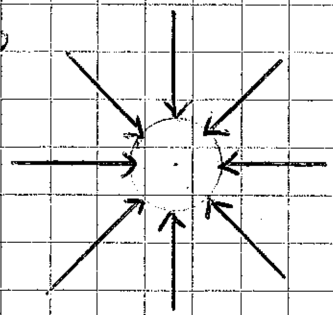
# Fields Review

## Gravitational

(1)



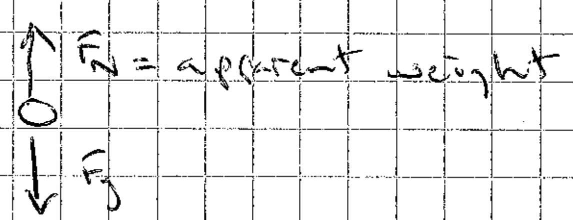
(2) g decreases with increasing altitude

g increases with increasing latitude (as you travel from the equator to the poles).

(3) Weight. In space, the scale would read 0.

(4) Humor. In reality, you and the elevator fall at the same rate. You would "float", not be pasted to the ceiling.

(5)




In free fall, $F_N = 0$

so you feel weightless.

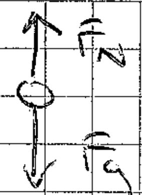
(6) a) $F_g = mg = (75)(9.8) = \boxed{735\ N}$

b) $F_g = mg = (0.050)(9.8) = \boxed{0.49\ N}$ ✓

⑦ $F_g = mg = (60)(1.6) = \boxed{96\ N}$

⑧ a) $F_g = mg = (100)(9.8) = \boxed{980\ N}$

b)




$\Sigma F = F_N - F_g$

$ma = F_N - mg$

$F_N = ma + mg$

$= (100)(0.55) + (100)(9.8)$

$F_N = \boxed{1035\ N}$

c) Same work as (b).

$F_N = ma + mg$

$= (100)(-0.5) + (100)(9.8)$

$F_N = \boxed{930\ N}$

⑨ a) $V_i = 0$
$a = -9.8\ m/s^2$
$t = 6\ s$

$V_f = V_i + at$

$= 0 - 9.8(6)$

$V_f = \boxed{-59\ m/s}$

b) $d = \left(\dfrac{V_f + V_i}{2}\right)t$

$= \left(\dfrac{-59 + 0}{2}\right)6$

$d = -176.4\ m$

$\boxed{176.4\ m}$ tall

(10)

$v_i = 21$ m/s
$d = -42$ m
$a = -9.8$ m/s$^2$

$v_f^2 = v_i^2 + 2ad$

$= 21^2 + 2(-9.8)(-42)$

$v_f^2 = 1264.2$

$v_f = -35.6$ m/s

$v_f = v_i + at$

$-35.6 = 21 - 9.8t$

$t = \frac{-35.6 - 21}{-9.8}$

$t = \boxed{5.8\ s}$

(11)

