--- Day 23: Amphipod ---

A group of **amphipods** notice your fancy submarine and flag you down. "With
such an impressive shell," one amphipod says, "surely you can help us with
a question that has stumped our best scientists."

They go on to explain that a group of timid, stubborn amphipods live in a
nearby burrow. Four types of amphipods live there: Amber (A), Bronze (B),
Copper (C), and Desert (D). They live in a burrow that consists of a
hallway and four side rooms. The side rooms are initially full of
amphipods, and the hallway is initially empty.

They give you a diagram of the situation (your puzzle input), including
locations of each amphipod (A, B, C, or D, each of which is occupying an
otherwise open space), walls (#), and open space (.).

For example:

```
#############
#...........#
###B#C#B#D###
  #A#D#C#A#
  #########
```

The amphipods would like a method to organize every amphipod into side
rooms so that each side room contains one type of amphipod and the types
are sorted A-D going left to right, like this:

```
#############
#...........#
###A#B#C#D###
  #A#B#C#D#
  #########
```

Amphipods can move up, down, left, or right so long as they are moving into
an unoccupied open space. Each type of amphipod requires a different amount
of energy to move one step: Amber amphipods require 1 energy per step,
Bronze amphipods require 10 energy, Copper amphipods require 100, and
Desert ones require 1000. The amphipods would like you to find a way to
organize the amphipods that requires the least total energy.

However, because they are timid and stubborn, the amphipods have some extra
rules:

  - Amphipods will never stop on the space immediately outside any room.
    They can move into that space so long as they immediately continue
    moving. (Specifically, this refers to the four open spaces in the
    hallway that are directly above an amphipod starting position.)
  - Amphipods will never move from the hallway into a room unless that
    room is their destination room and that room contains no amphipods
    which do not also have that room as their own destination. If an
    amphipod's starting room is not its destination room, it can stay in
    that room until it leaves the room. (For example, an Amber amphipod
    will not move from the hallway into the right three rooms, and will
    only move into the leftmost room if that room is empty or if it only
    contains other Amber amphipods.)
  - Once an amphipod stops moving in the hallway, it will stay in that
    spot until it can move into a room. (That is, once any amphipod starts
    moving, any other amphipods currently in the hallway are locked in
    place and will not move again until they can move fully into a room.)

In the above example, the amphipods can be organized using a minimum of `12521` energy. One way to do this is shown below.

Starting configuration:

```
#############
#...........#
###B#C#B#D###
  #A#D#C#A#
  #########
```

One Bronze amphipod moves into the hallway, taking 4 steps and using `40` energy:

```
#############
#...B.......#
###B#C#.#D###
  #A#D#C#A#
  #########
```

The only Copper amphipod not in its side room moves there, taking 4 steps and using `400` energy:

```
#############
#...B.......#
###B#.#C#D###
  #A#D#C#A#
  #########
```

A Desert amphipod moves out of the way, taking 3 steps and using `3000` energy, and then the Bronze amphipod takes its place, taking 3 steps and using `30` energy:

```
#############
#.....D.....#
###B#.#C#D###
  #A#B#C#A#
  #########
```

The leftmost Bronze amphipod moves to its room using `40` energy:

```
#############
#.....D.....#
###.#B#C#D###
  #A#B#C#A#
  #########
```

Both amphipods in the rightmost room move into the hallway, using `2003` energy in total:

```
#############
#.....D.D.A.#
###.#B#C#.###
  #A#B#C#.#
  #########
```

Both Desert amphipods move into the rightmost room using `7000` energy:

```
#############
#.........A.#
###.#B#C#D###
  #A#B#C#D#
  #########
```

Finally, the last Amber amphipod moves into its room, using `8` energy:

```
#############
#...........#
###A#B#C#D###
  #A#B#C#D#
  #########
```

What is the least energy required to organize the amphipods?

Your puzzle answer was 18170.

--- Part Two ---

As you prepare to give the amphipods your solution, you notice that the
diagram they handed you was actually folded up. As you unfold it, you
discover an extra part of the diagram.

