Date:
Name 1:
Name 2:

Answer the following questions in both relational algebra and SQL. The SQL must match the Relational Algebra.

Assume the following schema:

Classes(<u>class</u>, type, country, numGuns, bore, displacement)
Ships(<u>ship</u>, class, launched)
Battles(<u>battle</u>, date)
Outcomes(<u>ship</u>, <u>battle</u>, result)

a) List the *ship, type, country, battle* and *result* for all ships.

$\Pi_{ship, type, country, battle, result}$ C ⋈ S ⋈ O

```
select ship, type, country, battle, result from C NATURAL JOIN S
    NATURAL JOIN O;
```

b) For every ship that survived a battle (*result* = 'ok'), and for every ship that was sunk in that battle (*result* = 'sunk'), list the name of the *battle,* the surviving *ship,* and the sunk *ship.*

$A = \Pi_{ship \rightarrow survived, battle} \sigma_{result='ok'} O$

$\Pi_{battle, survived, ship \rightarrow sunk} (A \bowtie (\sigma_{result='sunk'} O))$

```
WITH A (SELECT ship AS survived, battle FROM O
        WHERE result = 'ok')

SELECT battle, survived, ship as sunk FROM
    A NATURAL JOIN (SELECT * FROM O
                    WHERE result = 'sunk');
```