Like a period, the question mark is used as a mark of ending punctuation.
Unlike a period, it is used only after direct questions.

What is the difference between a duck and a goose?

Do you have a good book on bricklaying?

Even if the word order of a sentence is that of a statement, use a question mark if a direct question is being asked. In other words, if the voice would rise at the end when the sentence is spoken, a question mark should be used.

The newspaper was late again this morning?

You said you called the office and complained?

If a sentence contains a question within a question, use only one question mark.

Who was it that asked, Of what use is a baby?

When a sentence contains a series of words, all of which are being questioned, a single question mark may be placed at the end of the entire sentence.

What does he propose to do about rising taxes, crime in the cities, unemployment, the international situation, and inflation?

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Commas

The comma is by far the most important mark of internal punctuation. It serves as a separator-separating clauses and phrases from each other, separating items in a series, and separating nonessential elements from the rest of the sentence. The comma also has a number of other uses, both as a separator of words and numbers and simply as a mark that conventionally appears in certain places.

Independent clauses contain a subject and a finite verb and are not preceded by a subordinating word such as that, until, or whenever. Finite verbs are those that can serve as complete verb phrases. When two or more independent clauses appear within one sentence, they must be separated by some mark of punctuation. If a coordinating conjunction connects these clauses, a comma is the appropriate mark of punctuation.

With Coordinating Conjunctions

Use a comma before a coordinating conjunction connecting two independent clauses. The coordinating conjunctions are and, but, or, and nor.

The land has been worked for centuries, and no effort has been made to maintain the fertility of the soil.

Ballads appeared as early as the thirteenth century, but they did not become popular until much later.

The architecture may have an English flavor, or it may display French influence.

No photography courses are offered at the local high school, nor are any planned for the future.

Note The comma is often omitted if the two clauses are short. However, it is never wrong to use a comma, even between short clauses.

The soil is poor and water is scarce.

Her sins were scarlet but her books were read.

I don't like rutabagas nor will I eat parsnips.

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Spelling

Some people seem to be natural-born spellers, but most of us have difficulty spelling at least some words or groups of words. Spelling is not necessarily related to intelligence or writing ability, yet it is one of the first things that readers notice. If there are a number of misspelled words, the writer will probably be classified as ignorant or careless. Furthermore, misspellings can confuse readers, diverting their attention from the subject matter. Even if you are a terrible speller, your difficulties are not as insolvable as you may think. You already spell better than you realize.
After all, you spell most words correctly. You never spell a word entirely wrong. you miss only a letter or two. A little attention to spelling can lead to a great deal of improvement.

Keep a dictionary handy while you are writing, and refer to it whenever you have doubts about the correct spelling of a word. When you find a misspelling in your writing or when one is pointed out to you, check the correct spelling. Spell the entire word aloud and write it down. Try to fix the correct spelling in your mind, making a mental image of the written word. Write the word on a 3 by 5 inch card and review your collection when you have a few minutes to spare. Develop your own crutches for remembering the spelling of words that you misspell over and over again. It does not matter how silly the crutch is as long as it helps you. For example, many people have difficulty remembering whether a word ends in sede, cede, or ceed. If you memorize the rather foolish sentence, The proceeds succeeded in exceeding estimates, you will have learned the only three words that end in ceed. Then, if you remember that supersede is the only word that ends in sede, you know that any other word with the same sound must end in cede, intercede, precede, recede, concede, accede, antecede, secede, and all their derivatives, such as procedure, antecedent, and conceded.

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Paragraphs

Everyone understands, at least implicitly, what a sentence is because we all speak in sentences. Regardless of how long and rambling or how short and incomplete the sentences may be, changes in the speaker's voice tell us when one sentence has ended and another has begun. Paragraph changes are not as obvious; we may realize that a speaker has changed the subject, but we normally do not hear the point at which he or she made the switch. Nor does it disturb us that we do not hear paragraphs because paragraphs are not essential to most kinds of speech.

Paragraphs are, however, conventional and essential in writing. Because we are accustomed to seeing paragraph divisions, we are uneasy when they do not appear or even when they appear only infrequently. All of us are familiar with the sense of despair that comes from turning a page and discovering that the next page does not contain a single new paragraph. Paragraphs are both a physical and a mental convenience for readers. Physically, they provide a break and allow readers to keep their places on the page more easily. They also signal that one unit of thought has been completed and another is about to begin. Paragraphs are a convenience for writers too because they help them organize their ideas into manageable blocks.