Between the first and second lines of text that contain amphipod starting
positions, insert the following lines:

```
  #D#C#B#A#
  #D#B#A#C#
```

So, the above example now becomes:

```
#############
#...........#
###B#C#B#D###
  #D#C#B#A#
  #D#B#A#C#
  #A#D#C#A#
  #########
```

The amphipods still want to be organized into rooms similar to before:

```
#############
#...........#
###A#B#C#D###
  #A#B#C#D#
  #A#B#C#D#
  #A#B#C#D#
  #########
```

In this updated example, the least energy required to organize these
amphipods is 44169:

```
#############
#...........#
###B#C#B#D###
  #D#C#B#A#
  #D#B#A#C#
  #A#D#C#A#
  #########


#############
#.........D#
###B#C#B#.###
  #D#C#B#A#
  #D#B#A#C#
  #A#D#C#A#
  #########


#############
#A.........D#
###B#C#B#.###
```

```
    #D#C#B#.#
    #D#B#A#C#
    #A#D#C#A#
    #########

############
#A........BD#
###B#C#.#.###
    #D#C#B#.#
    #D#B#A#C#
    #A#D#C#A#
    #########

############
#A......B.BD#
###B#C#.#.###
    #D#C#.#.#
    #D#B#A#C#
    #A#D#C#A#
    #########

############
#AA.....B.BD#
###B#C#.#.###
    #D#C#.#.#
    #D#B#.#C#
    #A#D#C#A#
    #########

############
#AA.....B.BD#
###B#.#.#.###
    #D#C#.#.#
    #D#B#C#C#
    #A#D#C#A#
    #########

############
#AA.....B.BD#
###B#.#.#.###
    #D#.#C#.#
    #D#B#C#C#
    #A#D#C#A#
    #########

############
#AA...B.B.BD#
###B#.#.#.###
    #D#.#C#.#
    #D#.#C#C#
    #A#D#C#A#
    #########

############
#AA.D.B.B.BD#
###B#.#.#.###
    #D#.#C#.#
    #D#.#C#C#
    #A#.#C#A#
    #########

############
#AA.D...B.BD#
###B#.#.#.###
```

```
###B#.#.#.###
  #D#.#C#.#
  #D#.#C#C#
  #A#B#C#A#
  #########

#############
#AA.D.....BD#
###B#.#.#.###
  #D#.#C#.#
  #D#B#C#C#
  #A#B#C#A#
  #########

#############
#AA.D......D#
###B#.#.#.###
  #D#B#C#.#
  #D#B#C#C#
  #A#B#C#A#
  #########

#############
#AA.D......D#
###B#.#C#.###
  #D#B#C#.#
  #D#B#C#.#
  #A#B#C#A#
  #########

#############
#AA.D.....AD#
###B#.#C#.###
  #D#B#C#.#
  #D#B#C#.#
  #A#B#C#.#
  #########

#############
#AA.......AD#
###B#.#C#.###
  #D#B#C#.#
  #D#B#C#.#
  #A#B#C#D#
  #########

#############
#AA.......AD#
###.#B#C#.###
  #D#B#C#.#
  #D#B#C#.#
  #A#B#C#D#
  #########

#############
#AA.......AD#
###.#B#C#.###
  #.#B#C#.#
  #D#B#C#D#
  #A#B#C#D#
  #########

#############
#AA.D.....AD#
```

```
###.#B#C#.###
  #.#B#C#.#
  #.#B#C#D#
  #A#B#C#D#
  #########


#############
#A..D.....AD#
###.#B#C#.###
  #.#B#C#.#
  #A#B#C#D#
  #A#B#C#D#
  #########


#############
#...D.....AD#
###.#B#C#.###
  #A#B#C#.#
  #A#B#C#D#
  #A#B#C#D#
  #########


#############
#.........AD#
###.#B#C#.###
  #A#B#C#D#
  #A#B#C#D#
  #A#B#C#D#
  #########


#############
#..........D#
###A#B#C#.###
  #A#B#C#D#
  #A#B#C#D#
  #A#B#C#D#
  #########


#############
#...........#
###A#B#C#D###
  #A#B#C#D#
  #A#B#C#D#
  #A#B#C#D#
  #########
```

Using the initial configuration from the full diagram, what is the least
energy required to organize the amphipods?

Your puzzle answer was 50208.

Both parts of this puzzle are complete! They provide two gold stars: **

At this point, all that is left is for you to admire your Advent calendar.

If you still want to see it, you can get your puzzle input.

You can also [Share] this puzzle.