**ANSWERS:**

From: *https://people.umass.edu/klement/100/logic-worksheet.html*
A.
1.  If P then Q
2.  P
3.  Therefore, Q
Valid (Modus Ponens)

B.
1.  If P then Q
2.  Q
3.  Therefore, P
Invalid
This argument form is commonly mistaken as being valid.  Notice that even if the premises are true, the conclusion could still be false: Jane could have a dog.

C.
1.  If P then Q
2.  Not: Q
3.  Therefore, Not: P
Valid (Modus Tollens)

D.
1.  If P then Q
2.  Not: P
3.  Therefore, Not: Q
Invalid
This is another argument form that is commonly mistaken as being valid.  Again, Jane could still have a pet even if she does not have a cat, maybe she has a bird. Her owning a bird is not ruled out by the premises.

E.
1.  If P then Q
2.  P
3.  Therefore, Q
Valid (Modus Ponens)
Notice that this argument is still valid even though (as far as we know) all the premises (and the conclusion) are, in fact, false.

F.
1.  If P then Q
2.  Q
3.  Therefore, P
Invalid
This is the same invalid form as argument B.   Notice that all the premises and the conclusion are in fact true.  Still, the argument is invalid: it is possible for all the premises to be true and the conclusion still be false. You can imagine a world in which the two premises are true, and yet George Bush is not president. Some other Republican could be president.

G.
1.  If P then Q
2.  Not: Q
3.  Therefore, Not: P
Valid (Modus Tollens)
This is the same argument form as argument C.  This seem trickier than argument C since premise (1) in argument G asserts an unlikely relationship between what Joe's favorite color is and whether or not E.T. phones home.  What could those two things have to do with one another?  They probably have nothing to do with one another.  Therefore, premise (1) is probably false.  But to check the argument for validity we need to imagine that it is true.  So we need to imagine that somehow, for some reason unbeknownst to us, if it is true that E.T. phones home, then it also will be true that Joe's favorite color is blue.

H.
1.  Not: P
2.  If Q then P
3.  Therefore, Not: Q
Valid (Modus Tollens)
This is the same argument form as argument C and G.  The only difference is that the if-then statement is the second premise rather than the first.  That's okay, the order of the premises is unimportant for determining validity. Also, don't be fooled by the actual falsity of the premises: IF they were true, the conclusion would have to be true as well.

I.
1.  P
2.  If Q then R
3.  Therefore, Not: Q
Invalid

J.
1.  All x are y
2.  All z are y
3.  Therefore, x are z
Invalid.  You can see this by considering an argument of the same logical form that has premises that are easier to imagine being true (because they are true):  1. All humans are primates.  2.  All gorillas are primates.  3.  Therefore, all humans are gorillas.

K.
1.  P
2.  Therefore, P
Valid
Obviously, if  "Kate is a lawyer" is true, then it would be impossible for "Kate is a lawyer" to also not be true.  But is this because of the logical form of the argument?  Well, try uniformly substituting different sentences for 'P' and see what happens.  (Remember, whatever you substitute for 'P' must go everywhere there is a 'P'.) However, this argument does *beg the question*, but that's a different question from the question of validity and invalidity.

L.
1.  If P then Q
2.  Not: Q
3.  Therefore, Not: P
Valid (Modus Tollens)
Same argument form as C, G, and H.

M.
1.  If P then Q
2.  Not: P
3.  Therefore, Not: Q
Invalid
Same invalid argument form as in argument D.  Even if the premises are true, it is still possible that other life-forms besides human beings have a right to life.  It is quite plausible to suppose at the very least that chimpanzees have a right to life.

N.
1.  All x are y
2.  All y are z
3.  Therefore all x are z
Valid

O.
1.  No x is y
2.  All z are y
3.  Therefore, no x is z
Valid.  If it is hard to see why, try drawing a Venn diagram.

P.
1.  If P then Q
2.  P
3.  Therefore, Q
Valid (Modus Ponens)

Q.
1.  P or Q
2.  Not: Q
3.  Therefore, P
Valid.

R.
1.  P or Q
2.  Q
3.  Therefore, P
Invalid.  The premises don't guarantee that Ariel joined the Air force (though he might have.)  Note:  In logic, the word 'or' is usually understood in its INCLUSIVE sense.  You should understand the first premise as saying something to the effect of: "either Ariel joins the air force or Nancy joins the Navy or both".