Problem Statement 1

$$f(d) = 20e^{-20(d-12.5)} \; where \; d \geq 12.5$$

i) The proportion scrapped is $1 - F_d(12.6) = \int_{12.6}^{\infty} 20e^{-20(d-12.5)} \, dd$ = 0.1353353

ii) CDF when diameter is 11 mm = 0

Problem Statement 2

```
> #Problem 2
> # (a)
> #P(Z > 1.26)
> pnorm(q = 1.26,lower.tail = F)
[1] 0.1038347
>
> #P(Z < -0.86)
> pnorm(q = -0.86)
[1] 0.1948945
>
> #P(Z > -1.37)
> pnorm(q = -1.37,lower.tail = F)
[1] 0.9146565
>
> #P(-1.25 < Z < 0.37)
> pnorm(0.37)-pnorm(-1.25)
[1] 0.538659
>
> #P(z <= -4.6)
> pnorm(q = -4.6)
[1] 2.112455e-06


>
```

Problem Statement 3

Let Y be the random variable current flowing through a copper wire.

Therefore $Y \sim N(10,2)$

(i) The probability that a current measurement will exceed 13 = P(Y >13)

$$= P\left(Z > \frac{13-10}{2}\right) = 0.9331928$$

(ii) The probability that a current measurement is between 9 and 11mA = $P\left(\frac{9}{1000} < Y < \frac{11}{1000}\right) = 1.524338^{-9}$

(iii) The current with 0.98 probability if between a and b were $0.98 = P(a < Y < b)$

Therefore a = 14.6527A and b = 5.347304A

```
> #Problem 3
> # (i) the probability that a current measurement will exceed 13
> pnorm(q = 13,mean = 10,sd = 2)
[1] 0.9331928
>
> # (ii)       The probability that a current measurement is between 9 and
11mA
```

```
> pnorm(q = 11/1000,mean = 10,sd = 2)-pnorm(q = 9/1000,mean = 10,sd = 2)
[1] 1.524338e-09
>
> #(iii) current measurement which has a probability of 0.98.
> ub = qnorm(p = 0.99,mean = 10,sd = 2)
> lb =  qnorm(p = 0.99,mean = 10,sd = 2,lower.tail = F)
> ub
[1] 14.6527
> lb
[1] 5.347304
```

Problem Statement 4

Let W be the random variable diameter of the shaft in a piston

$$Therefore\ W \sim N(0.2508, 0.0005)$$

(i) Proportion of shafts are in sync with the specifications = $P(0.2485 < W < 0.2515)$

$$= P\left(\frac{0.2485-0.2508}{0.0005} < Z < \frac{0.2515-0.2508}{0.0005}\right)$$

$$= 0.9192412$$

(ii) proportion of shafts conform to the new specifications = $P(W < 0.2515)$

$$P\left(Z < \frac{0.2515 - 0.2508}{0.0005}\right)$$

= 0.9192433

(iii) A very large proption is already in the specified range.

Used the R code below.

```
> #Problem 4
>
> #(i)Proportion of shafts are in sync with the specifications =  P(0.2485<W<0.2515)
> pnorm(q = 0.2500+0.0015,mean = 0.2508,sd = 0.0005)-pnorm(q = 0.2500-0.0015,mean = 0.
08,sd = 0.0005)
[1] 0.9192412
>
> #(ii) proportion of shafts conform to the new specifications = P(W<0.2515)
> pnorm(q = 0.2500+0.0015,mean = 0.2508,sd = 0.0005)
[1] 0.9192433
```