```fortran
!===============================================================================
! Program: planetary_masses.f90
! Beschreibung: Berechnet die Massen (in kg) aller HimmelskÃ¶rper aus Table 2
!               der JPL DE440/DE441 Ephemeriden sowie deren Gesamtsumme.
!===============================================================================
program planetary_masses
   implicit none

   ! Doppelte PrÃ¤zision (64-Bit IEEE 754 Real)
   integer, parameter :: dp = selected_real_kind(15, 307)

   ! Gravitationskonstante G in km^3 / (kg * s^2)
   ! CODATA 2018: G = 6.67430e-11 m^3 kg^-1 s^-2 = 6.67430e-20 km^3 kg^-1 s^-2
   real(kind=dp), parameter :: G_KM = 6.67430e-20_dp

   integer, parameter :: NUM_BODIES = 13
   integer :: i

   type :: celestial_body
      character(len=20) :: name
      real(kind=dp)     :: gm ! in km^3 s^-2
   end type celestial_body

   type(celestial_body), dimension(NUM_BODIES) :: bodies
   real(kind=dp) :: mass_kg
   real(kind=dp) :: total_mass_kg

   ! Initialisierung der Gesamtsumme
   total_mass_kg = 0.0_dp

   ! DatensÃ¤tze aus Table 2 (JPL DE440 / DE441)
   bodies(1) = celestial_body("Sun", 132712440041.279419_dp)
   bodies(2) = celestial_body("Mercury", 22031.868551_dp)
   bodies(3) = celestial_body("Venus", 324858.592000_dp)
   bodies(4) = celestial_body("Earth", 398600.435507_dp)
   bodies(5) = celestial_body("Mars System", 42828.375816_dp)
   bodies(6) = celestial_body("Jupiter System", 126712764.100000_dp)
   bodies(7) = celestial_body("Saturn System", 37940584.841800_dp)
   bodies(8) = celestial_body("Uranus System", 5794556.400000_dp)
   bodies(9) = celestial_body("Neptune System", 6836527.100580_dp)
   bodies(10) = celestial_body("Pluto System", 975.500000_dp)
   bodies(11) = celestial_body("Moon", 4902.800118_dp)
   bodies(12) = celestial_body("Ceres", 62.62890_dp)
   bodies(13) = celestial_body("Vesta", 17.288245_dp)

```

```
   ! Kopfzeile ausgeben
   write (*, '(A)') "================================================================================"
   write (*, '(A)') "  Berechnung der Planetenmassen aus JPL DE440/DE441 GM-Werten"
   write (*, '(A, ES12.5, A)') "  Verwendete Gravitationskonstante G: ", G_KM, " km^3 kg^-1 s^-2"
   write (*, '(A)') "================================================================================"
   write (*, '(A20, A25, A25)') "Himmelskoerper", "GM [km^3 s^-2]", "Masse [kg]"
   write (*, '(A)') "--------------------------------------------------------------------------------"

   ! Schleife zur Berechnung, Aufsummierung und formatierten Ausgabe
   do i = 1, NUM_BODIES
      mass_kg = bodies(i)%gm/G_KM
      total_mass_kg = total_mass_kg + mass_kg
      write (*, '(A20, F25.6, ES25.10)') bodies(i)%name, bodies(i)%gm, mass_kg
   end do

   ! Gesamtsumme ausgeben
   write (*, '(A)') "--------------------------------------------------------------------------------"
   write (*, '(A20, A25, ES25.10)') "Gesamtsumme", "", total_mass_kg
   write (*, '(A)') "================================================================================"

end program planetary_masses
```