A common definition of a paragraph is a group of related sentences developing one idea. It often includes a topic sentence that summarizes that idea, followed by additional sentences that expand, qualify, analyze, or explain the idea. Ideas, however, are not like automobiles. they are not clearly distinct units with standardized parts that can be easily counted and classified. Ideas may be as simple as I am eating a Reeses Peanut Butter Cup or as complex as the role of technology in the universe. One idea may blend into another with no sharp division between the two. Yet if we are to deal with ideas at all, we must have ways of segmenting them. we cannot comprehend or express complex ideas all in one breath or all in one sentence. In writing, we use the paragraph to handle one segment at a time. Because ideas are so diverse in their content and complexity and because the possible ways of segmenting them vary greatly, we cannot state hard and fast rules for what constitutes a good paragraph. Rather, we can

only talk about typical paragraphs.

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Outlines

All of us use outlines of one kind or another, even if we don't always think of them as outlines. The notes in our pocket calendars are an outline-however incomplete-of our day's activities. The list we take to the supermarket or stationery store is an outline of our intended purchases. When we write a letter to a friend, we have at least a mental outline of what we intend to say before we start writing. All of these are informal outlines, used to help us organize our thoughts and activities.

For many kinds of writing, an informal outline, either mental or written in the form of sketchy notes, is adequate. However, for long papers or for papers with complex arguments or ideas, a more formal outline is usually necessary because we cannot keep a mental picture of all the important points and their relationships. A written outline helps provide coherence to the final paper and reveals imbalances, logical gaps, and inadequate development of our thesis before we start writing. A well-developed outline also helps us estimate the length of the final paper and provides us with a guide as we write. Finally, an outline actually stimulates thought and ideas; seeing ideas written down makes us think of other ideas and of interrelationships among ideas.

In addition to their usefulness in writing papers, outlines are helpful in taking notes from material that has already been written. An outline reveals the structure of the author's argument more clearly and more quickly than several rereadings can. An outline of an unsatisfactory paper of your own can show what went wrong with it. An informal outline made before you answer an essay question on an examination helps you cover all important points in a logical order. Some classroom lectures lend themselves to note-taking in at least rough outline form. If not, putting the notes into outline form after the class is over provides a more organized, coherent picture of what the instructor considers important.

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ALICES ADVENTURES IN WONDERLAND by Lewis Carroll

CHAPTER I

Down the Rabbit Hole

Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do. once or twice she had peeped into the book her sister was reading, but it had no pictures or conversations in it, and what is the use of a book, thought Alice without pictures or conversation?

So she was considering in her own mind, as well as she could, for the hot day made her feel very sleepy and stupid, whether the pleasure of making a daisy chain would be worth the trouble of getting up and picking the daisies, when suddenly a White Rabbit with pink eyes ran close by her.

There was nothing so VERY remarkable in that nor did Alice think it so VERY much out of the way to hear the Rabbit say to itself, Oh dear. Oh dear. I shall be late. when she thought it over afterwards, it occurred to her that she ought to have wondered at this, but at the time it all seemed quite natural.

but when the Rabbit actually TOOK A WATCH OUT OF ITS WAISTCOAT POCKET, and looked at it, and then hurried on, Alice started to her feet, for it flashed across her mind that she had never before seen a rabbit with either a waistcoat pocket, or a watch to take out of it, and burning with curiosity, she ran across the field after it, and fortunately was just in time to see it pop down a large rabbit hole under the hedge.

In another moment down went Alice after it, never once considering how in the world she was to get out again.

The rabbit hole went straight on like a tunnel for some way, and then dipped suddenly down, so suddenly that Alice had not a moment to think about stopping herself before she found herself falling down a very deep well.

Either the well was very deep, or she fell very slowly, for she had plenty of time as she went down to look about her and to wonder what was going to happen next. First, she tried to look

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down and make out what she was coming to, but it was too dark to
see anything  then she looked at the sides of the well, and
noticed that they were filled with cupboards and book shelves
here and there she saw maps and pictures hung upon pegs.  She
took down a jar from one of the shelves as she passed  it was
labelled ORANGE MARMALADE, but to her great disappointment it
was empty   she did not like to drop the jar for fear of killing
somebody, so managed to put it into one of the cupboards as she
fell past it.
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