$v_i = 4.2$ m/s
$a = -9.8$ m/s$^2$
$t = 2.5$ s

$v_f = v_i + at$

$= 4.2 - 9.8(2.5)$

$v_f = -20.3$ m/s

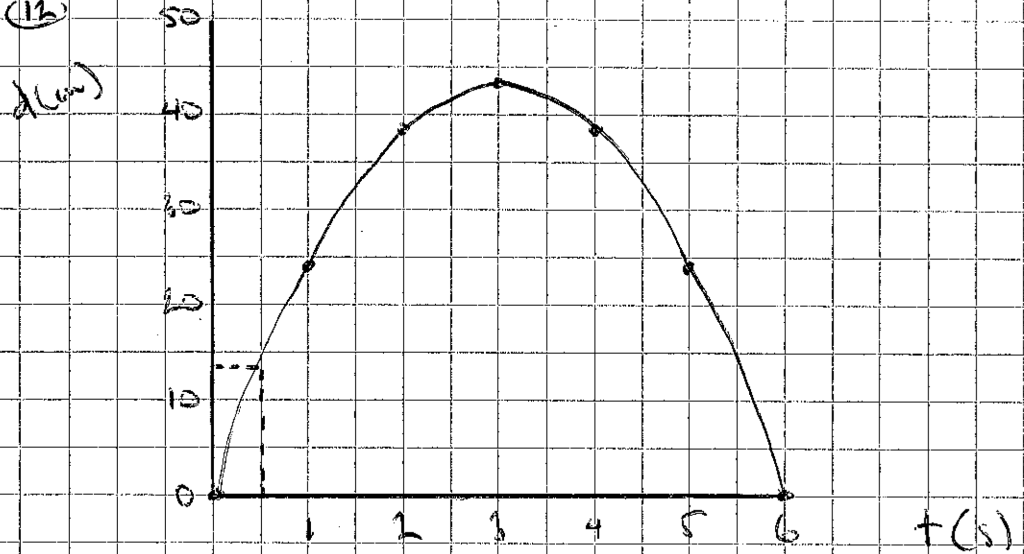
$d = \left(\frac{v_f + v_i}{2}\right)t$

$= \left(\frac{-20.3 + 4.2}{2}\right)2.5$

$d = -20.1$ m

$\boxed{20.1\ m}$ above water

(12)




b) at 0.5 s , d = 13.5 m (anything between 12 - 14 is ok)

c) at 5.5 s since the graph is symmetrical.

(13) • the maximum velocity reached by an object falling through the air

• occurs when the drag force and gravity are equal.

Electric

(14) a) force + field will have the same direction.

b) force + field will have opposite directions.

(15) see your notes for these diagrams

(16) $q = \pm Ne$

$-2.4 \times 10^{-17} = -N(1.6 \times 10^{-19})$

$N = \frac{2.4 \times 10^{-17}}{1.6 \times 10^{-19}}$

$N = \boxed{150}$

(17) $q = \pm Ne$

$1 = +N(1.6 \times 10^{-19})$

$N = \frac{1}{1.6 \times 10^{-19}}$

$N = \boxed{6.25 \times 10^{18}}$

(18) $q = 1000\,\mu C = 1000 \times 10^{-6}\ C$

$E = \frac{F_e}{q} = \frac{1}{1000 \times 10^{-6}} = \boxed{1000\ N/C}$

(19) $q = 7\ mC = 7 \times 10^{-3}\ C$

$E = \frac{F_e}{q} = \frac{5.6 \times 10^{-2}}{7 \times 10^{-3}} = \boxed{8\ N/C}$

(20) $\vec{E} = \frac{F_e}{q} = \frac{4.5\times10^{-5}}{6.5\times10^{-6}} = 6.9\ N/C\ [\text{Right}]$

Direction of force is the same as the direction of the field since $q$ is positive.

(21) $q = \frac{F_e}{\vec{E}} = \frac{3\times10^{-3}}{2} = \boxed{+1.5\times10^{-3}\ C}$

The charge must be positive since the force and field are in the same direction.

(22) a) $\Sigma F = F_e$

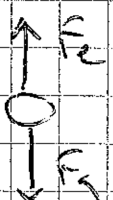
$ma = F_e$

$(9.11\times10^{-31})(6.3\times10^{3}) = F_e$

$F_e = \boxed{5.7\times10^{-27}\ N}$

b) $\vec{E} = \frac{F_e}{q} = \frac{5.7\times10^{-27}}{1.6\times10^{-19}} = \boxed{3.6\times10^{-8}\ N/C}$

(23)




$F_e = F_g$

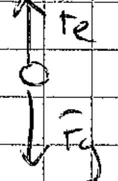
$q\vec{E} = mg$

$(18\times10^{-6})E = (0.012)(9.8)$

$\vec{E} = \boxed{6533\ N/C\ [\text{Down}]}$

Since $q$ is negative, the field direction must be opposite the force direction.

