```
(%i1) kill(all);
(%o0) done
```

1 Eq.(15)

```
(%i1) E15: g=2+h[bar]*omega[vac]/(m*c^2);
```

$$(\%o1)\quad g=\frac{h_{bar}\,\omega_{vac}}{c^2\,m}+2$$

```
(%i2) E15a: g=2+E[vac]/(m*c^2);
```

$$(\%o2)\quad g=\frac{E_{vac}}{c^2\,m}+2$$

2 Constants

```
(%i3) h[bar]: 6.62606957e-34/(2*%pi), numer;
(%o3) 1.0545717253362894 10^-34

(%i4) m: 9.10938215e-31;
(%o4) 9.1093821499999992 10^-31

(%i5) e: 1.602176565e-19;
(%o5) 1.602176565 10^-19

(%i6) h[bar]/e   /* J*s/C */;
(%o6) 6.5821192768244573 10^-16

(%i7) g: 2.00231930436182;
(%o7) 2.00231930436182

(%i8) c: 2.99792458e8;
(%o8) 2.99792458 10^8

(%i9) J[eV]: 6.24150974e18;
(%o9) 6.24150974 10^18
```

3 Vacuum energy quantum

```
(%i10) E15b: factor(solve(E15a, E[vac]));
```

$$(\%o10)\quad [E_{vac}=c^2(g-2)m]$$

```
(%i11) E15c: factor(solve(E15, omega[vac]));
```

$$(\%o11)\quad [\omega_{vac}=\frac{c^2(g-2)m}{h_{bar}}]$$

3.1 Total energy of an electron

```
(%i12) m*c^2*J[eV];
(%o12) 510998.917451789
```

3.2 Vacuum energy quantum in J and eV

```
(%i13) E: first(ev(E15b), eval);
(%o13) E_vac=1.8988386904789317 10^-16
```

```
(%i14) EeV: rhs(E)*J[eV];
(%o14) 1185.16201813131
```

3.3 Vacuum energy frequency in Hz

```
(%i15) omega[vac]: first(ev(E15c), eval);
(%o15) ω_vac=1.8005780402214144 10^18
```

```
(%i16) f[vac]: rhs(omega[vac])/(2*%pi), numer;
(%o16) 2.8657089552395565 10^17
```

3.4 Mass of a vacuum particle

```
(%i17) m[vac]: rhs(E)/c^2;
(%o17) 2.1127429753981628 10^-33
```

```
(%i18) m[vac]/m;
(%o18) 0.0023193043618202
```