(24)




$$\Sigma F = F_e - F_g$$

$$ma = qE - mg$$

$$(0.012)(1) = (18\times10^{-6})E - (0.012)(9.8)$$

$$0.012 = 18\times10^{-6}\,E - 0.1176$$

$$E = \frac{0.012 + 0.1176}{18\times10^{-6}}$$

$$E = \boxed{7200\ N/C\ \ [\text{Down}]}$$

↑ Same reason as #23.

Magnetic

(25) see your notes for these diagrams

(26) A region of an object that behaves like a tiny bar magnet.

(27) Magnetic = domains mostly point in the same direction

Non-magnetic = domains point in random directions (they cancel out)

Electromagnetism

(28) Counterclockwise

(29) South

(30) Down

(31) a) out of the page

b) clockwise

c) right

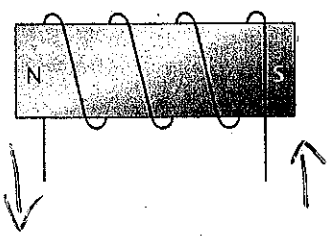
d) into the page

e) clockwise

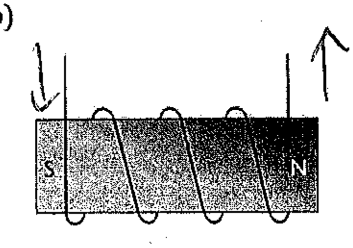
f) left

32. For each of the current-carrying solenoids shown below, label the direction that the current is flowing through the solenoid.

a)

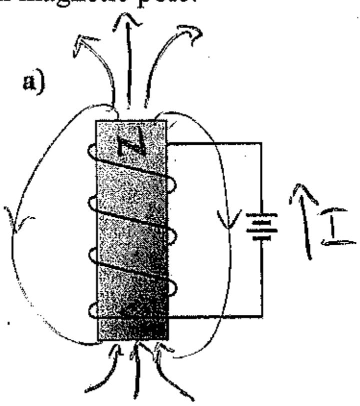



b)

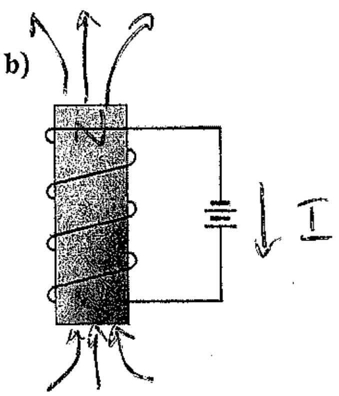



33. For each of the current carrying solenoids shown below, sketch the magnetic field lines around the solenoid. Label which end of the solenoid acts like a north magnetic pole and which end acts like a south magnetic pole.

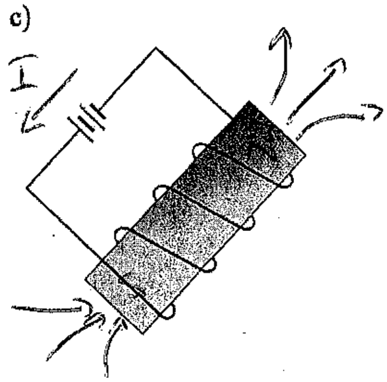
a)



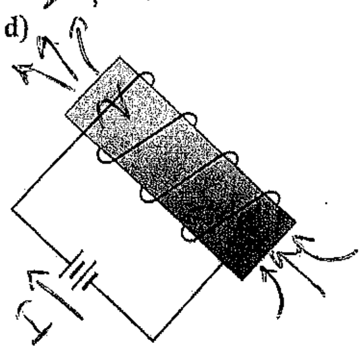
b)



c)



d)



34. A 5.0 $m$ long wire is aligned east-west. A current of 10 $A$ is flowing west through the wire, and a magnetic field of $5.0\times10^{-5}\ T\ [down]$ exists around the wire. Determine the magnitude and direction of the magnetic force acting on the wire.

(34) $F = BIL$

$= (5 \times 10^{-5})(10)(5)$

$F = 0.0025\ N$ [South]